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Juliana Hsuan*

Copenhagen Business School
Department of Operations Management
Solbjerg Plads 3
DK-2000 Frederiksberg, Denmark
jh.om@cbs.dk

Moren Lévesque

Schulich School of Business
York University
4700 Keele Street
Toronto, ON, Canada M3J 1P3
mlevesque@schulich.yorku.ca

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* Corresponding author

GROWING THROUGH INNOVATION REPLICABILITY: THE ROLE OF INVESTMENT IN ROUTINE ADAPTATION

We propose a formal model of firm growth through replication that considers the extent of the investment to adapt routines as replication unfolds and the portion of this investment that goes toward innovation in the routines. The use of these two investment constructs brings about four types of growth policies. We use a utility function that considers proxies for both growth and failure potential to uncover the role played in selecting these policies by the economic environment of the targeted market for expansion. Our analysis further reveals the importance of the innovation-relative-to-imitation investment efficiency in adapting the routines to be replicated while selecting a growth policy. The refinement of a replication theory through our analysis of growth policies result in two testable hypotheses.

Keywords: firm growth; replication; innovation; routine adaptation; utility maximization

1. Introduction

Most economies encourage firm growth, because it generates economic prosperity by creating jobs (e.g., Minniti and Lévesque, 2008, 2010). A means by which firms can grow more rapidly is through replication. Replication refers to "the creation and operation of a large number of similar outlets that deliver a product or perform a service" (Winter and Szulanski, 2001, p.730). In accordance with Winter's (2010) distinctions, we consider in this article *spatial* replication, whereby the growth arises via capacity expansion at a new location, rather than *temporal* replication with adding capacity at the current location. Many successful examples of spatial replication exist in the franchising industry (e.g., Jonsson and Foss, 2011).

Szulanski and Jensen (2008) note that "[g]iven that organizational routines embody a firm's productive knowledge […] competitive advantage on a global scale may require the replication of successful practices" (p.1733). These practices are short-run routines (e.g., method of payments) that determine the firm's operating characteristics, investment routines (e.g., employee training), or routines that modify over time various aspects of the operating characteristics (e.g., product features to respond to competitive pressures) (Nelson and Winter, 1982). When the firm chooses to grow through (spatial or temporal) replication, these routines (existing or new to the firm) will require some form of investment for adaptation (Aspara et al., 2010; Rivkin, 2001). Consequently, *what growth policy should a firm employ considering* (1) *the requirement of investment while replicating to adapt its routines to the newly targeted market,* (2) *the reduction of the threat of imitation through innovation in these routines, and* (3) *the deployment of more replication effort for higher levels of investment or innovation*? Addressing this question enables us to put forward a typology that categorizes firm growth policies as bear- or bull-innovation and bear- or bull-imitation.

We differentiate adaptation from innovation by considering the effort (in term of investment) required to adapt the firm's business routines contingent on the newness in these routines. Newness arises because the routine is either *new to the market* or *new to the firm*. Take the Swedish furniture company IKEA, for instance, which introduced in 1963 a new routine to the Norwegian market with its product distribution system, where buying customers could easily transport their fit-in-a-flat-box furniture. In the 60s, a more standard furniture distribution system (in Norway or elsewhere) was home delivery. The routine is new to the firm when, instead, its smallness (in the case of a new venture) implies that it still lacks many of the routines required to run a firm of a larger size and it must allocate resources to either create new routines or find and

implement the best routines of high-performing firms (Csaszar and Siggelkow, 2010). Imitation rather than innovation takes place when the firm can copy in the targeted market the routines that it has already in place in the source environment. Our treatment of innovation thus differs from Szulanski and Jensen's (2008, p.1733) "innovation in the form of local adaptation" (and is with respect to firms' routines rather than their product offerings[1]).

Current formulas for success do not indicate what degree of innovativeness (i.e., newness) should be embedded in the firm's business routines as it attempts to grow. Nor do they inform us on what the sensitivity of the effort allocated toward routine innovation should look like as the targeted market environment improves or deteriorates in comparison to the source environment. Yet, Zahra's (2011) classification of business opportunity exploitation, as being either 'entrepreneurial' or 'routine,' calls for the consideration of a continuum between these two extremes based on the degree of innovation in the firm's routines. We thus address the gap in the literature by formulating a formal model that offers a complementary theory of firm growth that is based on routine innovation and replication.

