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# Foreign Multinationals and Head Office Employment in Canadian Manufacturing Firms

by John R. Baldwin and W. Mark Brown

Micro-economic Analysis Division  
18-F, R.H. Coats Building, Ottawa, K1A 0T6

Telephone: 1 800 263-1136



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**How to obtain more information :**  
National inquiries line: 1 800 263-1136  
E-Mail inquiries: [infostats@statcan.ca](mailto:infostats@statcan.ca)

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The authors' names are listed alphabetically.

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## ***Abstract***

This paper examines head office employment in the Canadian manufacturing sector. It focuses on the characteristics that are related to the creation of a head office and the amount of employment in that head office. Among the characteristics investigated are firm size, number of plants, industrial diversity, geographical location, industry and nationality. The paper finds that foreign-owned firms are more likely to create a head office and to create more employment in their head offices than are domestic-controlled firms, after controlling for firm characteristics. It also finds that head office creation and employment levels are associated with a firm's level of complexity (e.g., its size) and how it organises its production geographically.

*Key words:* head office employment, foreign control, manufacturing, location theory

## *Executive summary*

Recently, considerable public attention has been paid to the possibility that corporate Canada is being hollowed-out. Many have become concerned that head offices in Canada are being moved abroad, resulting in the loss of senior management functions. Some of this concern is directed at firms that are foreign-controlled.

These concerns stem from the role that head offices play in the economy. Head offices function as centres of command and control for corporations; they are often where key decisions makers are located. Head offices are also seen to provide an important economic base for many cities (e.g., Toronto, Montreal and Calgary). Head offices are sometimes viewed as the prize jewel to be captured by prescient public policy.

Despite this interest in head offices, there have been few studies that attempt to understand the factors behind the creation or destruction of head offices. Although head offices fulfill a critical management function, there are few empirical studies of this part of the modern corporation. And the few studies that exist tend to focus more on management workers in general (non-production workers), than on head offices per se.

Head offices provide the centralizing management function in corporations. On the one hand, they provide visible services to client plants—from payroll, to advertising, to marketing, to legal advice. But they also serve to acquire and filter information for the various management teams within each of the plants of the firm.

The information acquisition and filtering process is at the heart of the difference between large and small firms. Information acquisition is more formalized and, arguably, more efficient in large firms—because it provides them with a method of overcoming diseconomies of scale in large organizations.

In this paper, we investigate the extent to which the head office phenomenon can be understood in relation to the economic factors that are likely to govern its activity. We are interested in doing so because of our ultimate interest in whether foreign multinationals operating in the Canadian manufacturing sector show less inclination to operate head offices than domestic firms. And to answer this question, we need to determine what firm characteristics are related to head office activity, so that we can condition on them when we examine the difference between foreign-controlled and domestic-controlled head office activity.

We find that manufacturing firms are more likely to establish a head office if they are more complex. Complexity in this study is measured by the size of firm, whether it has multiple plants, and whether it is industrially diversified. The study finds that larger firms, those with multiple plants, and firms that are diversified across industries are more likely to create a head office.

Geography also matters. Firms whose plants are located in rural areas are more likely to create a head office and to place it in an urban area. In addition to providing a larger pool of skilled labour, large urban areas offer a wide variety of producer services (intermediate inputs) demanded by managers, including management consulting, accounting, and corporate law.

Moreover, large cities often provide greater access to investment bankers and other forms of investment capital that might not be as easily tapped in more remote regions. In sum, large centres are able to offer a selection of service inputs that are scarcer and often more expensive in smaller urban centres and rural areas.

Once a head office is created, a number of similar factors determine the amount of employment in head offices—size of firm, its multi-plant nature, the extent of its cross-industry industrial diversity, the geographic spread of plants in the firm and the industry of location. The demand for head office workers per plant is a positive function of plant size, and a negative function of the number of plants controlled by the firm after conditioning on average plant size. This suggests there are firm-wide economies of scale associated with head office employment. It is also the case that firms that concentrate their non-production workers in plants and/or have geographically dispersed plants will have lower levels of head office employment per plant. There is substitution between plant-based non-production workers and head office-based non-production workers. Head office employment is positively associated with the industrial diversity of a firm, but this effect is restricted to broad-spectrum diversification into unrelated industries. It is only when firms diversify into unrelated industries that head office employment is significantly affected.

The industry in which a firm operates also has a strong influence on whether a firm decides to create a head office. Firms in industries that focus heavily on R&D expenditures (referred to in this study as science-based) are both more likely to establish a head office and to employ more managers. Conversely, firms in industries that are referred to as labour intensive are less likely to do so.

Finally, foreign-controlled firms typically have higher levels of head office employment than domestically-controlled firms. The paper finds that foreign ownership has a positive effect on aggregate head office employment. Foreign firms are more likely to create a separate head office and they are more likely to hire more head office workers than their domestic counterparts.

## ***1. Introduction***

Recently, considerable public attention has been paid to the possibility that corporate Canada is being hollowed-out. Many have become concerned that head offices in Canada are being moved abroad, resulting in the loss of senior management functions. Some of this concern is directed at firms that are foreign-controlled.

These concerns stem from the role that head offices play in the economy. Head offices function as centres of command and control for corporations; they are often where key decisions makers are located. Head offices are also seen as an important economic base for many cities (e.g., Toronto, Montreal and Calgary). This is because head offices bring with them high paying jobs and a demand for certain desirable producer services (e.g., financial services) (Klier and Testa, 2002). Head offices are sometimes viewed as the prize jewel to be captured by prescient public policy.

Despite this interest in head offices, there have been few studies that attempt to understand the factors behind the creation or destruction of head offices. Although head offices fulfill a critical management function, there are few empirical studies of this part of the modern corporation. And the few studies that exist tend to focus more on management workers in general (non-production workers) than on head offices per se.<sup>1</sup>

Head offices provide the centralizing management function in corporations. On the one hand, they provide visible services to client plants—from payroll, to advertising, to marketing, to legal advice. But they also serve to acquire and filter information for the various management teams within each of the plants of the firm.

The information acquisition and filtering process is at the heart of the difference between large and small firms. Information acquisition is more formalized and, arguably, more efficient in large firms—because it provides them with a method of overcoming diseconomies of scale in large organizations.

In this paper, we investigate the extent to which the head office phenomenon can be understood in relation to the economic factors that are likely to govern its activity. We are interested in doing so because our ultimate interest lies in investigating whether foreign multinationals that operate in the Canadian manufacturing sector show less inclination to operate head offices than domestic firms. And to answer this question, we need to determine the firm characteristics that are related to head office activity, so that we can condition on them when we examine the difference between foreign-controlled and domestic-controlled head office activity.

In a recent study (Baldwin, Beckstead and Brown, 2003), we examined head office employment in Canada over the period 1999-2002. Although our previous work presents a picture of recent levels of head office employment, it did not investigate the characteristics of firms or industries that underlie a firm's decision to establish a head office or the level of employment within its

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1. See Katz and Murphy (1992), Caves et al. (1993), Berman, Bound and Griliches (1994), Baldwin and Rafiqzaman (1999), Autor, Levy and Murnane (2003), and Rajan and Wulf (2003).



head office. If we are to understand head office employment, we need a better understanding of the factors behind these firm-based decisions.

Our previous work also ignored an issue of perpetual interest. It did not analyse the effect of foreign ownership on head office employment. Considerable public discussion has revolved around the effect on head office employment (amongst other factors) of take-overs of Canadian firms by foreign firms.<sup>2</sup> Understanding whether foreign firms hire more or less management in Canada informs this debate.

There are two views on how foreign ownership might influence head office employment. One view that has received considerable empirical support is that multinational corporations invest in order to exploit a proprietary technological advantage that cannot be easily exported or transferred between firms through contractual arrangements (Caves, 1974 and 1982). If these assets are created and managed by the foreign parents, fewer managers may be required in Canada. For example, if we adopt the hub and spoke model of the foreign multinational, with the key asset being transferred in a single direction with little development or local capabilities at the end of each artery, then we would expect foreign firms to have less head office employment than Canadian firms, all else being held equal.

