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Authors: Michel Leseure, Tarik Driouchi

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Exploitation versus Exploration in Multinational Firms: Implications for the Future of International Business

Michel Leseure*
Isle of Man International Business School, The Nunnery, Old Castletown Road,
Douglas IM2 1QB, Isle of Man

and

Tarik Driouchi**
School of Management
Cranfield University, Cranfield
Mk430AL, Bedford, UK

* Corresponding author:E-mail: m.leseure@ibs.ac.im
** Tel:01234751122x3080
email: tdriouchi@yahoo.fr

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Implications for the Future of International Business

Abstract

Given the economic weight of multinational corporations and their privileged access to resources, many different scenarios can be built about the future of international business and about the future impact of international business on economic, technological, and social development. In this paper, we argue that multinationals do not form a uniform organisational population, and we provide empirical evidence of the existence of traditional, rigid entities seeking benefits from low-risk exploitative strategies on one hand, and of flexible multinationals seeking higher performance levels by balancing the trade-offs between exploration and exploitation on the other hand. As these two sub-populations compete with one another for resources, we use a population ecology perspective to study likely ecological scenarios for the future. Our conclusion is that traditional multinationals tend to prevail over flexible multinationals, and the conditions required for a future society to allow a genuine growth of flexible multinationals are unlikely. This implies that multinationals remain primarily exploitative, and that as such, they will only be associated with marginal economic, technological, and social developments in the future. Other organisational forms, such as

entrepreneurial small business and communities of practices are shown to be much more likely vehicles through which society can progress and innovate.

Keywords: multinational, population ecology, real options, exploration

1. Introduction

The multinational corporation (MNC) and models of MNCs [1] have always been central concepts in international business theory. Thus, when investigating the future of international business, one direction for reflection is the future forms of MNCs and their future economic roles.

Back in the 1980s, in parallel with the business literature on globalisation, international business theory was promising radical change and the emergence of highly competitive and resilient large scale businesses. Multinational corporations (MNCs) were said to be more flexible [1], benefiting from unique economies of scale, economies of scope, learning and real options opportunities [2], and having access to more sources of (cheaper) funds from international markets [3]. The predictions from these theories of "*multinational advantage"* is that MNCs should be naturally more competitive than domestic firms, and that they should dominate the realm of economic activities through the management of their knowledge reserves, flexibility platforms, and portfolio of real options. Such superiority should naturally be reflected in the MNC's overall value and corporate performance. There is a significant empirical literature in international business research investigating this proposition and the relationship between multinationality and performance, but it reports mixed and controversial results [4][5].

Most of this research, however, investigates a population of MNCs assumed to be uniform. If this assumption is relaxed, then the theory of multinational advantage would only hold:

(1) if MNCs really seek, rather than avoid, strategic flexibility; and

(2) if flexible MNCs can remain competitive when compared with MNCs using alternative strategies.

The specifications of the flexible MNC [1][2] match those of an explorative firm, as described by March [6]. March describes exploration as being associated with activities such as "*search, variation, risk taking, experimentation, play, flexibility, discovery, and innovation*". Exploitation is associated with activities such as "*refinement, choice, production, efficiency, selection, implementation, execution*" [6]. March demonstrates the existence of delicate trade-off between exploration and exploitation. He also shows that because adaptive processes refine exploitation more rapidly than innovation, organisations naturally tend to exploit rather than explore. As a result, organisations become very effective in the short-run but do so at the cost of compromising or "self-destructing" long run economic prospects. Conversely, a firm investing solely in exploration processes operates at such a level of risk than it would be difficult for it to secure enough short-term returns to fund long-term growth.

Therefore, if several types of MNCs compete with one another through different strategies, the rather ambivalent nature of the relationship between multinational flexibility and performance in MNCs can be revisited in a different light. Specifically, some firms will tend to forego valuable exploration opportunities (e.g. learning and real options) for exploitation activities. For example, these MNCs could seek growth by replicating their existing business

models over a broader portfolio of markets, in what could be described as a "copy and paste" approach to strategy. At the other end of the spectrum, one would find MNCs systematically investing in flexibility and seeking an optimal trade-off between exploration and exploitation. In this work, we assume that managers' propensity to detect and appraise real options as resources and tools for flexibility management in MNCs is one way of differentiating flexible MNCs from traditional ones in the current international business landscape (consistently with [1, 2 and 9]). We argue that to appreciate the future of the international business landscape, one needs to investigate the validity of theories of multinational advantage. Thus our main research question is: is the flexible multinational a reality or a theoretical fiction? In other words, does the flexible multinational, once the hot topic of international business research, have a future? Is it able to recognise, explore, and exploit its (flexible) real options platforms? For example, Reuer and Leiblein [7] and Tong and Reuer [8] empirical findings, both focusing on real options as determinants of performance in MNCs, are that multinationality and international joint-ventures as flexibility options do not necessarily equate with a lower exposure to risk or higher performance.

This paper is organised as follows. In the second section, we use empirical data to investigate whether or not all MNCs are identical when it comes to flexibility. Our findings confirm the existence of two distinct subpopulations: traditional (non-flexible) MNCs and flexible MNCs. Having established the existence of two competing species of MNCs, we turn to the question of their likely co-existence, in the present and the future. The third section discusses our futures methodologies and our choice of a population ecology framework to assess the survival likelihood of both species on the basis of their ability to compete for

resources. The fourth section discusses the application of this framework in the case where traditional and flexible multinationals are competing with one another. The fifth section extends this analysis by enlarging the set of species with small and medium enterprises (SMEs) and communities of practice (COP). The sixth section concludes the paper by discussing implications for the future of international business and its role in society.

2. Multinational Advantage: An Empirical Investigation

2.1. Background

The pioneering theory of Kogut's [2] multinational advantage has been reinforced with a steady stream of conceptual, normative, and axiomatic research studies about the specific paradigm of real options and its implications for flexible MNCs [1][9][10][11]. Most converge toward a model of the multinational enterprise as a rich portfolio of capabilities, which can be updated, adapted, and deployed as opportunities arise.

The literature, however, is much thinner when it comes to empirical evidence to validate this view. When one would expect a steady empirical counterpart of research studies setting themselves to test the mediating role of flexibility between multinationality and performance, only a few papers directly address this issue [7][8][12][13]. In Reuer and Leiblein's [7] empirical study for example, results indicate that contrarily to the authors' expectations, multinationality as a platform for real options is not associated with reduced organizational downside risk, thereby partly refuting the theory of the flexibility advantages of multinationals. To confound these negative findings, the literature on real options now includes a stream of critical research

positions [14][15][16]. It is within this ongoing debate that this section inscribes itself. It empirically contributes to the study of the link between real options thinking, multinationality, and performance as a way of validating whether or not all MNCs are identical when it comes to flexibility.

2.2. Research Framework

Figure 1 provides a comparative display of the first research objective of this paper in the context of the multinationality-flexibility-performance debate discussed above. It highlights the distinction between the existence of opportunities (modelled as real options) and the ability of management to think flexibly about these opportunities. This is consistent with research on the role of managerial decision-making in triggering healthy real options flexibility [8][17]. The intermediate variable, flexibility management (cf. figure 1), also echoes Kogut's [2] original call for research regarding the organisational and infrastructural elements enabling firms to benefit from learning and real options in multinational business environments.