We focus on new business ventures (i.e., small new firms) and therefore consider their three key features: lack of routines, lack of resources, and lack of reputation (e.g., Joglekar and Lévesque, in press). The lack of routines required to grow through replication can arguably be an advantage, since 'nothing is set in stone,' thus providing the firm with more flexibility (Sapienza et al., 2006). The lack of resources, such as investment to adapt theirs or others' routines to be replicated, may force the ventures to be more efficient in using the little they have (e.g., Mosakowski, 2002). The lack of reputation, however, often leads to higher risk of failure (due to liability of smallness and newness, or legitimacy; Singh et al., 1986) and limited growth

[1] We refer the interested reader to Forsman (2011) for a discussion on innovation typologies.

potential.[2] By integrating these shortages in a decision framework, along with the extent of the investment to adapt routines and the portion that goes toward innovation, we show that a new venture's growth policies must be guided by changes in the external economic environment it will face, as well as changes in the efficiency of the innovation-relative-to-imitation investment to adapt the routines to be replicated.

While also considering the knowledge transfer advantage through the relative amount of effort allocated to the potentially hard-to-imitate routines (Rivkin, 2001), we thus simultaneously bring two key dimensions to the forefront: investment decisions and environmental changes, especially as they pertain to the venture's expected return and risk from the newly targeted market in comparison to the source environment. We use innovation effort as a mechanism that limits or prevents imitation by influencing the firm's level of replication effort. Our findings also speak to the performance-imitation relationship (Csaszar and Sigglekow, 2010) by describing when the venture should strive for a bear-imitation policy, where a small investment in routine adaptation with a small portion for innovation (or relatively more imitation) is made (e.g., where only a few known routines are required for the targeted market and most can be copied from the routines the venture has already in place in the source environment). We also bring additional light to the theory on replication and adaptation (e.g., Williams, 2007) by characterizing when to strive for a bull-imitation policy, where a large investment in routine adaptation with a small portion for innovation is made. We contribute to the work on the timing and scale of innovation in replication (Szulanski and Jensen, 2006, 2008) by articulating conditions under which suppressing innovation may not necessarily be a growth policy to follow for the venture.

[2] Short et al. (2009) find empirical evidence to contest this view, arguing that the niche market positioning of many new ventures and today's changing economy can relax the liability-of-newness concern for survival.

In the next section we review seminal studies on replication to clarify key constructs and better articulate our contributions. We then present a formal model that enables us to refine our theoretical arguments, followed by an analysis of growth policies for new business ventures. The proposed prescriptions offer a number of theoretical implications that we discuss prior to concluding with two testable hypotheses, their managerial implications and future research.

2. Growth through Replication and Innovation

The objective of replication is "to expand the scope of the existing accomplishment, avoiding 'reinventing the wheel' " (Winter, 2010, p.100). Replicators typically grow through repeated application of a simple formula or recipe, as seen with global giants like McDonalds, Starbucks or Walmart. Replication can also be viewed as a mechanism for exploring the extent to which superior routines and distinctive capabilities contribute to the likelihood of firm growth and survival (or failure). Superior routines and distinctive capabilities depend on processes that involve the combination of physical resources and human collaboration as repositories for firm tacit and explicit knowledge (Olavarrieta and Ellinger, 1997). As they define the heterogeneity of resources and internal capabilities of the firm, these routines can determine the extent to which the firm's offering is inimitable by competitors (Dierickx and Cool, 1989).

The replication literature has mostly focused on the growth of multi-national firms (Jonsson and Foss, 2011), franchises (e.g., Szulanski and Jensen, 2008), firms in the service industries (e.g., Williams, 2007; Winter and Szulanski, 2001; Voss and Hsuan, 2009), and the replication of business models (e.g., Aspara et al., 2010; Dunford et al., 2010; Teece, 2010). Of particular interest is the study by Williams (2007) that treats replication as a mechanism for knowledge transfer and "an effort aimed at creating activities at one location that are identical to those at another location" (p.869). When knowledge is more self-contained (i.e., with less

influence from external factors), firms do not have to consider external links, hence incurring lower costs of, or effort for, replication. Winter and Szulanski (2001) also bring the concept of knowledge transfer by introducing the 'Arrow core' to capture which attributes are replicable and worth replicating, and how these attributes are created.

Aspara et al. (2010) look instead at replication via the exploitation of an innovative business model that articulates "the logic and provides data and other evidence that demonstrates how a business creates and delivers value to customers" (Teece, 2010, p.173). Aspara et al. find that, unlike large firms, small ones exhibit strong profitable growth when they have a high emphasis on business model innovation, yet a low emphasis on replicating this model. Our focus on the growth of business ventures through the replication of routines requires us to pay a special attention to knowledge transfer by means of replication effort deployment. It also requires paying attention to the venture's business model, especially as it affects the investment made in routine adaptation and the portion that goes toward innovation.