An alternative view is that foreign firms invest not only to exploit a key asset that they possess but also to take advantage of the human resource and institutional environments of their host country. An example of this perspective is Teece's (1986) model of complementary assets. Teece argues that foreign firms invest in R&D intensive firms outside of their home country in order to complement their existing assets. Adaptation of this asset to the national market requires local managers. Since domestic firms do not benefit from this complementarity, they may in fact be less inclined than the affiliates of foreign firms to invest in R&D. Foreign firms as a consequence may have more head office employment than Canadian firms.

The same argument applies to foreign firms that operate in Canada and transfer other intangible assets related to marketing or to complex technology know-how. To the extent that these assets need to be adapted to local markets and local managers are best suited to do this, foreign-owned firms will be more likely to have a head office and to have more employment in that head office.

In order to better understand head office employment, we need to isolate factors related to the size of the management function within firms. By investigating this issue, we contribute to an understanding of who creates head office employment and whether changes therein are related to basic changes in industrial structure. Moreover, by including the nationality of the firm as one of our characteristics, we ask whether foreign-owned firms are any more likely to locate a head office function in Canada than are domestic-controlled firms.

The remainder of the paper is organised as follows. In Section 2, we describe the source of data used in the analysis, the Annual Survey of Manufactures. Following this, Section 3 describes trends in head office employment in Canada, both in terms of levels of employment and how important head office employment is relative to other forms of employment within manufacturing firms. The next two sections present models that test the relationship between

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2. Much of this discussion is summarized in Hurtig (2002).

several firm characteristics and head office employment. Since most firms do not report a head office, Section 4 asks what factors affect a firm's decision to establish a head office that is separate from its other operations. In doing so, we ask whether foreign firms are more or less likely to establish head offices than domestic firms. In turn, Section 5 asks what factors influence the level of head office employment in firms that have head offices. Again, we ask whether foreign firms have higher or lower levels than domestic firms, all else being held equal. Section 6 concludes the paper.

## ***2. Data***

Throughout the analysis we will use data derived from the Annual Survey of Manufactures (ASM) covering the period from 1973 to 1999. The ASM is effectively a census of manufacturing establishments (plants) and their related auxiliary units, which includes head offices. The longitudinal version of the file used here provides us with information on manufacturing plants and head offices and the firms that control them. It allows us to examine how various aspects of production and management is organised within manufacturing firms. Amongst other matters, it permits us to measure the head office employment within an enterprise in a given year and to track how its head office employment changes over time.

As we will be investigating the importance of head offices within firms, it is important to define from the outset what we mean by firms and head offices. We define a firm as being composed of a set of establishments that are under the control of a common entity. These establishments can be subdivided further into plants and auxiliary units. Auxiliary units are effectively all other units that do not meet the definition of a producing establishment. They are composed of head offices, sales offices and other auxiliary units (e.g., warehouses).

Head offices in the ASM are defined as those auxiliary units that primarily perform administrative functions. When this function is conducted at a location that is geographically separated from production units, it is reported separately from the latter. However, even when the head office is co-located with a production unit, it may be reported separately if the management function serves other plants and operates as a profit centre. If they are co-located and are imbedded within the production unit in a way that reduces the ability of the firm to report the entities separately, the head office will not be reported separately.<sup>3</sup> Hence, the ASM is composed of firms that report separate head office units—Head Office Firms (HOFs)—and those that do not.

Employment within head offices consists of non-production workers. It should be noted that not all non-production workers are in head offices. Some will be found within plants because of supervisory activities needed at the production level.

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3. If a firm cannot report its head office function separately (i.e., does not have the requisite management information system for control purposes), it is likely to be at the stage that it does not consider the management function important enough to monitor.

Our study then is concerned with the factors that are associated with a firm deciding to create the type of separate ‘head office’ as described above and the size of the employment in that unit. A separate paper will examine the determinants of non-production workers in total.

### ***3. Manufacturing head office employment in the 1970s, 1980s and 1990s***

In this section, we document how head office employment has evolved through the 1970s, 1980s and 1990s. We also provide an overview of the characteristics of head office firms, in particular, how head office employment in foreign-controlled firms differs from domestically-controlled firms.

We begin by comparing the characteristics of HOFs and non-HOFs. As will become apparent in the next section, it is important to understand how HOFs differ from non-HOFs in order to understand what determines aggregate head office employment. During the 1970s and 1980s, the average count of HOFs as a share of all firms was 1.0%. The HOF share rose in the 1990s, but at 1.3% remained only a small fraction of the overall population of enterprises (see Table 1).

Even though they represent a small share of firms, HOFs account for a significant share of employment, sales and value added. HOFs account for a third of all manufacturing employment and an even larger share of sales and value added (see Table 1). By the 1990s, HOFs averaged 46% and 43% of manufacturing sales and value added, respectively. Thus, although HOFs are relatively few in number, they are among the largest enterprises in the population and their importance, at least in terms of value added and sales, has increased between the 1980s and 1990s.

**Table 1.** Head office firms relative to the total firm population

	Firms	Employment	Sales	Value added
1973-1979	1.0	33.7	40.3	37.4
1980-1989	1.0	31.8	40.8	37.3
1990-1999	1.3	31.9	46.4	42.9

Source: Special tabulation, Annual Survey of Manufactures.

It is significant that head office firms increased their shares of output (measured as sales or value added) during the 1990s, all the while keeping their shares of employment constant. This implies this group of firms was increasing relative labour productivity—due to labour saving technology and other efficiencies. A reduction in head office employment does not imply that the function was disappearing; it may simply have become more productive.

Head office employment between the 1970s and the 1980s grew both in absolute and relative terms (see Table 2). Head office employment increased from an average of 47,500 during the 1970s to 48,700 during the 1980s. In contrast to head office employment, average non-head office employment (of HOFs) was lower in the 1980s than in the 1970s. These contrasting trends

resulted in an increase in the ratio of head office to non-head office employment, increasing from an average of 0.08 in the 1970s to 0.09 in the 1980s.

In contrast to the 1980s, the decade of the 1990s was a time of retrenchment for head office and non-head office employment. The average annual level of head office employment in the 1990s was 42,000, representing a 14% decline from the 1980s average. The ratio of head office to non-head office employment also fell between the 1980s and 1990s, reflecting the fact that non-head office employment did not fall at the same rate as head office employment (see Table 2). The ratio of head office to non-head office employment by the 1990s fell to just below its 1970s average level. This indicates that the overall economies that were being made in the managerial labour force were concentrated in the head office function.

**Table 2.** Average annual head office and non-head office employment in head office firms

	Head office [1]	Non-head office [2]	Ratio of [1] to [2]
1973-1979	47,465	562,752	0.084
1980-1989	48,720	541,326	0.090
1990-1999	41,969	532,949	0.079

Source: Special tabulation, Annual Survey of Manufactures.

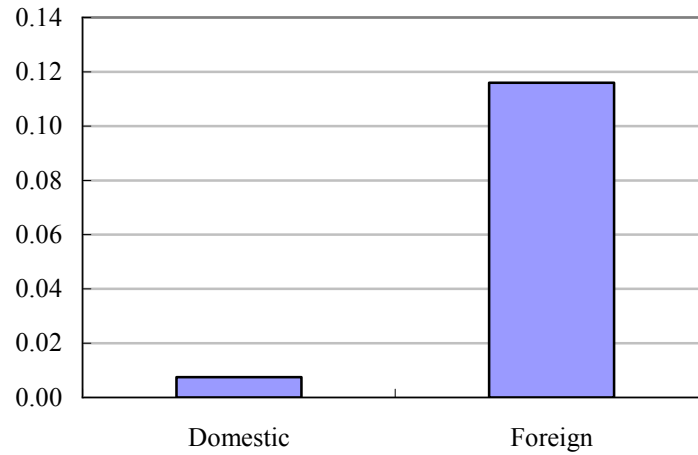
As we noted previously, foreign-control may have either a positive or negative influence on the level of head office employment within an economy. In practical terms, foreign ownership can influence the overall level of head office employment in two ways. It can influence the likelihood a firm establishes a head office and the level of employment within its head office.