It is important to contrast the research approach used in this paper with the traditional multinational performance debate. If one posits the existence of variability in terms of exploration and exploitation amongst MNCs, empirical investigations of the multinationality-performance link are not trivial. An exploitative MNC is likely to exhibit performance in the short-run but will have, relatively speaking, a lower exposure to risk than an explorative MNC. This relative difference is amplified if an exploitative firm is compared to an explorative firm that overlooks exploitation.

((Insert figure 1 here))

Figure 1 shows that in this paper, a firm's managerial ability to manage flexibly is assessed with the use of real options, or more generally, with the fact that a firm pays "attention" to real options [18] as a proxy measure. Note however that this paper does not claim that real options thinking is the only approach available to acquire a flexibility management capability. For example, Adner and Levinthal [14] present other management approaches which are available to achieve strategic flexibility (e.g. strategic search methods).

The aim of this section is to gather empirical evidence to provide an empirical validation of the association between real options attention and performance in order to differentiate explorative firms from exploitative ones. The latter should lack the capability to explore, and thus, are likely to ignore real options as a management framework. We also conjecture that these firms have different characteristics with regards to their performance, operations and strategic investments. Thus, we underline real options attention in firms as a factor differentiating between traditional MNCs from flexible MNCs.

This paper does not argue that the above statement is a law, i.e. that exploitative firms never use nor exercise real options. For example, an oil company may use a real options framework to assess if, and when, a new oil well should be developed. In this example, the oil company is using real options *valuation* as a tool to refine its exploitation activities. Contrast this example with that of a film manufacturer faced with the emergence of digital cameras: this company could use real options thinking *and* valuation to search and discover which strategic course of action is adequate for its future. In this second case, real options answer a corporate need for exploring a space of strategic options, and are as such equivalent to scenario planning or search mechanisms. In the former case real options valuation is an optional refinement tool,

and thus, is just an analytical technique used within an exploitative strategic environment. Although the possible use of real options in an exploitative environment is acknowledged, it is considered incidental. On the other hand, we conjecture that real options thinking is a salient specificity of MNCs trying to balance the trade-off between exploration and exploitation. Balancing this trade-off requires the ability of management decision making to frame competencies and to conduct exploratory searches. Kogut and Kulatilaka [19] highlight that real options theory is a suitable heuristics to this end.

The key research hypothesis is presented as follows:

Ho: A firm's attention to real options, and possibly real options thinking, is associated with increased performance.

In order to inform our distinction between explorative and exploitative firms, and the impact of multinationality, we further breakdown this hypothesis into:

H0.a. A firm's attention to real options, possibly real options thinking, is associated with higher levels of multinationality.

H0.b. A firm's attention to real options, possibly real options thinking, is associated with higher levels of R&D activity.

H0.c. A firm's attention to real options, possibly real options thinking, is associated with better operating performance.

H0.d. A firm's attention to real options, possibly real options thinking, is associated with higher economic performance.

2.3. Methodology

Recent studies conducted by Block [20], Ryan and Ryan [21] and Graham and Harvey [22] show that 10 to 27% (based on the period) of Fortune 1000 companies claim to have used in some way real options analysis in capital budgeting decisions. There is a variety of accounts of real options adoption by firms. They are either directly focusing on identifying real options users or potential users [23] or simply confirming the use of the technology in some operations and strategic decisions [24][25][26]. We assume that most of the MNCs mentioned in the "attention" or "usage" literature are practicing the technology in some way. In other words, these firms can be considered to have used or to be using real options thinking as part of their management decisions. Their real options are to be found in international operations, R&D and production facilities, and should translate into higher performance levels.

2.3.1. Analytical Method

A firm's attention to real options is encoded as a simple dichotomous variable. No attempt is made, however, to identify exact time windows in which options thinking was used. No attempts are made either to try to estimate, for each of these time windows, the corresponding time periods where the lagged effects of the possible use of options thinking will make a difference. Thus the data used bears limitations. It is because of these limitations that the association between real options attention and performance measures is tested through a χ^2 test of association over cross-tabulations. Rather than test for a specific strength and direction of association, cross tabulations are used to identify significant association patterns between the variables, and to interpret these patterns, if any.

2.3.2. Performance Measures and Related Characteristics

The following four accounting and financial ratios are used as performance and flexibility indicators for the selected companies.

Property Plant and Equipment Over Assets (PPEOA)

This ratio evaluates to which extent a firm efficiently utilises its long term productive assets. It represents the portion of long term physical operating assets over the total book value of the assets of the firm.

This ratio measures both the real options potential (a labour intensive company will have a low ratio, and very few real assets with underlying options) and the ability to manage assets effectively (an inflexible firm will have a higher ration than a flexible one).

R&D Expenses Over Assets (R&DOA)

This ratio highlights the proportion of R&D incurred costs to company assets. It is traditionally described as an indicator of a company future performance through R&D capabilities and is also a proxy for strategic flexibility. Explorative firms should have a higher R&DOA ration than firms relying on exploitation.

Multinationality

Multinationality is set as the number of countries in which the company has international subsidiaries [27]. This indicator measures both the level of foreign investments and the potential for flexibility. Firms with a higher network of international subsidiaries naturally embed more real options in their operations. This variable can also be viewed as indicator of firm ability/tendency to operate flexibly (e.g. switching or shifting) if associated with performance.

Return on Assets (ROA)

It is the ratio of income to total assets and measures the return on all of the firm's assets [28]. For Bernstein [29], it is the best measure of operating efficiency. It constitutes an excellent measure of the ability of operations managers to utilise their assets effectively to generate value and earnings.

EVA over Assets (EVAOA)

Economic Value Added or EVA is a measure of performance based on residual income. It is computed as the difference between net operating profits after taxes and the cost of capital. EVA is hence an accurate estimate of a company true *economic* profit. EVA shows the dollar amount of wealth a business has created or destroyed in each reporting period.

2.3.3. Data Set

The dataset includes 50 MNEs, divided into real options and non real options users. The former sub-sample groups 25 firms quoted by Triantis and Borison [22] and Copeland [23] as having adopted the real options "technology" in their investment decisions. It is worth noting that there are more than 25 firms which have developed attention to their real options to date [30], and that the selection of 25 is a cross-industry sample (we choose to focus on these 25 for comparison only). The 25 remaining companies, the control group, were added to the sample as follows. For each firm in the first sample, its most direct competitors or "peer" of similar size was identified (Worldscope) and included as a counterpart in the second sub-sample (provided that it was not in the list of real option users/attentive firms). When several "peers" were available, one was randomly selected. The purpose of this "matched" sampling strategy was to try to group two sub-samples which were relatively uniform in terms of their industrial

composition. In cross tabulation, the alternative hypothesis is that there should be no patterns between different sub-samples. Thus, the matched sampling strategy used was an effort to build two samples which would be so similar that any pattern would be the result of the only source of variation (attention to real options). Thus, although the selected MNEs belong to a variety of industries including pharmaceuticals, technology, aerospace, oil and automotive, the cross sample industrial affiliation are identical and can be considered as a reliable control group.