The concepts of innovation and imitation in replication are therefore at the forefront of our study. Winter and Szulanski (2001) articulate that "[r]eplicators are a subset of the class of organizations whose founding and/or early growth is closely tied to a particular innovation" (p.731). Rivkin (2001) points out that entrepreneurs' goal is to have a superior system of production that they can replicate themselves, but not be imitated by others. Replication can thus be a firm's competitive advantage (enabling it to grow) if imitation from rivals can be prevented. That can be the case, while replication is made easier, when the firm possesses compatible specifications and protocols within its boundaries or across industry. Rivkin (2001) further identifies game-theoretic strategic maneuvers by incumbents as potential barriers to imitation, but not to replication, since productive knowledge can be duplicated within a firm at no cost.

This literature also adds that, within the firm, standardization creates flexibility and makes it easier to replicate through learning and routines (Nelson and Winter, 1982), while outside the firm, standardization facilitates imitation (Rivkin, 2001). Although these studies have investigated some of the strategic growth implications of replication, the formulas for success do not indicate the level of innovation that should be embedded in a venture's routines as it attempts to expand. Nor do they inform us on what the effort allocated to creating new routines, finding and implementing the best routines of high-performing firms, or implementing the routines that the venture masters but that are new to a market (i.e., effort toward innovation) should look like as the venture's targeted market differs from its source environment. Our approach can attend to these strategic issues.

Additionally, investing in routine adaptation plays a key role in firm growth. Williams (2007) considers replication (i.e., exact copying or cloning) and adaptation (or modification) as two separate knowledge transfer mechanisms, suggesting that "[f]irms need to differentiate between ambiguous knowledge, which must be copied exactly, and knowledge intertwined with the environment, which requires modification" (p.884). Williams also observes that the use of adaptation increases significantly with the time elapsed, or experience gained, in a partnering relationship. Szulanski and Jensen (2008) argue instead that "[i]nnovation in the form of local adaptation, if undertaken too early or too substantially may undermine the ability to use the template, or original set of practices, thus hampering the replication" (p.1733).

Jonsson and Foss (2011) further note that the retail part of IKEA could not neglect the heterogeneity of its targeted markets, because successful replication is highly dependent on product range, pricing, standard operating procedures, etc., all of which needing to be adapted locally. Due to small-scale economies drawn from market adaptation, rather than large-scale

ones enabled by standardization (Kaufmann and Eroglu, 1998), this local adaptation requires the firm to make irreversible and costly investments in order to support its many retail activities. The model we now introduce considers the crucial role played by investment in routine adaptation, in addition to being well-grounded in the above replication literature.

3. A Growth Model based on Innovation Replicability

We develop our arguments using a decision-theoretic model. Such model is desirable to refine and build theory of decision-making, especially when considering the dynamics born from simultaneous changes in factors that influence the outcome of the decision to be made. A decision-theoretic model is also desirable when the objective is to deepen our understanding of the tradeoffs that may be involved. In our context, these tradeoffs are not only guided by the wealth that can be generated through replication, but also by the variability surrounding that wealth, thus considering return (or growth) as well as risk (survival) potentials.

Sapienza et al. (2006) argue for the need to consider both firm growth and firm survival as new firms attempt to initiate their internationalization. Such consideration is particularly important since firm survival (without which a firm cannot grow) is far from guaranteed for any new business ventures (e.g., Headd, 2003). Published numbers on business failure over the past decade have been astonishingly scary. The statistics for the U.S. has been at 40% of new ventures failing within two years and 80% within five (Small Business Administration, 2009). Numbers are slightly more encouraging for Sweden, with Short et al.'s (2009) representative sample from the late 90s showing a 48% rate of failure within the first five years. Deepening our understanding of what might yield firm growth can only happen without disregarding what might lead to firm failure. We use utility theory to build an objective function that considers both

growth and failure, but first we describe model parameters and decision variable that enable us to suggest a typology of growth policies.

3.1. *Adaptation Investment, Innovation and Replication Efforts*

Consider a new business venture attempting to grow by adding capacity, or replicate, at a newly targeted location. The expansion depends on the venture's ability to deploy, and thus adapt, various business (or organizational) routines in the new market. We represent by i the investment for routine adaptation for this expansion, and by ρ the proportion of that investment that goes toward innovation (i.e., creating new routines, finding and implementing the routines of best-performing firms, or implementing the routines mastered by the venture that are new to the targeted market). The proportion ρ, which we also refer to as *innovation effort*, is a decision to be made by the venture owner, while the *routine adaptation investment i* is considered to be given based on the venture's financial capabilities.[3] These two constructs are attractive because they are tangible and measurable (also facilitating empirical measurement and testing); that is, the venture owner is likely able to identify their values.[4]

Replication is not straightforward (Winter, 2010); we represent by e the *replication effort*. This effort depends on both, the amount of routine adaptation investment i as well as the innovation effort ρ. Williams (2007) argues that, due to context dependence on knowledge transfer leading to replication, not only copying but also adaptation (modification) is required. Rivkin (2001) further argues that what eases replication also eases imitation, thus suggesting that hard-to-imitate innovation diminishes the ease of replicability. Hence, we put forward a positive relationship between e and i and between e and ρ. That is, larger investment or greater

[3] The symmetry of i and ρ in the replication effort function we define results in similar technical findings (although with a change of interpretation) if instead ρ is given and i becomes the decision variable.