The likelihood that a firm has a head office can be measured by taking the ratio of head office to non-head office firms. This ratio is reported in Figure 1 for domestically- and foreign-controlled firms, averaged across all years between 1990 and 1999. The odds that a foreign firm had a head office were about 15 fold higher than the odds for domestic firms.

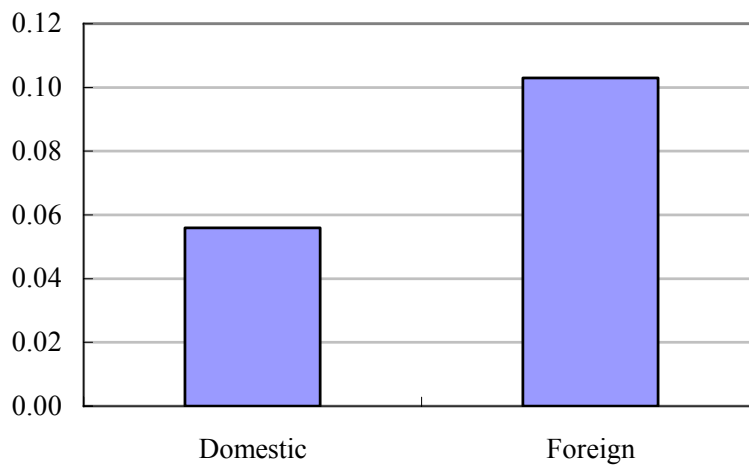
Calculating the ratio of head office to non-head office employment of head office firms provides a measure of the importance of head office employment. Figure 2 compares the average of this ratio for foreign- and domestically-controlled firms during the 1990s. It shows that foreign-controlled firms had almost twice the ratio of head office to non-head office employment as domestically-controlled firms.

Both Figures 1 and 2 suggest foreign ownership has a positive influence on head office employment. However, foreign ownership is only one variable among many that may be related to head office employment. A more complete understanding of head office employment requires a multivariate approach. For instance, foreign investment may be concentrated in industries with inherently high levels of head office employment or that are more likely to have a separate head office unit. The higher levels of head office employment in foreign-controlled firms may simply be a result of industry effects. We approach this issue in the next two sections first by examining what characteristics are related to whether a firm creates a head office and then by examining the correlates of the number of head office employees.

**Figure 1. Average ratio of head office to non-head office firms: foreign- versus domestically-controlled firms, 1990-1999**



**Figure 2. Average ratio of head office to non-head office employment in head office firms: foreign- versus domestically-controlled, 1990-1999**



## ***4. Why does a firm establish a head office?***

As we have noted above, a firm characteristic like foreign ownership influences head office employment in two ways: (1) through its effect on the likelihood that a firm establishes a head office; and (2) through its effect on the level of employment within head offices. We therefore investigate the effect of characteristics like foreign ownership on both to understand how they influence aggregate levels of head office employment.

The first step is to provide a framework to explain why a firm chooses to establish a separate head office—that is, why it creates a separate entity within which it houses its management function. The next sub-section does this. Subsequent sub-sections define the correlates of head office choice and present the results of an econometric model of head office creation.

### ***4.1 Head office choice***

Head offices group management employees into units that are separate from production facilities. To understand the decision process, we need to ask what head offices do and why they are set up as separate units.

Head offices provide a centralized management function. Management provides key direction on the overall strategy that a firm will take—sometimes referred to as the ‘command’ function. They also monitor activities and regulate the delivery of the product—the ‘control’ function. Activities in head offices, at the most basic level, provide services to the production process—services involving payroll, finance, human resources, legal, and marketing.

These services can be provided at a site that is contiguous to the production process or at a separate location. When the latter occurs, head offices emerge as separate statistical units.<sup>4</sup> The creation of separate units as a firm grows depends very much on the same factors that determine specialization of other functions—the size of the market (in this case, the size of the firm that consumes these services). As firms become larger, there is an increasing division of labour—in terms of management function in the areas of accounting, technology acquisition, industrial relations, intellectual property management, R&D management, and marketing.

However, specialization of function does not necessarily lead to head office creation. Specialists can be found working within production entities. The creation of separate head office units involves more than just the specialization decision; it also involves a decision to create a unit that is separate (often geographically removed) from the ongoing day-to-day operations of the production units of the firm. The benefits of doing so involve making a transition to a specialized command function that distances itself from day-to-day operations and considers overall strategy; the disadvantages consist of removing the management from an appreciation of the problems of the ongoing operations of the firm.

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4. As noted previously, they can but do not necessarily emerge as separate units when co-located. In this case, they emerge as separate units when they become separate cost centers not covered by the operating units.

Since the majority of head offices are located separately from production facilities, the decision to establish a separate head office involves a decision regarding location. And that is the reason that so much of the literature on head offices involves location theory (Klier and Testa, 2002 and Davis and Henderson, 2004).

A firm must decide whether it is more profitable to locate its head office with one of its production facilities or on a separate site. This decision is affected by centripetal forces that pull the head office towards its production units and centrifugal forces that draw the head office away from these same units.

Centripetal forces are internal to the firm and result from the extra cost of establishing a separate head office. On the other hand, centrifugal forces are typically external to the firm and result from the benefits of establishing a head office in a different location than production units. At minimum, any model of head office choice has to take both forces into account. We will begin our discussion by focussing on the nature of centripetal forces.

Centripetal forces derive from the efforts of firms to minimize fixed and coordination costs associated with the management of operations. By co-locating management with production in the same establishment, the head office and production sides of the firm are able to share the fixed costs (e.g., land costs). This can be thought of as a form of diversification. When there is co-location at the production site, the firm is producing a diversified product at that site—diversified across both management services and production output because of a fixed cost at the site that can be shared between the two products.<sup>5</sup> Co-locating management with production may also minimize distance-related coordination costs, as managers do not have to incur the time and monetary costs of travelling between their head office and production facilities.

The strength of these centripetal forces should be inversely related to the size of the firm. There are two reasons for this. First, as the firm increases in size the number of managers increases. As a consequence, the savings on fixed costs of co-locating management and production together declines because economies are not likely to be gained in terms of shared building and site space. Second, as the firm increases in size, managers become increasingly specialized,<sup>6</sup> which reduces the proportion of managers closely involved in the production process and, therefore, the cost of separating managers from day-to-day operations falls.

Coordination costs are also affected by whether the firm organizes its production within a single plant or across multiple plants. To illustrate this point, compare a single-plant to a two-plant firm. For the single-plant firm, the location that minimizes the distance between the management and workers is the plant itself. But for a two-plant firm, all the points on a straight line between the two plants result in the same average distance between management and the plants, assuming both plants are equal in size. Thus, by moving from a single- to two-plant status, the savings on coordination costs of co-locating management with workers in the one plant may be nullified. Of

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5. See Baldwin, Caves and Gu (2005) for a discussion of this diversity model.

6. This argument relies on Adam Smith's (1986) well-known principle that the division of labour increases with the size of the market. The only difference here is that the division of labour occurs among managers rather than production workers.

course, there remain other incentives to continue to co-locate head office management with production, such as savings on fixed costs.

To this point, we have outlined the factors that contribute to the centripetal forces that tend to pull management and production together in space. Although increased firm size and multi-plant status tend to reduce these centripetal forces, they do not eliminate them altogether. We have to turn our attention to centrifugal forces to understand what might tip the balance between the costs and benefits of establishing a separate head office.