Since the first implementation of real options in industry are dated from the early nineties [31][22] performance measures were collected over the period 1994-2004. Data and ratios on the period have been obtained from the Worldscope finance database. Multinationality data was obtained from the Lexis-Nexis international directory of corporate affiliations.

2.3.4. Testing

The sample is cross-classified according to a pair of attributes: (1) attention to real options, and (2) a categorical grouping of performance and multinationality measures. For each performance measures, frequency tables were built to identify three tiers: high values, average, and low value. Tiers either represent top, average, and low performers (e.g. ROA) or different ratio levels (e.g., PPEOA). Each financial year gives a data point. As there are 50 companies and 10 years of data, a total 500 observations are used for each statistical test. In practice, this number is adjusted from test to test when some data is missing about some companies.

2.4. Results

2.4.1. PP&EOA Chi-Square Test

Figure 2 summarises the results. "Ropt" represents the PPEOA ratio observations for firms attentive to, or using, real options, and the "NonRopt" is the column of PPEOA observations for peers.

((Insert figure 2 here))

Figure 2 shows that there is a 95% confidence level that an association pattern exits between the use of real options and the values of the PPEOA ratio.

An analysis of figure 2 shows that there is no pattern of association for firms with low PPEOA ratios. As firms with low values (ratios lower than 0.2 in our data set) are likely to be those with labour rather capital intensive operations systems, it is not surprising that using real options or not has no impact.

Figure 2 shows the following association patterns:

- Firms with high PPEOA tend not to use real options.
- Firms with average values of PPEOA tend to use real options.

This pattern is perfectly consistent with theoretical predictions. Firms with high ratios (0.4 to 0.8) tend to have invested in inflexible assets that they cannot depreciate as their utilisation rate is low. In contrast, firms which use real options invest in flexible assets, which can be adapted to changing demand requirements. These firms manage at all times to load these assets. The resulting high utilization rate leads to a ratio value which tends toward an optimum (between 0.2 and 0.4 in our data set).

2.4.2. R&DOA Chi-Square Test

This test also reveals the existence of statistically significant (95% confidence level) patterns between the use of real options and the intensity of R&D investments, as shown in figure 3.

((Insert figure 3 here))

Firms that invest heavily in R&D are those that use real options, whereas firms with lower, more moderate values of the ratio, tend not to use real options. Firms with extremely low value of the ratio are indifferent to the use of options: it is not surprising as firms with relatively weak R&D levels are unlikely to exhibit a high performance impact if their management of R&D is improved. The results, however, cannot be used for the identification of an optimal value of the ratio. A structured model linking R&DOA with the use of real options and a profitability measure would be needed to this end. Figure 3 shows that real options change the way in which companies invest in R&D, but the possibility that they over-invest and negatively affect their profitability cannot be excluded.

2.4.3. Multinationality Chi-Square Test

Figure 4 shows that in the case of the multinationality indicator, there is an association between the use of real options and the number of countries in which a company operates. An analysis of figure 4 shows a significant pattern whereby top international firms tend to use real options. This provides them with a larger scope for both strategic and operating flexibility.

((Insert figure 4 here))

2.4.4. ROA Chi-Square Test

Figure 5 shows that in the case of the ROA ratio, the null hypothesis is rejected, i.e. there is no association between the use of real options and return on assets. An analysis of figure 5 shows a small pattern whereby top performers tend to use real options, but this observation is not statistically significant.

((Insert figure 5 here))

2.4.5. EVAOA Chi-Square Test

Figure 6 shows that there is a statistically significant association between the EVAOA ratio and attention to real options.

The pattern is similar to the patterns observed in previous cases. Low values of EVAOA indicate firms for which the use of real options does not make a difference.

A pattern exists in the case of higher value of the EVAOA ratio. Figure 6 shows that top performers are much more likely to use real options whereas not so efficient firms (second tiers) are much more likely not to use real options.

The difference between the results obtained with ROA and EVAOA can only be explained by the difference in the numerator of the ratio:

- In the case of ROA, an accrual net income figure is used.
- In the case of EVAOA, an economic definition of profits, rather than an accounting figure, is used.

((Insert figure 6 here))

The EVA is a measure of the economic profit of a firm after it has addressed the earning requirements of stockholders, which means that the EVA is a good measure of a firm ability to generate excess returns which can be re-invested in the business. In contrast the ROA ratio includes within its definition of profits funds still to be distributed to shareholders.

A plausible interpretation of the apparently conflicting results of the ROA and EVA tests is that the use of real options is not associated with higher profitability or operating efficiency, as non real options users can be highly profitable ventures. Real options users tend to also be users of EVA, and thus, they perform better on this dimension than non users (in other words, the association between EVAOA and real options usage could be spurious).

2.5. Multinationality and Performance: Empirical conclusions

The empirical results can be used to conclude that there is no such thing as a "one size fits all" theory of multinational advantage. Multinational firms that have invested in building real options thinking capabilities within their management decision-making frameworks exhibit a better management of corporate assets, more investment in research and development, higher level of internationalisation, and good economic performance. These firms, however, are not necessarily more profitable than firms that use more traditional models of appraising capital investments and strategic decisions.

We conjecture that traditional multinationals rely mostly on March's [6] exploitative processes: as such they derive profits from existing portfolios and processes that they tend to replicate in new markets and locations. With this approach, profitability and growth are generated primarily from scale. The first type of multinationals, however, is made of firms

proactively engaged in exploration activities, i.e. firms dedicated to the discovery of new opportunities through searches and innovation. This approach goes hand in hand with the tendency of managers to develop an attention towards real options, learn the real options logic, and implement it for projects, operations and investment appraisal. As these flexible multinationals permanently develop new capabilities to handle new markets and new technologies, they need the real options perspective to manage their deployment of flexibility.

3. The Future of Multinationals: A Population Ecology Perspective

3.1. Futures Methodology

Although our empirical data set demonstrates the current co-existence of two types of MNCs, it does not tell us anything about their respective proportion in economies and their likelihood of survival.

In order to answer this question, our futures methodology is inspired by Fuller's paper on the future of small business [32]. Fuller's approach is based on recognising that the future of small businesses is before all determined by what society will support, stimulate, or reject. For example, the fact that small businesses have been "othered" by large businesses raises questions about the potential of small businesses to continue to fulfil some of their ecological roles in society. Fuller concludes that small businesses have a bright future only if society learns to value personal commitment and entrepreneurship. In the opposite case, they may become extinct, or continue to be marginalised as a form of antiquated but robust and cheap providers

of labour [32]. Given current, or likely future economic environments, how are traditional and flexible MNCs likely to fare? Does society favour traditional or flexible multinationals? In order to answer this question, we need to investigate what are the reciprocal impacts of traditional and flexible MNCs when they compete against one another.