[4] Forsman (2011) warns that innovation development in small firms may not always be easily distinguishable, since the corresponding activities can be viewed as "quality improvements in collaboration with customers" (p.740).

innovation is expected to require more effort to replicate the venture's routines in order to grow. Arguably, more investment requires more learning and changes to properly use the routines (in the existing or new market), with a greater portion of that investment toward innovation further accentuating the learning and changes.

We swipe a large number of possible (multiplicative) functional forms for these relationships by using a power (or Cobb-Douglas type) function. Formally, $e = \theta \rho^a i^b$, where θ (> 0) is the productivity (in terms of the required replication effort) of the investment, and exponents a and b, both positive, represent the elasticity of the innovation effort and of the routine adaptation investment, respectively.[5] Taken together these three parameters characterize the *efficiency* of replication effort (i.e., the efficiency of the innovation-relative-to-imitation investment to adapt the routines to be replicated), where less replication effort is required per investment dollar for small values of θ, b and a than for large values. This functional form is also attractive for empirical testing of the relationship between our two investment constructs and the replication effort, as its logarithmic transformation results in a linear (e.g., regression) function.

We further characterize (albeit now qualitatively) the relationship between these three key constructs by providing a typology of new business ventures. We label the venture as being a 'bear-imitator' in its source environment when both, routine adaptation investment i and innovation effort ρ, are low (and hence e is low). An online delivery of fresh produces could fit this profile. Its expansion would likely involve some investment in adapting its goods sourcing/delivery, selection, and web design, but it would not be substantial, nor would be a need for creating new routines or finding/implementing the routines of best-performing firms. Most likely, this venture would deploy the routines it already masters and that are known to the

[5] Without a loss of generality, we could have also written the functional form as $e = \theta[\rho i]^a i^{b-a}$, where ρi represents the innovation investment.

targeted market, thus imitating what is already in place to expand. This characterization somewhat differs from Winter's (2010), which views the imitator acting more independently in that "the knowledge transfer occurs without the active support of the source" (p.102).

When i is high but ρ is low, there is a significant amount of routine adaptation but not much innovation effort. We thus employ the term 'bull-imitator' for labeling the venture in its source environment. A distributor of generic drugs could fit this profile, because it would likely encounter substantial investment (to expand) while adapting its distribution channels (e.g., hospitals, pharmacies, general practitioners, etc.) as well as order sizes and product selection for customization, just to name a few. However, the need for creating new routines and implementing the routines of best-performing firms and those it masters but that are new to the targeted market (i.e., its required innovation effort for expansion) could be negligible when using, for instance, existing distribution channels and a mix-and-match of the generic drugs.

When both i and ρ are high, we employ the term 'bull-innovator,' since the actual amount of investment toward routine innovation (i.e., $\rho \times i$) would be substantial. We could consider Voss and Hsuan's (2009) small mortgage bank to exemplify this type. The key routines included IT design and compatibility across branches, employee training for call centers, accessibility to services through multiple channels, and customization of service packages. The bank had to substantially invest in routine adaption to compete, as it required the alignment of the front office (e.g., customization options for customers) with the back office activities (e.g., IT development to ensure multi-channel access). In addition, the portion of its routine adaptation investment toward innovation was substantial, because it had to create new routines (e.g., IT design) and bring those that it mastered but that were new to the targeted market (e.g., service packages).

We finally coin the term 'bear-innovator' for when i is low but ρ is high; that is, when money is scarce yet innovation must take place. A venture that created face recognition software could fit this profile. It could have been working with hardware manufacturers to sell the software as part of a bundle, where a computer recognizes who the person is and uses this in several areas (e.g., another means of identity for authentication, personalizing the experience, etc.). The venture could have decided to try and sell the same exact software to law enforcement agencies, since the software could also be used to find a person in a crowd (or to notice if a particular person went by a camera). Although the software is the same, which keeps routine adaptation investment low, the routines on how to sell to this new niche market are different, thus the need to deploy more innovation efforts to create new routines.

The resulting typology is summarized in Table 1(a). We return to this table (parts a and b) once we analyze the dynamics of innovation replicability to argue how a new business venture might be best advised to move from one growth policy to another (since the environment of the targeted market for expansion is unlikely to be identical to the source environment). However, we must first describe the venture's utility function.