In general, centrifugal forces are exogenous to the firm. However, there are circumstances when they are related to the nature of the firm. We will focus on those first. Here we return again to the distinction between multi- and single-plant firms. Multi-plant status not only reduces the coordination cost savings of co-locating management and workers together, but it also provides an incentive for head offices to be located separately from plants. A central location may minimize the distance traveled by managers in a firm that possesses three or more plants. Moreover, even for a two-plant firm, a central location may be preferable if it allows managers to travel to and from each plant in a day, rather than having to stay over night. Therefore, multi-plant status reduces centripetal forces and increases the centrifugal forces working within the firm.

Centrifugal forces that are external to the firm derive from localization economies that differentially affect the management and production activities of the firm. These localization economies relate to (1) labour market pooling, (2) access to intermediate inputs and (3) knowledge spillovers (see Marshall, 1920). We will deal with each of these in turn.

As we have noted above, when firms become larger there is an increasing division of labour among their managers. Consequently, as firms increase in size, they need access to larger pools of skilled labour with specialized talents (engineers, financial experts). It is in large cities that these pools of labour are most likely to be found.<sup>7</sup> Therefore, firms whose operations are primarily located in smaller urban centres and rural areas have an incentive to establish head offices in larger cities in order to gain access to these pools of labour.<sup>8</sup>

In addition to providing a larger pool of skilled labour, large urban areas offer a wide variety of producer services (intermediate inputs) demanded by managers, including management consulting, accounting, and corporate law offices (see Coffey, 1994). Moreover, large cities often provide greater access to investment bankers and other forms of investment capital that might not be as easily tapped in more remote regions. Therefore, large centres are able to offer a selection of service inputs that are scarcer and often more expensive in smaller urban centres and rural areas.

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7. Beckstead and Vinodrai (2003) describe how so-called knowledge workers are concentrated in Canadian urban areas.

8. Duranton and Puga (2001) suggest that in Europe firms start in large, diversified cities and then move their production to smaller specialized cities. This does not, however, contradict the logic expressed here, since our argument suggests that the head office would tend to remain in the larger cities to take advantage of the localization economies found there rather than move to specialized centres where external economies benefit the production side of the firm more than the management side.



Finally, large cities are likely to be the headquarters of major clients and competitors. By locating its headquarters in larger cities a firm is able to remain in constant contact with its customers, while keeping a close watch on its competitors. As such, it is able to take advantage of knowledge spillovers.

Taken together, these various localization economies act as a centrifugal force that draws head offices away from production locations if production takes place in smaller urban centres and rural areas. Therefore, *ceteris paribus*, firms whose production is concentrated in more remote regions will be more likely to establish head offices than those whose production is based in larger centres.

The complexity of a firm's operations should also influence its decision to establish a separate head office. Firms that operate across several industries have to collect and analyse large amounts of information. This may increase their demand for managers with specialized skills and their demand for producer services.

Foreign-control may also influence whether a firm decides to open a separate head office. The asset-specific theory of multinationals (Caves, 1982) suggests that foreign firms exist because of special assets—marketing, R&D, technology know-how—that they transfer across international boundaries by creating subsidiary operations.<sup>9</sup> Arguably, foreign firms might be less likely to have a separate head office if they believe that their Canadian operations can be effectively controlled from their home base. Alternatively, foreign firms may need to tailor the applicability of the asset that they possess to local conditions. Their larger demand for highly skilled managers and other management-type services that are purchased by head offices may mean that they will be more likely to establish head offices away from their production facilities where these services are not available.

In summary, firms that are larger, operate more than one plant, are located in more remote regions, and are more industrially diverse are expected to be more likely to have a head office establishment. On the other hand, our expectations regarding the influence of foreign ownership are less certain.

#### ***4.2 Specifying the correlates of head office location choice***

This section contains the names, definitions and expected signs of the various correlates of head office location choice (see Table 3).

We measure size through the number of non-production workers in the firm (MANAGE). Non-production workers include those located in plants and in head offices. Our use of this variable assumes that head office personnel are involved in managing the entire management structure more than they are the operations structure of the firm—though use of overall employment yields about the same results.

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9. For a discussion of the applicability of this theory to explain the intensity of foreign ownership in Canada, see Baldwin and Gellatly (2005).

We capture multi-plant operations with two variables. The first is a binary variable,  $M\_PLANT$ , which takes on a value of one if the firm has two or more plants and a value of zero otherwise. The second variable captures the effect of the number of plants on head office employment. It is measured as a count of the number of manufacturing plants (minus 1) operated by the firm ( $NPLANT$ ). In the model,  $NPLANT$  is multiplied by  $M\_PLANT$  to form an interaction term ( $M\_PLANT*NPLANT$ ). It captures the extra incentive to locate management in a central location as the number of plants increase.

To classify the geography of each firm's output, we utilise the Beale rural-urban coding system used in our previous studies.<sup>10</sup> This system classifies plants according to the size and locational characteristics of the census division in which the plant is located. Plants are classified into three urban classes—larger ( $URBAN\_L$ ), medium ( $URBAN\_M$ ) and small ( $URBAN\_S$ )—and two rural classifications—rural adjacent ( $RURAL\_A$ ) and rural non-adjacent ( $RURAL\_NA$ ) to metropolitan areas. Each firm is placed into one of these same five categories—based on where the *plurality* of its production (measured by value added) takes place. Table 3 provides a definition of these five classes. Firms classified into the two smaller urban categories or the rural categories are hypothesized to be more likely to establish head offices, because of the pull of stronger localization economies in larger centers. To test this hypothesis, we include binary variables for the urban- and the rural-firm categories. The largest urban category is excluded and is used as a basis of comparison.

To account for the complexity of a firm, we include a measure of its industrial diversity ( $INDDIV$ ). Industrial diversity is measured using a Herfindahl index:

$$INDDIV = 1 - \sum_i s_{pw,i}^2 \tag{1.1}$$

where  $s_{pw,i}$  is the share of the firm's production workers located in industry  $i$ . Equation (1.1) subtracts the summation term from one to ensure the index increases with the firm's level of industrial diversity.

The effect of foreign ownership ( $FOWN$ ) is captured with a binary variable that takes on a value of one if the firm is foreign-owned and zero if it is domestically-owned. As noted above, there are competing hypotheses regarding the sign that the parameter related to this variable might take.

Finally, we control for industry effects by including binary variables for the industry that accounts for the *plurality* of the firm's value added. These industrial sectors are defined using five broad categories—natural resource-based industries, labour intensive industries, scale-based industries, product-differentiated industries, and science-based industries.<sup>11</sup> Each industry in the model is given a binary variable, with science-based industries excluded in order to avoid perfect multi-collinearity among the industry variables.

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10. See Brown and Baldwin (2003) for a detailed description of the Beale classification system.