To appreciate the scope of this question, compare the global airline industry with the oil industry. In the airline industry, the co-existence of explorative and exploitative firms can be witnessed. Examples of explorative firms are firms differentiated by their quality of service (e.g. Singapore Airlines, Virgin Atlantic) or low cost airlines (e.g. Ryanair). Examples of exploitative firms are the traditional national flag carriers. The oil industry, in contrast, does not present any vividly differentiated example of an explorative firm: in this sector, one business strategy, exploitation, seems to dominate. We argue that market-based factors cannot be used to explain this difference. Consumers should be as interested in cheap oil, or alternative products, than they are in cheap or high quality airlines. Instead, the difference between the airline and the oil industries can be explained from an industrial ecology perspective, i.e. from the resources that firms have access to (or that society is willing to provide to them), and their relative ability to utilise these resource efficiently. The theoretical framework of organisational ecology developed by Hannan and Freeman [33][34] was designed to conduct this type of investigation.

3.2. Population Ecology Framework

For the sake of simplification, we summarise the variance observed within the contingency tables of section 2 by making the assumption that a population of multinationals ($P = P_1+P_2$) in a specific industry is composed of two sub-populations: (1) a class (P_1) of multinationals using

traditional investment and strategic decision models and (2) a class (P_2) of multinationals adopting flexibility management (e.g. using real options) in order to plan for and exercise strategic flexibility. We assume that members of the first population rely predominantly on exploitation mechanisms, whereas members of the second population have the competencies to balance exploitation with exploration [6]. The empirical results of the previous section support the realism of these assumptions.

Let N_1 and N_2 be respectively the number of members of P_1 and P_2. In order to estimate values for N_1 and N_2, we need to consider birth and mortality rate functions for these two sub-populations. Hannan and Freeman [34] use Lotka and Voltera's assumption that birth rate falls linearly with the size of the population, as shown in equation 1.

$$\lambda_{N_i} = a_0^i - a_1^i \times N_i \qquad \text{Equation 1}$$

λ_{N_i} represents the birth rate of new firms within a population (P_i). a_0^i is a constant parameter for population (P_i) representing the unconstrained birth rate whereas a_1^i is a positive constant parameter measuring the decrease in birth rate as the population grows.

The mortality rate μ_{N_i} of a population (P_i) is shown in equation 2, where:

- b_0^i is a constant parameter for population (P_i) representing the unconstrained mortality rate.

- b_1^i is a positive constant parameter measuring the increase in mortality rate as the population grows and competition intensifies.

$$\mu_{N_i} = b_0^i + b_1^i \times N_i \qquad \text{Equation 2}$$

The growth rate of a population *i*, ρ_{N_i}, is the difference between the birth rate and the mortality rate. The Lotka-Voltera population growth model, shown in equation 3, expresses that the increase of the population dN_i over a short time interval *dt* can be computed as the product of the growth rate ρ_{N_i} and the current population level N_i.

$$\frac{dN_i}{dt} = \rho_{N_i} \times N_i \qquad \text{Equation 3a}$$

A more useful way of writing equation 3 is shown in equation 3b (see [34] for details).

$$\frac{dN_i}{dt} = r_i \times N_i \times \left(\frac{K_i - N_i}{K_i}\right) \qquad \text{Equation 3b}$$

Where r_i is the intrinsic growth rate, i.e. the growth rate in the absence of any population size effects. K_i is the carrying capacity of population P_i, i.e. the maximum number of members

that a population can contain given the population dynamics parameters used in equations 1 and 2. Analytical expressions for r_i and K_i are shown respectively in equation 4 and 5 (Cf. [34]).

$$r_i = a_0^i - b_0^i \qquad \text{Equation 4}$$

$$K_i = \frac{a_0^i - b_0^i}{a_1^i + b_1^i} \qquad \text{Equation 5}$$

Equation 3b can be used to model the evolution of N_i over time in the case of an isolated population of firms. The Lotka-Voltera model of competitive interaction between two populations is an extension of the basic population growth model by introducing two competition coefficients α_{ij}. α_{ij} measures the impact that population *j* has on growth of population *i*. This impact is illustrated in equation 6, which can be extended to the case of more than 2 populations competing with each other (cf. Section 4).

$$\frac{dN_i}{dt} = r_i \times N_i \times \left(\frac{K_i - \alpha_{ij} \times N_j - N_i}{K_i}\right) \qquad \text{Equation 6}$$

There are two ways through which the size of competing sub-populations can be studied. The first and most commonly used method is to derive equilibrium conditions from equation 6: for *n* sub-population problems, this consists of solving a system of *n* equations. In this paper, we prefer a second way of deriving equilibriums conditions by means of a simple time-based simulation. The results (N_i at equilibrium) are the same. The advantage of the second approach is the fact that we can graph the convergence of the populations toward the equilibrium point and study directly the sensitivity of results to changes in the model parameters.

3.3. Parameter Estimation

In order to run a simulation, realistic assumptions about the population dynamics parameters must be made, as shown in table 1.

((Insert table 1))

Although empirical works have estimated these parameters for specific industries [35][36], there are no clear published benchmarks regarding what these parameters could be for MNCs. It is important to note from a methodology standpoint that the absolute values of these parameters are less important than estimating the relative difference between the values for populations 1 and 2. As the objective of this paper is to contrast the normative view of flexible MNCs with a population ecology view, we only need a realistic assessment of the difference between parameters rather than actual values.

a_0^i represents the unconstrained birth rate of population (P_i). Most empirical studies of population ecology use industries where enterprise creation is easy and frequent, as for example the restaurant business [37] or the retailing industry [38]. It is more unusual to think of the "birth" of a multinational.

The parameter estimates for a_0^i are based on the idea that new multinationals can be the result of three separate demographic processes: (i) the internationalisation of a domestic firm, (ii) the creation of a born-global firm [39], and (iii) the abandonment of exploration activities by a member of P_2 joining P_1. As members of P_1 focus on exploitation, they are likely to rely on rigid structures and to exhibit strong structural inertia [40], and thus, they are unlikely to be able

to re-engineer themselves toward acquiring exploration capabilities, so we exclude the possibility of a P_2 to P_1 transformation.

Becoming a new member of P_1, where imitation and replication of existing business models suffice to fuel growth, should be considerably easier than becoming a member of population P_2. Consider the contrast between a domestic firm investing in a neighbouring country and a new firm trying to launch at a global scale an innovative idea. For these reasons, we assume that a_0^1 is much higher than a_0^2.

a_1^i represents the impact of population size, N_i, on birth rate. As members of P_1 rely on replication and imitation, there is no need for a unique competitive advantage to enter the industry: as this is independent of how many firms are already in place, a_1^1 is assumed to be very low. The relative ease with which the Virgin group has entered the train and media industries is an illustration of low a_1^1 coefficients.

Members of P_2, however, require specific management and technological competencies to enter the industry. Explorative firms combine the difficulty of becoming a multinational with that of innovating and creating new processes. This is an acceptable strategy in the absence of competition in order to seek first-mover advantages. This is a risky strategy if several firms within P_2 are trying to compete with one another. The controversy behind the adequate use of real options in management decision making [14] in the context of new markets and new technical agendas confirms the difficulty of entering a crowded innovative industry segment. Moreover, Cottrell and Sick [41] show how innovative advantages often accrue to second

movers or followers rather than to first movers. Thus, it is more difficult to enter a mature rather than a young population 2. For this reason, we assume that a_1^2 is much higher than a_1^1.