---------- (Insert Table 1 about here) ----------

3.2. *Optimizing Utility*

The venture accumulates wealth, denoted W, which can encompass its sales or sales growth, regarded as the most important measures of new venture performance (Robinson and McDougall, 2001), or even assets or other key items that are considered for valuation purposes. The wealth is inversely related to the replication effort e. Indeed, as more effort must be allocated toward replication, less effort remains available for other crucial venture activities that can generate wealth, which is especially an issue for small firms with limited resources (Aspara

et al., 2010; Ebben and Johnson, 2005). The wealth is also affected by some random external effects (e.g., those emerging from the competitive landscape, from new governmental regulations, or from industrial regulation changes) that escape the control of the venture. We aggregate these effects into a random variable X (viewed as a random percentage of change in the venture's wealth due to effects outside its control) that is normally distributed with mean μ_X and standard deviation σ_X. Factors under the control of the venture (e.g., timing of entry or supplier selection) further affect the wealth. We again aggregate these firm-based factors into a parameter, ω, since our primarily goal is to tease out the impact of replication effort e on the wealth, not these factors' impacts. Formally, $W = \frac{\omega}{e}[1 + X]$ or, using the functional form for e, $W = \frac{\omega}{\theta \rho^a t^b}[1 + X]$.[6]

The venture owner wishes to maximize utility from generating wealth, where the more the wealth the more the utility. However, the venture owner has a certain attitude toward risk in that he/she is risk-averse. Caliendo et al. (2009) report that 79% of self-employed individuals exhibited low-to-medium willingness to take risks, while Elston and Audretsch (2011) found that the majority of entrepreneurs they sampled were risk-averse. We thus represent the utility by an exponential function U with $U(W) = -e^{-\alpha W}$, where α is positive to characterize the owner's risk aversion.[7] The use of this exponential utility function, along with the normally distributed external effects X (and thus W given its linear relationship with X), makes the venture owner indifferent, for any alternative W, between maximizing expected utility and selecting the maximum of the *certainty equivalent* $E(W) - \frac{1}{2}\alpha Var(W)$ (e.g., Freund, 1956). $E(\cdot)$ is the

[6] Without a loss of generality, the exponent of e can be 1 (because θ, a and b can be rescaled accordingly).
[7] The underlying assumption is that the decision maker possesses a constant absolute risk aversion (or CARA). The use of other utility functions (e.g., constant relative risk aversion [CRRA] or utility or prospect theory) is at the cost of losing mathematical tractability.

expectation operator, $Var(\cdot)$ the variance operator, and the certainty equivalent is a risk-adjusted wealth. Given the amount of investment i toward routine adaptation, the venture must select the proportion of that investment that goes toward routine innovation ρ so as to maximize expected utility; i.e., ρ^* that maximizes $E(W) - \frac{\alpha}{2} Var(W) = \frac{\omega}{\theta \rho^a i^b}[1 + \mu_X] - \frac{\alpha}{2} \frac{\omega^2}{\theta^2 \rho^{2a} i^{2b}} \sigma_X^2$.

We highlight a few facts about this certainty equivalent. We begin with the first term, the expected wealth; that is, a proxy for the *likelihood of firm growth*. This growth proxy decreases (whenever $1 + \mu_X > 0$[8]) as more replication effort ($e = \theta \rho^a i^b$) is required. Indeed, easing replication, thus requiring less effort, enables the venture to gain from learning effects, develop abilities to serve more markets, or perhaps shape industry structures, which in turn facilitate the generation of more wealth and enable growth. Also, more effort remains available for other crucial activities of the resource-limited venture (Aspara et al., 2010; Ebben and Johnson, 2005). Furthermore, the level of investment i in routine adaptation moderates this negative relationship in that more investment makes the relationship less negative (i.e., $\frac{\partial^2 E[W]}{\partial i \partial e} > 0$), because there is more of a (financial) cushion to address or absorb the negative consequences of deploying more replication effort.

As for the second term of the certainty equivalent, it represents a proxy for the *likelihood of firm failure* and also decreases as more replication effort is required. This negative relationship between failure and deployed replication effort is expected, because easing replication exposes the venture to imitation and erodes its competitive advantages (e.g., Porter, 1996). The level of investment i in routine adaptation also moderates the negative relationship in that more investment makes the relationship less negative (i.e., $\frac{\partial^2 Var[W]}{\partial i \partial e} > 0$), because this

[8] In other words, the expected percentage of change in the venture's wealth due to external effects must not be worse than –100%, which is expected for the business to be going in the first place.

additional (financial) cushion can limit the variability in lost wealth resulting from more replication effort. Figure 1 illustrates these moderating effects as well as the tradeoffs between the growth proxy (return) and the failure proxy (risk).