11. See Baldwin and Rafiqzaman (1994) for an in-depth discussion of these industrial aggregates.

**Table 3.** Head office location choice model variables

Name	Description	Expected sign
MANAGE	A proxy for the importance of managers that is measured with the number of non-production workers plus head office workers in the firm.	+
M_PLANT	A multi-plant variable represented by a binary variable that equals one if the firms has two or more plants and zero otherwise.	+
M_PLANT* NPLANT	Interaction of M_PLANT with the number of manufacturing plants (NPLANT) controlled by the firm, where NPLANT is the number of plants controlled by the firm minus 1.	+
URBAN_L	A binary variable for large urban areas that equals one if a plurality of the firm's value added is generated in census division(s) that are within or partially within a Census Metropolitan Area (CMA) with a population greater than 1 million and zero otherwise.	N/A
URBAN_M	A binary variable for medium-sized urban areas that equals one if a plurality of the firm's value added is generated in census division(s) that are within or partially within a CMA with a population between 250,000 and 999,999 and zero otherwise.	+
URBAN_S	A binary variable for small urban areas that equals one if a plurality of the firm's value added is generated in a census division(s) that are within or partially within a CMA or Census Agglomeration (CA) with a population between 50,000 and 249,999 and zero otherwise.	+
RURAL_A	A binary variable for rural adjacent areas that equals one if a plurality of the firm's value added is generated in census division(s) that shares a boundary with a CMA/CA and the CMA/CA has a population greater than 50,000 and zero otherwise.	+
RURAL_NA	A binary variable for rural non-adjacent areas that equals one if a plurality of the firm's value added is generated in a census division(s) that <i>does not</i> share a boundary with a CMA/CA and the CMA/CA has a population greater than 50,000 and zero otherwise.	+
INDDIV	Industrial diversity of the firm	+
FOWN	Binary variable equals one if the firm is foreign-owned and zero otherwise.	+/-
NR_IND	Binary variable equals one for natural resource-based (NR) industries and zero otherwise.	+/-
LI_IND	Binary variable equals one for labour intensive industries (LI) and zero otherwise.	+/-
SB_IND	Binary variable equals one for scale-based industries (SB) and zero otherwise.	+/-
PDI_IND	Binary variable equals one for product-differentiated industries (PDI) and zero otherwise.	+/-
SCI_IND	Binary variable equals one for science-based industries (SCI) and zero otherwise.	N/A

### 4.3 Logit model results

The decision to establish a separate head office is at root a binary event. A firm either reports a separate head office or it does not. Therefore, we use an econometric model that takes into account the binary nature of the dependent variable and specifically a logit model that estimates the probability that a firm chooses to establish a head office.

We estimate several models using progressively more comprehensive specifications based on the variables defined above. All models are estimated using data from the most recent survey year, 1999. The results include the estimated coefficients and their respective p-values for each model (Table 4) and the odds ratios for each variable (Table 5). The sign of the coefficients and p-values provide us with a measure of the direction and statistical significance of the relationship between each variable and the probability that a firm chooses to establish a head office, while the odds ratio gives us a measure of the economic significance of the variable.

An odds ratio measures the change in the odds of an event occurring—in this case the presence of a head office—resulting from a change in the value of an independent variable. In the case of the binary variables and M\_PLANT\*NPLANT, the change in the independent variable is +1. For the remaining continuous variables, we use the (positive) standard deviation of the variable to measure change.

As a benchmark, Model 1 only includes the industrial controls on head office choice. As noted above, the excluded sector is science-based industries. The results indicate that labour intensive industries and product-differentiated industries are significantly less likely to have a head office than science-based industries (see Table 4). The odds ratios reported in Table 5 indicate the odds of a head office in labour intensive industries and product-differentiated industries are 50% and 30%, respectively, of science-based industries. The industry in which a firm operates, therefore, has a considerable impact on whether a firm decides to create a head office.

Science industries are those with special types of assets. They are characterized by high expenditures on R&D and the introduction of innovations that are distributed to other industries in the way of intermediate products (see Baldwin and Hanel, 2003). It is here that firms find head offices that provide long-term strategic direction and other management services (perhaps R&D direction) most useful. In contrast, product-differentiated industries are less likely to have head offices. Product-differentiated industries include, *inter alia*, those industries that have higher advertising expenditures and where marketing assets are more likely to be important. These are not the industries where head offices appear to have the same advantages as in science-based industries. Different assets then appear to have different centralizing effects.

Of course, industry differences are a reflection of the average characteristics of the firms that make up that industry. The remaining models reported in Table 1 attempt to account for the effect of firm characteristics on head office choice.

As we have noted above, firm size, and in particular the number of managers in a firm, may have a positive influence on its choice to establish a separate head office. Model 2 combines MANAGE with the industry controls used in Model 1. Consistent with expectations, the number

of managers in a firm has a positive and statistically significant effect on the odds that a firm has a head office (see Table 1). The inclusion of MANAGE also increased the model's pseudo R-Squared from 0.02 to 0.26.

The number of plants that a firm controls is hypothesized to have a positive influence on the likelihood that a firm has a head office. This effect is captured by a multi-plant binary variable (M\_PLANT) and the interaction between this variable and the number of plants (minus 1) controlled by the firm (M\_PLANT\*NPLANT). Model 3 estimates the effect of M\_PLANT and M\_PLANT\*NPLANT.

Both M\_PLANT and M\_PLANT\*NPLANT have positive and highly significant coefficients. Firms with more than one plant are found to be more likely to have a head office and the likelihood of having a head office also increases as the number of plants increases. These effects are not merely statistically significant. Multi-unit firms have 25 fold higher odds of having a head office than single unit firms, all else held equal (see Table 5). Moreover, for every additional plant, the odds of having a head office increase by approximately 10%. These results are consistent with the proposition that moving from single- to multi-plant status reduces the coordination cost savings of locating managers and production together in the same site and that there are benefits of locating head offices away from production, possibly in a more central location. It is also worth noting that the model's level of explanation increases significantly when both multi-plant variables are included.

**Table 4.** Head office location choice models, 1999

	Model 1		Model 2		Model 3		Model 4		Model 5	
	estimate	p-value	estimate	p-value	estimate	p-value	estimate	p-value	estimate	p-value
Intercept	-3.8828	<.0001	-4.9399	<.0001	-5.3357	<.0001	-5.4290	<.0001	-5.6518	<.0001
MANAGE			0.00777	<.0001	0.00287	<.0001	0.00294	<.0001	0.00239	<.0001
M_PLANT					3.2153	<.0001	3.1984	<.0001	2.6926	<.0001
M_PLANT* NPLANT					0.0854	0.0001	0.0906	<.0001	0.0781	0.0006
FOWN									1.2218	<.0001
INDDIV									0.6384	0.0968
URBAN_M							-0.1408	0.4906	-0.0991	0.6332
URBAN_S							0.2056	0.3593	0.2349	0.3022
RURAL_A							0.8303	<.0001	0.8146	<.0001
RURAL_NA							0.6516	0.0007	0.7906	<.0001
NR_IND	-0.0197	0.9192	0.6097	0.0185	0.2813	0.2661	0.0730	0.7761	0.2031	0.4337
LI_IND	-0.7575	0.0004	0.1129	0.6805	0.1714	0.5195	0.0545	0.8384	0.2050	0.4486
SB_IND	-0.0798	0.6957	0.2472	0.3649	0.0265	0.9203	-0.1472	0.583	-0.1527	0.5741
PDIF_IND	-1.3548	<.0001	-0.5924	0.0681	-0.5568	0.0773	-0.6708	0.0339	-0.6714	0.0361
n		24,048		24,048		24,048		24,048		24,048
Pseudo R-square		0.0206		0.2605		0.4025		0.4108		0.4267

**Table 5.** Head office odds ratio estimates, 1999

	Change <sup>a</sup>	Model 1	Model 2	Model 3	Model 4	Model 5
MANAGE	141.2		<b>3.0</b>	<b>1.5</b>	<b>1.5</b>	<b>1.4</b>
M_PLANT	1			<b>24.9</b>	<b>24.5</b>	<b>14.8</b>
M_PLANT* NPLANT	1			<b>1.1</b>	<b>1.1</b>	<b>1.1</b>
FOWN	1					<b>3.4</b>
INDDIV	0.08					1.1
URBAN_M	1				0.9	0.9
URBAN_S	1				1.2	1.3
RURAL_A	1				<b>2.3</b>	<b>2.3</b>
RURAL_NA	1				<b>1.9</b>	<b>2.2</b>
NR_IND	1	1.0	<b>1.8</b>	1.3	1.1	1.2
LI_IND	1	<b>0.5</b>	1.1	1.2	1.1	1.2
SB_IND	1	0.9	1.3	1.0	0.9	0.9
PDIF_IND	1	<b>0.3</b>	0.6	0.6	<b>0.5</b>	<b>0.5</b>

<sup>a</sup> If the unit of change is not +1, it is the positive standard deviation of the variable.