Firms in population 1 do not adopt risky strategies, and thus, their risk of mortality b_0^1 should be less, relatively speaking, than that of population 2, b_0^2. Table 1 shows that the assumed intrinsic growth rate of population 1 is $r_1 = 50$ whereas that of population 2 is $r_2 = 20$. This takes into account not only the probability of failure of risky exploration strategies, but the fact that many once-innovative firms will join the ranks of population 1 after maturity.

Although firms in population 1 can be created and can grow easily, competition between them is likely to be intense as they are unlikely to be differentiated. Firms in population 2, however, thanks to the differentiation resulting from exploration, are likely to compete less intensively with each other once established. Therefore, we assume that b_1^1 is much higher than b_1^2.

The estimation of the competition coefficients α_{ij} is more difficult, and this difficulty finds its roots in the myopic view that multinational compete only with domestic firms. As most research papers try to demonstrate that multinationals are "better" organisational forms, researchers have overlooked the fact that multinationals compete with one another and the impact that this competition has on performance. The problem is that because competition between multinationals is under-researched, coming up with realistic value for α_{ij} is not trivial. It is useful to consider Schoener's method [42] for estimating competition coefficients. This

computation method is based on the resource utilisation of the two different populations, as shown in equation 7.

$$a_{ij} = \left[\frac{\sum_{k=1}^{m} \left(\frac{d_{ik}}{f_k}\right)\left(\frac{d_{jk}}{f_k}\right) b_{ik}}{\sum_{k=1}^{m} \left(\frac{d_{ik}}{f_k}\right)^2 b_{ik}} \right] \qquad \text{Equation 7}$$

The expression $\left(\frac{d_{ik}}{f_k}\right)$ in equation 7 measures the difficulty for a member of population *i* to find a needed resource input d_{ik} given the availability f_k of this resource. The numerator terms estimate the probability of competition between a member of population *i* and a member of population *j* for a given resource *k*. It is compared at the denominator level with the probability of two members of the same population *i* to compete with each other for this unit of resource. These probabilities are weighted with the benefits b_{ik} derived by each population for each unit of resource consumed.

Our estimation of competition coefficients is done by considering that MNCs compete with one another on five key resources: public fund, private funds, standard labour, talented labour, and entrepreneurs.

We consider that:

- both types of MNCs permanently compete for public funds,
- explorative MNCs may use private funds but are not in competition with traditional MNCs for that resource,

- both moderately compete to attract standard labour,
- they also compete on attracting talented labour.
- that explorative multinationals are much more apt at attracting talented labour when compared to traditional MNCs, and
- it will always attract potential "intrapreneurs" whereas traditional MNCs will have very little career appeal to entrepreneurs.

On this basis, we estimate:

$$\alpha_{12} = 0.7 \text{ and } \alpha_{21} = 0.4$$

Note that a competition coefficient is always between 0 (no resource competition) and 1 (as much competition as between two members of the same species).

4. Findings: Exploration and Exploitation by MNCs

We consider a hypothetical economy, composed exclusively of traditional and flexible multinationals, with an initial number N_1=25 and N_2=25 of MNCs respectively.

Given the parameters estimated in table 1, the carrying capacity of the population of traditional firms is K_1=48 firms and that of flexible multinational is K_2=28. Thus, even in the absence of inter-species competition, and contrary the theory of multinational advantage, traditional multinationals are likely to thrive when compared with flexible multinationals. Figure 7 displays how the hypothetical economy converges toward equilibrium conditions when

competition between the two species takes place. The competitive impact of flexible multinationals on traditional ones is higher (0.7) than the reciprocal impact: this is due to the higher economic profitability of flexible MNCs (cf. Section 2, taken into account through the coefficients b_{ik} in equation 7). Despite this competitive advantage and the ability to attract some specific resources (e.g. entrepreneurs), figure 7 shows that this does not result in a demographic advantage. As competition takes place, traditional multinationals increase their membership from 25 to 38 firms whereas flexible MNCs drop theirs to 13 firms.

((Insert figure 7 here))

Thus, current societal and economic rules, over time, imply that MNCs relying on exploitation tend to dominate (demographically speaking) MNCs engaging in exploration. This conclusion is highly sensitive to the value of the competition coefficients. A sensitivity analysis on α_{12} and α_{21}, however, shows that the existence of traditional MNCs is not at stake: even in the extreme (and unrealistic) case where α_{12}= 1 and α_{21}=0, traditional MNCs survive with 19 firms (against 28 explorative firms). If the ability of traditional MNCs to forage the resources of flexible multinationals is increased to α_{21}=0.6, then flexible MNCs are likely to become extinct altogether.

Kogut's [2] and Buckley and Casson's [1] flexible MNC will always struggle to survive, and can only do so by maintaining excellence and a highly competitive behaviour. This possibly explains why only a minority (10 to 27%) of Fortune 1000 firms use innovative flexibility management techniques (e.g. real options) in their decision making. The few flexible MNCs that manage to survive through the integration of real options thinking in their corporate decision

making procedures manage to maintain a competitive position. This position, however, is fraught with risks. Should some of our assumptions about resource availability and resource acquisition change, the struggle of flexible MNCs could end. For example, in an economy where investors prefer to invest in innovative ventures, and resent investing in exploitative firms, or if talented labour refused to work in exploitative firms, the flexible MNE could strive.

It is important to moderate these conclusions with the acknowledgement that the population dynamics parameters used in this section remain crude estimates. A research programme about the population ecology of multinationals could help to provide more accurate estimates of the parameters used in the simulation. For instance, empirical values of the estimates would be needed to confirm at what level both types of MNCs really coexist.

5. Findings: Generalised Competition Model

MNCs do not compete just with one another in terms of securing resources. For example, the majority of workers in an economy tend to work for small businesses. MNCs find themselves in direct competition with small businesses when it comes to resource consumption. Whereas standard labour is likely to be indifferent to work for MNCs or small businesses, talented labour may have a strong preference to join the ranks of MNCs, where better career opportunities can be found: this is an example of the impact that society, through its shared and socially constructed values, can have on the survival of different types of business firms. Entrepreneurs are likely to be strongly attracted to small businesses where they can pursue projects of radical innovation which would be difficult to finance and justify at a larger scale.

The model of population ecology presented in section 4 is expanded in this section by recognising that other organisational forms will compete for resources with MNCs. Consistently with Fuller [32], we recognise that small business form a heterogeneous population. In the context of this paper, we are especially concerned with the existence of explorative and exploitative small businesses.

Explorative small businesses, or "innovative SMEs" are trying to breakthrough new markets through innovation. As they grow, they are often purchased by and merged within large MNCs. Thus, the mortality rate of explorative SMEs is high: not only is their creation and strategic directions based on aggressive risk positions, but success often ends up in acquisition, and thus, exiting the population.

Exploitative small businesses, or "supply SMEs", use standard business models and specialise in the supply of undifferentiated goods and service to either consumers or MNCs.