---------- (Insert Figure 1 about here) ----------

4. Analysis: Growth Policy Dynamics

The decision model just described enables us to identify the innovation effort (i.e., the portion of routine adaptation investment puts toward innovation) that maximizes the venture owner's utility. We investigate how a change in a model parameter affects this effort. We then move away from a static view and look at how the simultaneous evolutions of key model parameters during expansion influence the trajectory of innovation efforts. This exercise enables us to bring back the typology in Table 1 to investigate how the dynamics of innovation replicability might move a venture from one growth policy to another.

We straightforwardly find the unique optimal innovation effort to be $\rho^* = \left[\frac{a\omega\sigma_X^2}{\theta i^b[1+\mu_X]}\right]^{\frac{1}{a}}$.[9] This ρ^* corresponds to the level where additional utility from expected wealth resulting from a change in this effort *equals* the additional disutility associated with the variation in the wealth (a marginal-revenue-equals-marginal-loss argument). We can characterize eight key relationships from this derivation. The first five are negative relationships between ρ^* and the venture's adaptation investment i, the productivity θ of that investment (in terms of replication effort), the elasticity a of the innovation effort, the elasticity b of the routine adaptation investment, and the mean percentage μ_X of the change in wealth due to external effects. The next three are positive

[9] This ρ^* is formally derived by taking the first-order derivative of the certainty equivalent with respect to ρ. Note also that the second-order derivative with respect to ρ is $\frac{a\omega}{\theta\mu^{a+2}i^b}\left\{[a+1][1+\mu_X]-\frac{[2a+1]a\omega\sigma_X^2}{\theta\mu^a i^b}\right\}$ and we straightforwardly verify that once $\rho^* = \left[\frac{a\omega\sigma_X^2}{\theta i^b[1+\mu_X]}\right]^{\frac{1}{a}}$ is replacing ρ in that equation then it becomes negative. In other words, the certainty equivalent is concave at ρ^*, which makes ρ^* the unique optimal solution.

relationships between ρ^* and the marginal wealth ω from firm-based factors (aggregated), the standard deviation σ_X of the change in wealth due to external effects, and the venture owner's risk attitude α. The utility-disutility tradeoff born from an increase in any of these parameters depends on how easing growth through replication by restricting innovation outweighs the potential damage from imitation. Table 2 summarizes this sensitivity analysis on ρ^*.

---------- (Insert Table 2 about here) ----------

The characterization of these negative and positive relationships enables us to find conditions under which the venture should decrease or increase its innovation effort based on simultaneous changes in the routine adaptation investment, in the efficiency of replication effort, and in the economic environment that it will face for the newly targeted market. In taking this more dynamic view, we first note that risk attitude α is a stable personality trait not expected to change across different situations that may arise over time (e.g., Weber and Milliman 1997). We can thus reasonably assume that it is fixed. We can also keep fixed the marginal wealth ω from aggregated firm-based factors, because the venture has the option of altering its inversely proportional relationship between wealth and replication effort via the efficiency of this effort when investment are made to adapt routines (without a loss of generality). We recall that this efficiency is controlled by the adaptation investment's productivity θ and elasticity b, as well as by the elasticity a of the innovation effort.

Therefore, taken together, θ, b and a characterize whether replication effort efficiency improves (when at least one of them decreases, the others staying the same) or deteriorates (when at least one of them increases, the others staying the same) over time. This efficiency brings about the first condition in our analysis of the dynamics of growth policies. The second condition characterizes changes in the economic environment of the newly targeted market as

compared to the venture's source environment. Specifically, it involves the mean percentage μ_X of the change in wealth due to external factors (in the new market) and the standard deviation σ_X of this change. The economic environment is improving when the venture experiences an increase in μ_X but no increase (i.e., stays as is or decreases) in σ_X, since the new environment will be more rewarding and no more, or even less, risky. It is however deteriorating when the venture experiences a decrease in μ_X but no decrease (i.e., stays as is or increases) in σ_X. We next use the four resulting scenarios to describe utility-maximizing policies for growth (i.e., routine adaptation investment i and its portion for innovation ρ). While, for each scenario, Table 3 sums up the impacts of simultaneous changes in model parameters on the innovation effort, Table 4 summarizes the growth policies and Table 5 illustrates their movements for expansion.