Note: Odds ratios in bold indicate they are significant at the 5 percent level or below.

Model 4 is estimated with binary variables for firms classified into the five urban and rural categories, with the largest urban category excluded. Firms located in rural regions are significantly more likely to have a separate head office. The odds ratio estimates (see Table 5) indicate that firms in rural areas are twice as likely to have a head office than firms in large urban regions. The likelihood that a firm in the other urban categories will have a head office is not significantly different than those found in larger metropolitan regions. These results are consistent with the hypothesis that firms located in rural regions have a higher incentive to establish a separate head office in order to take advantage of localization economies not found in these areas.

The confidence that we place in this interpretation of this finding would be reinforced if firms whose production is concentrated in rural areas tend to locate their head offices in urban regions. Table 6 cross-tabulates the classification of the enterprise based on where the plurality of its production takes place against the location of its key head office; that is, its head office with the most employment.<sup>12</sup>

Our maintained hypothesis is that if firms locate their key head office outside of their own classification, they will tend to locate it in census divisions that are higher in the urban-rural hierarchy. For instance, a firm classified as ‘small urban’ would tend to locate its head office in census divisions classified as either ‘medium’ or ‘large’ urban. The shaded region in Table 6 includes cells where the location of the firm’s head office is higher up the rural-urban hierarchy than the location of the firm’s production. This region has more observations than the unshaded, off-diagonal region, which consists of cases where the head office is located in a census division that is further down the urban-rural hierarchy than their production locations. Moreover, regardless of where a firm’s production takes place, the most common location for its head office is in large urban areas (see Table 6). This is a clear indication that there are agglomeration economies drawing head offices to urban centres and, combined with the regression results, that these economies act as an additional incentive to establish a separate head office unit.

12. We restrict our definition of a firm’s head office to its key head office unit only in this instance. Elsewhere a firm’s ‘head office’ is treated as the aggregate of all its individual head office units.

**Table 6.** Head office counts by head office and firm location, 1999

		<i>Head office location</i>					
		URBAN_L	URBAN_M	URBAN_S	RURAL_A	RURAL_NA	
<i>Production location</i>	URBAN_L	111	8	4	4	1	128
	URBAN_M	27	19	1	3	0	50
	URBAN_S	21	3	15	1	0	40
	RURAL_A	34	8	4	8	3	57
	RURAL_NA	23	10	8	2	20	63
	Total	216	48	32	18	24	338

Source: Special tabulation, Annual Survey of Manufactures.

Model 5 incorporates two additional variables, the ownership status of the firm (FOWN) and its level of industrial diversity (INDDIV). Both have a positive effect on a firm's choice to establish a head office and are statistically significant—though in the case of industrial diversity, its statistical significance is relatively weak. The positive effect of industrial diversity suggests that firms with more complicated organisational structures are more likely to establish a head office.

The economic effect of foreign ownership is quite strong. The odds of a foreign firm establishing a head office is 3.4 times higher than a domestic firm—after controls are entered for other firm characteristics. The significantly positive coefficient attached to foreign ownership allows us to reject the hypothesis that foreign firms are less likely to have a Canadian head office because they can be managed effectively from their home country without having to establish a Canadian headquarters. Our results are consistent with the hypothesis that foreign firms need the type of management function that is best included in a head office in order to exploit its special assets.

In summary, the probability that a firm establishes a head office is affected by a range of factors. Key among these is its size, whether it is a multi-plant or single plant operation, the nationality of its ownership and the geographic location of its production. All these factors have a positive effect, with multi-plant status being the most important. In general, these results are consistent with increased size and multi-plant status reducing the centripetal forces that pull head office management and production units together and management-specific localization economies increasing the centrifugal forces drawing management away from production locations.

## ***5. Correlates of head office employment***

### ***5.1 Head office worker demand model***

Any establishment within an enterprise, be it a plant or an auxiliary unit (e.g., a distribution facility) requires management services. In an enterprise that has a separate head office unit, part of this demand for management services is provided by the head office and can be quantified in the form of the number of employees located there.

Since head office management is concerned with plant activity, we examine the demand for head office employment per plant managed. The demand for head office employment generated by the average establishment ( $H_p$ ) is:

$$H_p = H / NPLANT \quad (1.2)$$

where  $H$  is total head office employment in the firm<sup>13</sup> and  $NPLANT$  is the number of non-head office establishments (plants and auxiliary units) within the firm. For simplicity we refer to non-head office establishments hereafter as plants.

The demand for head office employment per plant is posited to depend on the average size of a firms' plants, the number of plants in the firm and set of firm characteristics. The demand function for head office employment generated by the average plant is written as:

$$H_p = \alpha + \beta PLNTSIZ + \delta NPLANT * PLNTSIZ + \sigma \mathbf{X} * PLNTSIZ + \varepsilon \quad (1.3)$$

where  $PLNTSIZ$  is employment (production and non-production workers) within the average plant,  $NPLANT$  is the number of establishments within the firm and  $\mathbf{X}$  is a vector of other factors hypothesized to affect the demand for head office employment.

Equation (1.3) assumes that the demand for head office employment is a function of the number of workers in the average establishment and the size of the firm itself ( $NPLANT * PLNTSIZ$ ), among other factors. We posit that the number of head office employees per plant is a negative function of the size of the firm ( $NPLANT * PLNTSIZ$ ) because of firm-wide economies of scale associated with head office employment.

The remaining variables that are included in the vector  $\mathbf{X}$  in equation (1.3) are interacted with  $PLNTSIZ$ , and thereby are assumed to affect the slope of  $PLNTSIZ$ —how increases in average plant size are expected to affect average head office employment.<sup>14</sup> A negative coefficient implies that the variable reduces the effect of plant size on head office employment—perhaps because of economies that are positively associated with the variable. A positive coefficient implies that the variable increases the amount of additional employment, perhaps because of added complexity associated with the variable. Table 7 defines each of these additional variables. The first firm-based characteristic postulated to affect head office employment is the ratio of plant-based non-production workers to head office workers (NPWHO). A larger value of this variable occurs when a larger proportion of non-production workers as a whole are located in plants. And this will occur when the operations of a firm are such as to require a relatively large proportion of their managers to be situated at the plant production site. When this occurs, we should expect that as plants get larger, there will be relatively lower demand for managers at head office. The expected sign of NPWHO is therefore negative.

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13. Total head office employment is the sum of employment across all head offices under the firm's control.

14. We interact these additional variables with  $PLNTSIZ$  because we expect that their effect on the demand for head office employment will depend on the size of the plant. For instance, we expect that the effect of foreign ownership on the level of head office employment demanded in a larger plant of 1000 workers to be higher, in absolute terms, than a small plant of 20 workers.



The second firm-based characteristic captures the degree of geographical separation of a firm's plants. A firm may choose to locate more of its managers in plants, rather than in head offices, in order to reduce coordination costs. In part, coordination costs are a function of the geographic scope of the firm's operations. We measure geographic scope (GEOSCOPE) as

$$GEOSCOPE = \sum_l s_l d_{lh} \quad (1.4)$$

where  $s_l$  is the share of the firm's sales accounted for by plant  $l$  and  $d_{lh}$  is the distance between plant  $l$  and the closest head office  $k$  to plant  $l$ . It measures the average distance between plants and their respective closest head office, weighted by the level of sales in each plant. Our expectation is that firms with a higher level of geographic scope, *ceteris paribus*, will have a lower level of head office employment for a given average plant size.

As with the head office choice model, we include a foreign ownership binary variable (FOWN). As we have noted above, there are two competing theories as to the effect of foreign ownership on head office employment. One holds that foreign-owned firms will have fewer head office workers because they are able to manage their Canadian operations from abroad. Alternatively, if foreign-owned firms possess more special assets that require adaptation to national circumstances, they may have higher levels of head office management in Canada. Therefore, it is unclear whether the expected sign for FOWN will be positive or negative.