In addition to these two additional species, we also consider communities of practices (COP) as another organisational form that compete for funds, talent, and entrepreneurial skills with the other species. Our analysis only considers "independent" communities of practice (such as the COP which resulted in the development of Linux) rather than intra-organisational COPs, which are typically part of MNCs [43]. As discussed in other papers in this special issue [44], it is expected that COPs could play a role in the future of international business. From a population ecology perspective, the fact that COPs are often based on volunteer time, may be self-financed, and be the result of individual's passion for a project give them a relatively high propensity for birth and a strong ability to attract resources, which they will need to a lesser degree than

traditional organisations (e.g. funds). COP can fail though [43], and thus they are not immune to mortality. Table 2 lists the parameter estimates regarding population dynamics for each of the five species.

One difficulty in estimating these parameters is the drastic difference between the large MNCs, in terms of turnover, assets, and employees and small businesses. As Fuller [32] points out, small businesses, although numerous, are powerless in the modern economic environment, suggesting weak individual competitive impact on MNCs. In order to make table and graphs more easy to interpret, table 2 is based on a notional *average* MNC of 5000 employees competing with a cluster, or network, of 100 small businesses employing on *average* 50 employees. For example, the carrying capacity of supply SMEs of 99 in table 2 should be read as a carrying capacity of 9,900 businesses.

Table 3 shows estimates of the community matrix of competition coefficients between each of the species. Each coefficient was estimated with the same qualitative procedure inspired from equation 7, as described in section 3.

Key assumptions are:

- Public funds: The competition is intense between MNCs. Innovative SMEs and COPs also seek this resource, but they only have a very weak impact on MNCs ability to secure public funds.

- Private funds: This is the main battlefield of supply and innovative SMEs, with innovative SMEs having a head advantage: whereas we assume that investors in publicly traded

funds prefer safe, exploitative businesses, we assume that in the private funds market, investors prefer innovative businesses.

((Insert table 2 here))

- Standard Labour: Competition is high between all species, at the exception of COPs, which need very little, or none, of this resource.

- Talented labour: All species compete actively for this resource, which includes talented management, operators, technicians, etc. In the small business sector, we assume that innovative firms will attract more of this resource, and similarly, we assume that flexible MNCs will have more appeal than traditional MNCs. Small businesses have a small competitive impact on large MNCs, and MNCs have an important competitive impact on small businesses. COPs are a new form of competition, which attract talented labour away from all other species. The impact, however, is stronger on small businesses than MNCs, who can run their own intra-organisational COPs.

- Entrepreneurs: Small businesses compete with one another, with innovative SMEs having a clear advantage over supply SMEs. Innovative SMEs also have a strong competitive impact on flexible MNCs, as entrepreneurs prefer to work in an unconstrained, small-scale environment rather than for corporate giants. COPs are a strong competitor of innovative SMEs.

((Insert table 3 here))

Figure 8 displays three graphs. Graph (1) shows all the species together, but with only MNCs competing with one another (hence other species reach their carrying capacity, K_i). Graph (2) takes into account the competition between P_3 (supply SMEs) and P_4 (Innovative SMEs) in addition that between the MNCs. Finally, graph (3) is based on the full community matrix shown in table 3, and illustrates the case where all species compete with one another.

((Insert figure 8 here))

Figure 8 shows a clear pattern. As creating, managing, and sustaining an innovative business which balances exploration and exploitation (populations P_2 and P_4) is inherently more difficult and risky than relying on economic exploitation (populations P_1 and P_3), explorative firms, whether large or small, struggle for survival. Whereas some individual factors support them (the willingness of individuals to risk personal savings, the desire of entrepreneurs to be independent, etc.) other societal factors (e.g. the preference to invest in safe firms, the preference for workers to pursue a career in a low risk industry), the balance in terms of competition dynamics is against them. Graph 3 above shows that they can barely survive whereas exploitative populations strive. In terms of innovation and exploration, communities of practice are the organisational form that can strive in the face of competition from exploitative firms: their existence, however, in the possibly exaggerated graph 3, would bring both flexible MNCs and innovative SMEs to near extinction.

6. Conclusion: Implications for the Future of International Business

The future of international business is likely to be the result of an intensification of competition on the basis of exploitative processes. At the time of writing this paper, there are still ample opportunities for international growth, irrespectively of the nature of the strategy (exploration versus exploitation) followed by MNCs. There are also considerable growth opportunities for MNCs from emerging economies to invest in markets overlooked by MNCs from older economies.

It is because firms' adaptive processes prefer exploitation over exploration [6], that the simulation of population dynamics suggests that it is unlikely that a new era of competition on the basis of exploration only could emerge. This also explains the low proportion of P_2 companies nowadays, and the disappointing results of the multinationality-performance research programme. The population dynamics parameters used in this paper show that, despite the apparent superiority of explorative companies, both type of multinationals should coexist in the long-run, with traditional multinationals being able to emerge and grow more easily than explorative firms. The findings also implies that because of population dynamics and the permanent competition from traditional multinationals (not so good at innovation, but lucrative and numerous), the multinational organisational form may not the best organisational template for innovation, leaving space for small organisations, or other organisational forms, to operate profitably.

Alternatively, one could argue that if it ever comes to the saturation of population P_1, this may lead MNCs to switch to the strategies of population P_2 to seek more differentiated market positions and novel approaches to growth. This turnaround would match Kogut and Kulatilaka's [19] recommendation of using real options for corporate renewal and against structural inertia.

Whether firms that have fine tuned their exploitative processes can operate such a transformation is a question for debate. Thus, the once golden child of international business research, the flexible MNC, seems to have a future fraught with the danger of extinction.

Given the scale of assets and manpower of multinationals, and their increasing economic and political importance, the question of the relative evolution of the two sub-population P_1 and P_2 is key to understanding the future of international business, and the potential contribution of internal business to economic, technological, and social development.

To illustrate this point it is useful to consider two practical examples of industries at different stages of population maturity. Unlike other industrial sectors, the airline industry is probably close to the saturation of its traditional population P_1 as evidenced by the bankruptcy of many national carriers (e.g. Swissair, Sabena, and Alitalia). The industry has always had an exploitative character with its self-imposed regulation forbidding differentiation on the basis of quality of services. Its more explorative sub-population P_2 (e.g. Singapore Airline, Cathay Pacific, Virgin Atlantic) is smaller (consistently with the dynamics shown in figure 7) but remains a robust, differentiated, and profitable segment despite the troubled times experienced by other airlines.

The global oil industry is at a different evolutionary stage. Due to the fundamental role of oil in national economies, the oil industry is characterised by a dominance of exploitation mechanisms, as evidenced by the cartel-type arrangements currently in place. In an exploitation-based economy, significant profits can be accumulated by voluntarily restricting supply when demand is increasing. Profits are derived from inflated prices rather than growth,

and both the restriction of input and the economic gloom which comes with this restriction make it more difficult for an innovative and competition-oriented population P_2 to grow and turn markets around.