---------- (Insert Tables 3, 4 and 5 about here) ----------

Scenario 1: *The venture faces improvement in both the new environment and the replication effort efficiency*. Our decision framework (Table 2) proposes that the venture increases the routine adaptation investment (i) sufficiently to counteract the impact on innovation effort (ρ^*) (an increase) from the improved replication effort efficiency (θ, a and/or b decrease). As a result, the improved environment (μ_X increases and/or σ_X decreases) and high investment in routine adaptation enable the venture to decrease its (relative) innovation effort, that is, the portion of this investment that goes toward routine innovation. We therefore suggest a *bull-imitation* policy (with i high and ρ low) for the targeted market, as portrayed in Table 1(b). From this policy and the venture typology in Table 1(a), a bull-imitator in the source environment should remain a bull-imitator (keep i high and ρ low) for the newly targeted market, but all others—bear-imitators, bear- and bull-innovators—should become bull-imitators. But if the venture cannot afford a sufficient increase in the routine adaptation investment, our framework

instead proposes that it decreases this investment sufficiently to counteract the impact on the innovation effort (a decrease) from the improved economic environment. Yet, the improved replication effort efficiency and lower investment in routine adaptation enable the venture to increase the portion of this investment that goes toward innovation. We thus suggest a *bear-innovation* policy (with i low and ρ high) for the targeted market, and a bear-innovator should remain so, while all others—bear- and bull-imitators, as well as bull-innovators—should become bear-innovators.

Scenario 2: *The venture faces improvement in the new environment but deterioration in the replication effort efficiency*. The deteriorated replication effort efficiency encourages the deployment of less innovation effort (because greater innovation effort also means greater replication effort). Hence, our framework proposes that the venture either keeps as is or increases the investment in routine adaptation (given the improved environment), but decreases the portion of this investment that goes toward innovation (i.e., relative innovation effort). We therefore suggest a *bull-imitation* policy for the targeted market, leaving some room for the *bear-imitators* (with both i and ρ low). Specifically, from this policy and the typology offered in Table 1(a), a bear-imitator in the source environment should stay as is or become a bull-imitator, a bull-imitator should stay as is, a bear-innovator should become a bear- or a bull-imitator, and a bull-innovator should become a bull-imitator.

Scenario 3: *The venture faces deterioration in the new environment but improvement in the replication effort efficiency*. The deteriorated environment encourages innovation, but not so much investment in routine adaptation. Our framework proposes that the venture either keeps as is or decreases the routine adaptation investment (given the deteriorated environment), but increases the portion of this investment that goes toward innovation (i.e., relative innovation

effort). We therefore suggest a *bear-innovation* policy for the targeted market, leaving some room for the *bull-innovators* (with both i and ρ high). Specifically, a bear-imitator should become a bear-innovator, a bull-imitator should become a bull- or a bear-innovator, a bear-innovator should stay as is, and a bull-innovator should stay as is or become a bear-innovator.

Scenario 4: *The venture faces deterioration in both the new environment and the replication effort efficiency*. This last scenario requires similar growth policies to that of Scenario 1, albeit for different reasons. Our decision framework proposes that the venture increases the investment in routine adaptation sufficiently to counteract the impact on innovation effort (an increase) from the deteriorated environment. Nevertheless, both the deteriorated environment and replication effort efficiency encourage the venture to decrease its (relative) innovation effort (since more innovation yields more replication effort), that is, the portion of the investment that goes toward routine innovation. We thus suggest a *bull-imitation* policy for the newly targeted market, where a bull-imitator should remain so, while all others—bear-imitators, bear- and bull-innovators—should become bull-imitators. But when the venture cannot afford a sufficient increase in the routine adaptation investment, our framework proposes that it decreases this investment sufficiently to counteract the impact on the innovation effort (a decrease) from the deteriorated replication effort efficiency. The deteriorated environment and lower investment encourage the venture to increase the portion of this investment that goes toward innovation to gain some competitive advantages. We thus suggest a *bear-innovation* policy, where a bear-innovator should stay as is, while all others should become bear-innovators.

We can exemplify some of these scenarios by considering whether the venture contemplates growth in an emerging as opposed to a developed market. Scenario 2 might best represent growth in an emerging market, where the efficiency of replication effort is expected to

deteriorate since the structures in the business environment (e.g., intellectual property regulations, product safety laws, etc.) that are in place are likely less stringent than in the source environment. But the economic environment is likely more vibrant than the source environment, and the venture can likely attract more funding to adapt its routines because financers are eager to explore these new markets. In this context, the growth policy should leave some room for bear-imitation for those who are already bear-imitators or bear-innovators in their source environment, but mostly focus on bull-innovation for the newly targeted market.

Scenario 3, on the other hand, might best represent firm growth in developed markets that experience deteriorating economic conditions, as seen in some of today's power economies of the West. The efficiency of replication effort is expected to increase from known and established structures in the business environment, as well as from the venture's experiences if the source environment is already in a developed market. However, developed (new) markets may not enable the venture to attract more investment, because it may already be financially saturated (as part of the deteriorating economic conditions). In this context, the growth policy for the newly targeted market should mostly focuses on bear-innovation, but also leave some room for bull-innovation for those who are already bull-innovators or bull-imitators in their source environment.