A firm's need for managers as it expands its plants should also depend, in part, on how sophisticated (or complicated) its operations are. Management performs the planning, organisation and control functions within firms. The more complicated the firm's operations, the greater the demand on managers, and therefore, the need to increase their numbers, all else being held equal. Industrial diversity (INDDIV) is used here to measure the degree of complexity that managers have to handle. A firm that is diversified across more industries should be expected to have more managers in head office.

The complexity of a firm's operations is expected to depend not only on the level of diversity across industries but also on the type of diversification involved. On the one hand, some firms pursue narrow-spectrum diversification (NSD), which entails diversifying into closely related sectors. In contrast, other firms pursue broad-spectrum diversification (BSD), which involves diversifying across unrelated sectors. We hypothesize that BSD requires more managers, because of the complications that result from managing very different businesses. We account for these two forms of diversification by using binary variables to classify firms, based on whether they diversify operations only within two-digit industries (NSD) or across two-digit industries (BSD).

Since each plant is assigned a unique industry, firms increase their industrial diversity by adding plants from different industries. This means that the measure of industrial diversity is likely to be correlated with the number of plants controlled by a firm, which we hypothesize reduces a firm's demand for head office employment on a per plant basis. To address this problem, we use an interaction variable consisting of the product of the number of plants controlled by the firm (NPLANT), its level of industrial diversity (INDDIV) and whether it pursues narrow or broad diversification (NSD or BSD) strategies:

$$\begin{aligned}
N * IND * NSD &= NPLANT * INDDIV * NSD \text{ and} \\
N * IND * BSD &= NPLANT * INDDIV * BSD
\end{aligned}
\tag{1.5}$$

We can estimate (1.3) directly, but many commentators are interested in the ratio of head office to non-head office worker employment. Equation (1.3) can be transformed into this ratio by multiplying both sides by the number of non-head office establishments in the firm and dividing both sides by total non-head office employment ( $E$ ):

$$HO\_RATIO = \frac{H}{E} = \frac{H_p * NPLANT}{E} = \beta + \alpha \frac{1}{PLNTSIZ} + \delta NPLANT + \sigma \mathbf{X} + \mu \tag{1.6}$$

where  $\mu = \varepsilon/E_p$ . We use the model described by equation (1.6) in the estimation.

**Table 7.** Independent variable descriptions for head offices of consolidated enterprises

Name	Description
PLNTSIZ	Average plant/auxiliary unit size
NPLANT	Number of plants and auxiliary units per enterprise
NPWHO	Ratio of plant-based non-production workers to head office employment in the firm
GEOSCOPE	Geographic scope of management for production workers of the enterprise
INDDIV	Industrial diversity of the firm (defined formally above)
NSD	Narrow spectrum diversification represented by a binary variable that equals one if the firm controls plants only across 4-digit industries within the same 2-digit industry and zero otherwise
BSD	Broad-spectrum diversification represented by a binary variable that equals one if the firm controls plants across 2-digit industries and zero otherwise.
FOWN	Foreign ownership represented by a binary variable that equals one if the firm is foreign-owned and zero otherwise.

## 5.2 Pooled and fixed-effects models

In this sub-section, we report estimates for the head office employment model described by (1.3). For the estimates, we use observations from all the years covered by our data set (1973-1999). Initially, we treat this data set as straightforward pooled cross-sections and then later estimate a fixed-effects model.

We restrict our sample of head offices in two ways. We do so in the first instance by including only head offices that are present for two or more years. Our primary reason for doing this is that it ensures that our cross-sectional results utilize the same sample as the fixed-effects model, which requires at least two observations for each firm. We also restrict the sample in this way to avoid the inclusion of head offices that are merely transitory and as such do not represent a true organizational change on the part of the firm. In the second instance, we eliminated observations above the dependent variable's 95 percentile ( $HO\_RATIO = 0.923$ ). This effectively eliminates all observations with a head office ratio above one. These observations can have a disproportionate impact on our estimates. Moreover, they are likely to include manufacturing-based holding companies rather than firms that are fully engaged in the manufacturing process. We have not specified our model to take into account the activities of holding companies.

Table 8 presents descriptive statistics for the dependent and independent variables for the restricted sample. We include in Table 8 both the number of head office workers per plant ( $H_p$ ) and the ratio of head office employees to non-head office based employees. The average firm has an  $H_p$  of 17.1 and a mean HO\_RATIO of 0.15. The latter implies that for every 100 non-head office employees there are 15 head office employees. Head offices are a non-trivial location of employment for these firms.

Turning to the independent variables, the average firm has 11 plants, employing 150 workers per plant, a non-production to head office worker ratio of 7.4, a sales weighted distance between its plants and closest head office of 448km (GEOSCOPE) and a level of industrial diversity (INDIV) equal to 0.33 (on a scale between 0 and approximately 1).

**Table 8.** Descriptive statistics

Variable	Mean	Standard deviation	0%-minimum	25%	50%-median	75%	100%-maximum
$H_p$	17.1	28.3	0.048	3.5	8.5	19	450
HO_RATIO	0.15	0.17	0.0004	0.04	0.09	0.20	0.92
PLNTSIZ	150	179	4	54	100	184	2,686
NPLANT	11	16	1	3	6	13	165
NPWHO	7.4	21.5	0	1.1	2.5	6.1	619.0
GEOSCOPE	448	519	0	84	263	625	3,419
INDDIV	0.33	0.29	0	0	0.37	0.59	0.92

Source: Special tabulation, Annual Survey of Manufactures.

The results of the cross-sectional models are reported in Table 9. Models 1 through 5 are pooled cross-sections, while Model 6 is a fixed-effects model. All of the models have highly significant F statistics and, with the exception of the fixed-effects model, explain roughly 20% of the variation in the head office ratio.

Model 1 is the simplest and includes only an intercept, PLNTSIZ, an interactive term PLANTSIZ\*NPLANT, and industry controls. The intercept, which corresponds to  $\alpha$  in (1.3), can be interpreted as the number of head office workers required if there was no employment in the firm's plants and auxiliary units. Its estimate is positive and significant, indicating that, on average, there are 2.6 head office workers for each plant, irrespective of its size. These head office workers can be thought of as the fixed management input per plant required by the firm. Plant and firm size both affect the demand for head office employment generated by the average plant. The parameter estimate for PLNTSIZ is positive and highly significant. Its value implies that for every 100 workers in a plant in a science-based industry there are 18 head office workers.

The parameter estimate for firm size (PLNTSIZ\*NPLANT) is negative and highly significant. This suggests that as the size of the firm increases, the demand for head office workers generated by the average plant declines. There are firm-wide economies of scale associated with head office employment.

**Table 9.** Head office employment models

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	estimate	p-value	estimate	p-value	estimate	p-value	estimate	p-value	estimate	p-value	estimate	p-value
Intercept	2.6	<0.001	2.5	<0.001	2.5	<0.001	2.6	<0.001	2.6	<0.001	2.3	<0.001
PLNTSIZ	0.18	<0.001	0.19	<0.001	0.20	<0.001	0.17	<0.001	0.17	<0.001		
PLNTSIZ*NPLANT	-0.0019	<0.001	-0.0017	<0.001	-0.0016	<0.001	-0.0016	<0.001	-0.0022	<0.001	-0.0035	<0.001
NPWHO			-0.0014	<0.001	-0.0014	<0.001	-0.0013	<0.001	-0.0013	<0.001	-0.0005	<0.001
GEOSCOPE					-0.000019	<0.001	-0.000022	<0.001	-0.000022	<0.001	-0.000040	<0.001
FOWN							0.037	<0.001	0.037	<0.001	0.022	0.2719
N*IND*NSD									-0.000056	0.889	0.0010	0.1988
N*IND*BSD									0.00096	<0.001	0.0025	<0.001
NR_IND	-0.050	<0.001	-0.050	<0.001	-0.049	<0.001	-0.040	<0.001	-0.039	<0.001		
LI_IND	-0.050	<0.001	-0.052	<0.001	-0.053	<0.001	-0.040	<0.001	-0.041	<0.001		
SB_IND	-0.071	<0.001	-0.065	<0.001	-0.065	<0.001	-0.055	<0.001	-0.056	<0.001		
PDIF IND	-0.049	<0.001	-0.047	<0.001	-0.049	<0.001	-0.044	<0.001	-0.044	<0.001		
n		7,806		7,806		7,806		7,806		7,806		7,806
R-square		0.17		0.20		0.20		0.22		0.22		0.78
Adj R-square		0.17		0.20		0.20		0.21		0.22		
Pr> F		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Estimator		OLS		OLS		OLS		OLS		OLS		Fixed effects

Note: P-values are corrected for heteroscedasticity, with the exception of Model 6.