Although our simulation results suggest that explorative MNCs can never dominate an economy in the long run, reflecting upon such a future is not uninteresting. To go back to the oil industry example, it would mean the rise of a sub-population of MNCs not thinking of themselves as exploiting a natural resource but seeking differentiated and sustainable ways to better serve the needs of energy consumers. Such transformations have taken place in other industries, as for example by film manufacturers that have reconverted themselves to the digital camera industry. In other words, if flexible MNCs could come to dominate their industries, it is under such a scenario that the greatest economic transformations could take place, as exploration is opposed to the structural inertia that comes with exploitation. However, our population ecology approach shows that if current societal values and processes are an indication of what the future will be, such a scenario is very unlikely to ever unfold. Not unlike Fuller's conclusion about the bright future of small businesses in a society which values individual human spirit [32], the flexible MNC only has a bright future in a society which values, support, and select progress and innovation over easy, safe, and short-term gains.

Finally, this paper's findings also highlight that seeking social progress and innovation through businesses that have to compete for survival with non innovative businesses may simply be a poor idea. The origin of this poor idea could be a general confusion between the idea of competing for market share (which requires innovation) and competing for resources (which does not require innovation). Therefore, the future of international business may be one

of providing undifferentiated, or moderately differentiated products and services, to the masses. Innovation, social progress, improvement to quality of life, flexible responses to changing economic and societal conditions are reasons why small business networks, or new organisational forms such as communities of practice, have a bright future.

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Parameter	Population 1 Traditional Multinationals	Population 2 Flexible Multinationals
a_0^i	100	50
a_1^i	0.05	0.5
b_0^i	50	30
b_1^i	1	0.2
α_{ij}	0.7	0.4

Table 1 – Assumptions about Model Parameters

	Parameters					
Species	ao	a1	b0	b1	Ri	Ki
Exploitative MNEs	100	0.05	50	1	50	48
Explorative MNEs	50	0.5	30	0.2	20	28
Supply SMEs	200	0.01	100	1	100	99
Innovating SMEs	100	0.2	50	0.5	50	71
COPs	60	0.05	30	0.2	30	120

Table 2. Population Dynamics Parameters

Community Matrix	1	2	3	4	5
Exploitative MNCs (i= 1)	1	0.7	0.05	0.05	0.1
Explorative MNCs (i= 2)	0.4	1	0.01	0.65	0.1
Supply SMEs (i= 3)	0.1	0.1	1	0.4	0.01
Innovating SMEs (i= 4)	0.1	0.52	0.6	1	0.45
COPs (i= 5)	0.1	0.3	0.05	0.4	1

Table 3. Community Matrix of inter-species Competition Coefficients

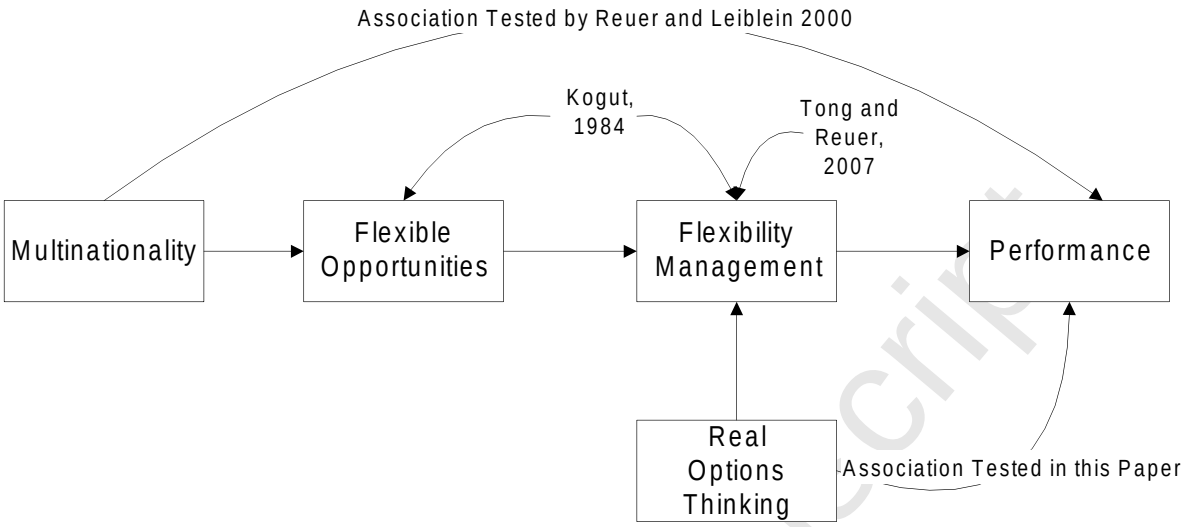

Figure 1: Research Framework

P&EOA	Ropt	NonRopt	total
High	**79**	**88**	**167**
Expected	*89.846*	*77.154*	*167*
Medium	**102**	**64**	**166**
Expected	*89.308*	*76.692*	*166*
Low	**88**	**79**	**167**
Expected	*89.846*	*77.154*	*167*
total	**269**	**231**	**500**

Significance Level	**10%**	**5%**
χ2 table value	4.61	**5.99**

	Squared Differences		
ChiSquare	1.309304	1.524687	
	1.803723	2.100439	
	0.037928	0.044168	
Sum	3.150955	3.669294	**6.820249**

Degree of freedom = (3-1)*(2-1)=2

Figure 2: Summary of statistical results for assets utilisation

R&DOA	Ropt	NonRopt	total
High	**94**	**49**	**143**
Expected	*83.56*	*59.44*	*143*
Medium	**69**	**69**	**138**
Expected	*80.63*	*57.36*	*138*
Low	**83**	**57**	**140**
Expected	*81.8*	*58.19*	*140*
total	**246**	**175**	**421**

Significance Level	**10%**	**5%**
χ2 table value	4.61	**5.99**

	Squared Differences		
ChiSquare	1.304855	1.834253	
	1.679262	2.360563	
	0.01745	0.024529	
Sum	3.001567	4.219346	**7.220912**

Degree of freedom = (3-1)*(2-1)=2

F

igure 3: Summary of statistical results for R&D intensity

Multinationality	Ropt	NonRopt	total
High	**90**	**51**	**141**
Expected	*77.55*	*63.45*	*141*
Medium	**75**	**64**	**139**
Expected	*76.45*	*62.55*	*139*
Low	**66**	**74**	**140**
Expected	*77*	*63*	*140*
total	**231**	**189**	**420**

Significance Level	**10%**	**5%**
χ2 table value	4.61	**5.99**

	Squared Differences		
ChiSquare	1.9987	2.4429	
	0.0275	0.0336	
	1.5714	1.9206	
Sum	3.5976	4.3971	**7.9948**

Degree of freedom = (3-1)*(2-1)=2

Figure 4: Summary of statistical results for multinationality

ROAOA	Ropt	NonRopt	total
High	**97**	**70**	**167**
Expected	*90.05*	*76.95*	*167*
Medium	**85**	**79**	**164**
Expected	*88.43*	*75.57*	*164*
Low	**86**	**80**	**166**
Expected	*89.51*	*76.49*	*166*
total	**268**	**229**	**497**

Significance Level	**10%**	**5%**
χ2 table value	4.61	**5.99**

	Squared Differences		
ChiSquare	0.536026	0.627314	
	0.133393	0.15611	
	0.137876	0.161357	
Sum	0.807294	0.944781	**1.752076**