The coefficients on the industry variables confirm the industry differences outlined in the previous section. Compared to science-based industries, the other industries add fewer head office employees as the number of workers per plant increases.

The parameter estimates and level of statistical significance for all of the variables reported in Model 1 remain stable across all models reported in Table 9. Therefore, the discussion of the remaining models in Table 9 will focus on the variables that differ from those of Model 1.

To control for how firms allocate non-production workers between head offices and plants, Models 2 and 3 add NPWHO and GEOSCOPE, respectively. As expected, firms who have a higher ratio of non-production workers in plants relative to non-production workers in head office tend to have a lower incremental head office employment. Firms tend to substitute non-production worker employment in plants for head office employment. Consistent with expectations, GEOSCOPE's parameter estimate is negative and significant. Firms whose production is more geographically dispersed from their head offices are more likely to concentrate non-production workers in their plants in order to save on coordination costs associated with distance.

Model 4 adds a control for the effect of foreign ownership (FOWN) on head office employment. The independent effect of foreign ownership is positive and statistically significant. In addition to being statistically significant, the independent effect of foreign ownership is also economically significant. Utilizing the parameters from Model 5, the predicted level of head office employment for a single-industry, domestically-controlled firm in a scale-based industry evaluated at the means for the continuous variables was 21, while for foreign firms with the same characteristics the predicted level of head office employment was 27. Foreign owned firms, on average, had a level of head office employment that was about 25% higher than domestically-controlled firms. Therefore, after controlling for a series of firm characteristics, including their industry, foreign-owned firms typically have a higher level of head office employment.

Foreign firms may be more industrially diversified and this may account for their higher level of head office employment. We test for the effect of industrial diversity by adding the interaction terms defined in equation (1.5). Firms that follow a narrow spectrum diversification strategy (NSD) have the same level of head office employment as firms that operate only in one 4-digit industry. On the other hand, firms that follow a broad-spectrum strategy (BSD) add more to head office employment as plant size increases, suggesting these firms require more managers in order to manage plants operating across unrelated industries.

It is noteworthy that taking into account industrial diversity has no effect on the parameter estimate for FOWN. Foreign-owned firms do not have a high level of head office employment because they are operating across a broader spectrum of industries than their Canadian counterparts. There are other characteristics of foreign-owned firms that account for their difference.

The last model reported in Table 9 (Model 6) is a fixed-effects model that takes into account unobserved, fixed, firm-specific characteristics that might be correlated with our hypothesized correlates. The fixed-effects model provides estimates for most of the variables reported in

Model 5. The exceptions are time-constant variables that have no effect on the other parameter estimates in a fixed-effects framework, which are the industry controls in this instance. In the fixed-effects model, each firm has its own intercept. Therefore, we also exclude the parameter estimate for PLNTSIZ, because it is based on the intercept term from (1.3).

With one exception, the fixed-effects results are qualitatively the same as the pooled results. In other words, for the majority of variables, there are no unobserved fixed-effects that substantially bias the estimates of their coefficients in the pooled version. The main difference is that the effect of foreign-control, although remaining positive, is now insignificant. This result is not surprising for two reasons. The first is that foreign-control acts as a proxy measure for a group of unobserved fixed effects that we associate with foreign-control. In other words, it is not foreign ownership *per se* that results in more head office employment, but a set of underlying characteristics that we associate with being foreign-controlled. For instance, there is strong evidence that foreign firms operating in Canada are more likely to perform R&D than the average Canadian firm (see Baldwin and Hanel, 2003). Firms that perform R&D may in turn have higher levels of head office employment, because more managers are required to organise the R&D process. It is not surprising, therefore, that after implicitly controlling for R&D—or other fixed effects—that the effect of FOWN is no longer significant. This simply emphasizes the point that the results of fixed-effects models need to be carefully interpreted. When we use them, we are merely transferring our attention from one characteristic (the nationality of a firm) to another set of characteristics that underlie the nationality (the characteristics of these firms that make them differ from domestic firms). The second reason is that there are relatively few instances where firms switch from domestic- to foreign-controlled status or *vice versa*. The lack of variation that results will tend to reduce the precision of the FOWN's point estimate in the fixed-effects model, and thus its p-value.

## 6. Conclusion

In this paper, we investigate whether certain economic factors are related to the size of head office employment. In particular, we want to know whether multinationals operating in Canada show less inclination to operate head offices than domestic firms. And to answer this question, we need to determine which firm characteristics are related to head office activity, so that we can condition on them when we examine the difference between foreign-controlled and domestic-controlled head office activity.

We find that manufacturing firms are more likely to establish a head office if they are more complex. Complexity is represented by the size of firm, whether it has multiple plants, and whether it is industrially diversified. Manufacturing firms are also more likely to set up a head office if the firm is primarily based in rural areas and in science-based industries.

Once a head office is created, a number of the same characteristics are related to the amount of employment in head offices—size, multi-plant nature, the industrial diversity, the geographic spread of the firm and once again the industry of location. The demand for head office workers per plant is a positive function of plant size, and a negative function of the number of plants controlled by the firm after conditioning on average plant size. This suggests there are firm-wide

economies of scale associated with head office employment. Larger firms have a lower head office ratio than smaller firms, all else being held equal. It is also the case that firms that concentrate their non-production workers in plants and/or that have geographically dispersed plants will have lower levels of head office employment per plant. There is a substitution between plant-based non-production workers and head office-based non-production workers. Head office employment is positively associated with the industrial diversity of a firm, but this effect is restricted to broad-spectrum diversification. It is only when firms diversify into unrelated industries that head office employment is significantly affected.

Throughout the analysis, we find that foreign ownership has a positive effect on aggregate head office employment. Foreign firms are more likely to create a separate head office and they are more likely to hire more head office workers than their domestic counterparts.

All of this suggests that foreign-owned firms have a special complexity that leads to more not less management in a host country. The theory of the multinational firm as developed by Caves (1982) argues that foreign ownership is associated with the exploitation of special lumpy indivisible assets. Recent work (Baldwin and Gellatly, 2005) suggests that these assets are associated with R&D assets in the manufacturing sector. The findings of this paper reinforce these results in that there is both more foreign investment in science-based industries, and more head office employment there as well.

Other research papers substantiate the view that foreign-owned firms bring special assets to Canada. Foreign-controlled firms appear to be innovative across all industries whereas domestically-controlled firms are innovative only in a core set of what are regarded as the more innovative industries (Baldwin and Hanel, 2003). When foreign-controlled firms merge with other firms, benefits accrue to the merged entity regardless of the industry (Baldwin and Caves, 1991). On the other hand, mergers between domestic firms generally only contribute a positive impetus in the core innovative industries. Both of these findings suggest that foreign-controlled firms are generally creating special assets or transferring them during the merger process—regardless of the industry in which they are located.

Our findings here contribute to this picture by suggesting that the foreign firm needs a special type of management to coordinate the assets that it brings to Canada. The foreign-controlled firm operates in an environment where these special assets are important—but it has even more of these types of assets than the average. And this makes these firms more likely to create head offices and to hire more managers for them.

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