Degree of freedom = (3-1)*(2-1)=2

Figure 5: Summary of statistical results for accounting performance

EVAOA	Ropt	NonRopt	total
High	**80**	**54**	**134**
Expected	*70.21*	*63.79*	*134*
Medium	**57**	**76**	**133**
Expected	*69.68*	*63.32*	*133*
Low	**71**	**59**	**130**
Expected	*68.11*	*61.89*	*130*
total	**208**	**189**	**397**

Significance Level	**10%**	**5%**
χ2 table value	4.61	**5.99**

	Squared Differences		
ChiSquare	1.366136	1.503472	
	2.308306	2.540358	
	0.122555	0.134875	
Sum	3.796997	4.178706	**7.975702**

Degree of freedom = (3-1)*(2-1)=2

Figure 6: Summary of statistical results for economic performance

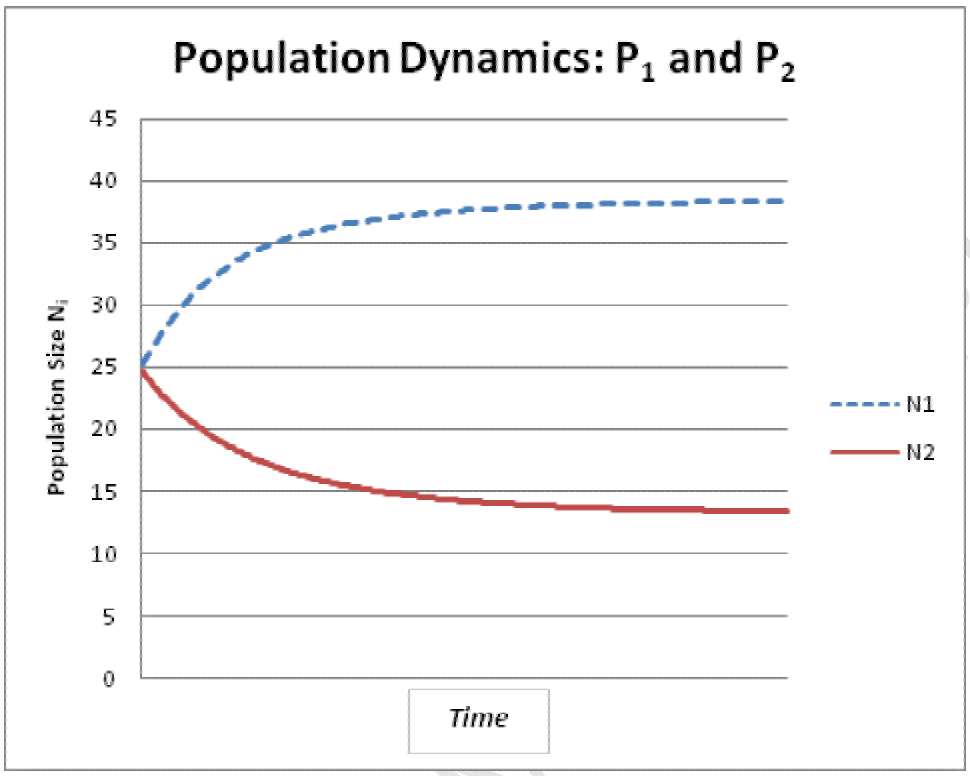

Figure 7. Evolution of populations over time

(Both populations start with 25 members).

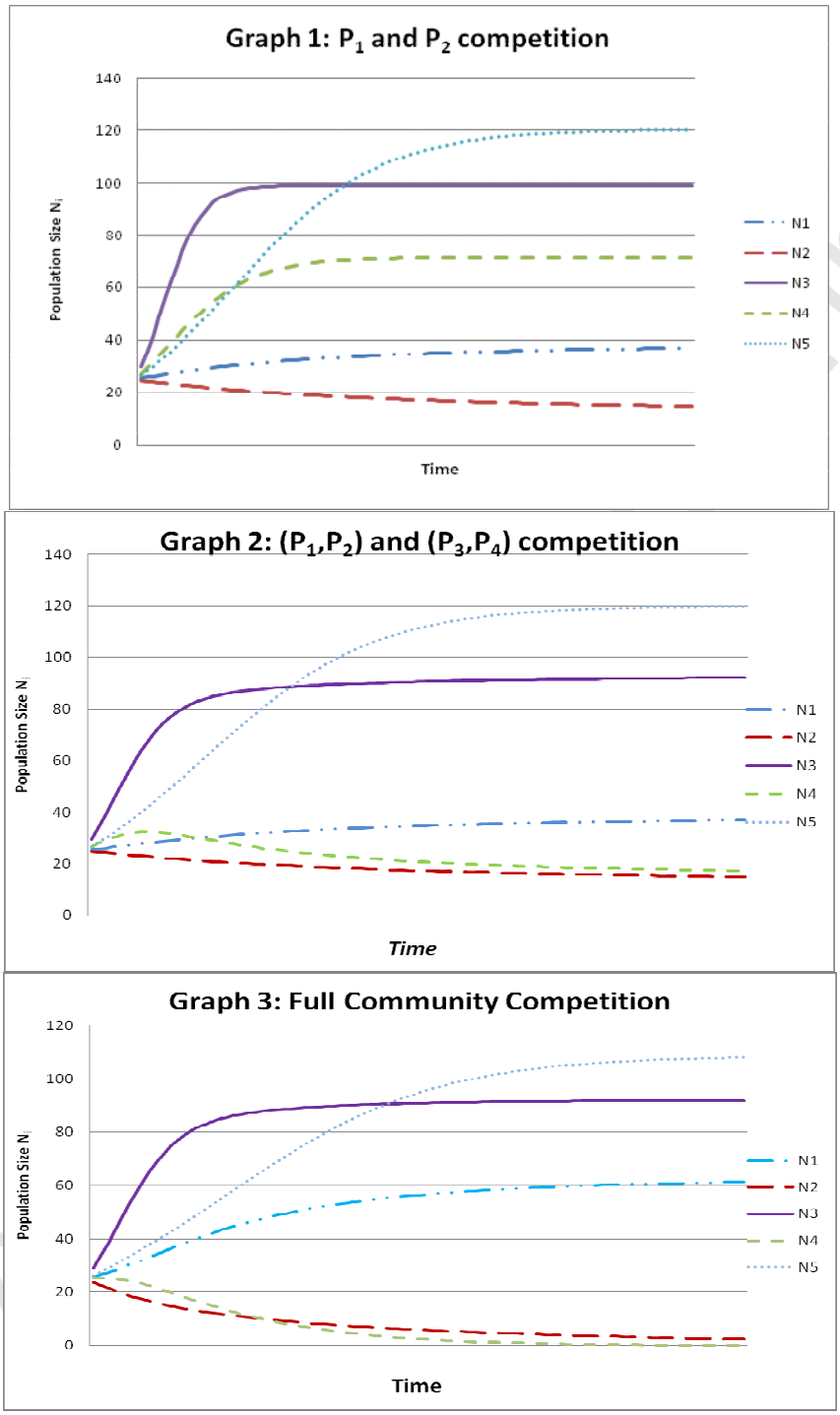

Figure 8. Population Dynamics under Different Competitive Scenarios