5. Discussion

These prescriptions yield a number of theoretical and practical implications. Winter and Szulanski's (2001) approach to replication is grounded in the economics of information and entails a broad scope of knowledge transfer as well as dynamic capabilities through routinized activities. "The resource leveraged by true replication strategy is an informational resource, and information is not 'spread thin' by being used at multiple locations" (p.734). They further argue

that the replication strategy is resistant to imitation (i.e., sustainable), because replicators have better access to key routines, learn from experiences, possess firm-level capabilities unavailable to others, have an organizational history that enables superior transfers of knowledge, and a tight fit exists between these knowledge-based advantages and activities. We use a different angle by grounding our arguments in the economics of innovation.

Specifically, we use innovation effort (i.e., the portion of investment in routine adaptation that goes toward innovation by, e.g., creating new routines, finding and implementing the best routines of high-performing firms, or implementing the routines mastered by the venture that are new to a market) as the mechanism that limits or prevents imitation by influencing the firm's level of replication effort. This approach enables us to characterize conditions that are based on the efficiency of replication effort and the economic environment of the newly targeted market, under which a variety of growth policies might be suboptimal to a utility-maximizing venture owner. For instance, investing more in routine adaptation and increasing the portion of that investment that goes toward innovation, which conditions characterize a bull-innovation policy, should be beneficial only if the venture's targeted new market is associated with improved replication effort efficiency, but a deteriorated economic environment.

In our approach to firm growth through replicability, we also view the knowledge transfer advantage through the relative amount of effort allocated to routine innovation. This view echoes Rivkin's (2001) in that "knowledge that is moderately complex lends itself to being replicated without being imitated" (p.287), where complexity is measured by the number of decisions a firm must make and of interactions among these decisions. Greater innovation effort thus likely leads to greater complexity. Rivkin's explanation for 'replication-without-imitation' lies with the managerial search for knowledge, where the imitator has to discover while the replicator, instead,

only has to *re*discover. This rediscovery corresponds to an easier transfer of knowledge as compared to the imitator's discovery, since the replicator enjoys the benefits (e.g., learning) of its original template. Our framework, albeit not focused on the replication-imitation connection, brought two key dimensions omitted by Rivkin (2001) to the forefront: investment decisions and environmental changes, both affecting the search for knowledge. New business ventures are especially sensitive to these two dimensions (e.g., formal investors may control where their invested money goes), and we do find that they affect growth policies.

Our framework also leaves room for the imitator. Csaszar and Sigglekow (2010) put forward conditions under which greater investment in imitating the practices of high-performing firms can be valuable. These conditions involve firm and context similarity (e.g., same industry maturity), complexity (based on interactions among practices), and the timeframe during which the benefit of imitation is observed. In the short-run, their findings differ from common wisdom by proposing a negative relationship between firm performance and low levels of imitation breath (i.e., expected number of successfully copied practices) when context similarity and complexity are both high. A negative relationship also stands almost consistently in the short-run when context similarity is low. Although our analysis compares in the short-run the environments that the venture faces—rather than the environment of the firm it copies—to its own, our findings also speak to the performance-imitation relationship. New ventures should strive to grow via a bear-imitation policy (i.e., low levels of investment in routine adaptation with small portions toward innovation) when the targeted market's economic environment improves as compared to the source environment, but the venture cannot afford to change its routine adaptation investment and in fact should make the innovation portion even smaller (i.e.,

mostly copies in the targeted market the routines that it has already in place in the source environment) because the efficiency in replication effort is going to deteriorate.

Moreover, our operationalization of adaptation differs from Williams (2007) who views replication (exact copying) and adaptation (modification) as separate mechanisms of knowledge transfer. For us, adaptation is through investments rather than based on a combined scaling for the use of, among other things, modified practices from partners. Nevertheless, we bring additional light to Williams' claims in that knowledge transfer is context dependent and a change in the economic environment can put the role of adaptation and, as a result, bull-imitation policies to the forefront. We propose that firms should strive to use such growth policies (of large routine adaptation investments with small portions for innovation) when the targeted market's economic environment improves, as compared to that of the source environment, and the venture can afford a sufficient investment increase. But even when the new environment is worse, a venture should still favor adaptation, and the corresponding bull-imitation policy, if efficiency in the replication effort is also going to deteriorate yet it can afford a sufficient increase in the routine adaptation investment.[10]

Lastly, Szulanski and Jensen (2006, 2008) highlight the harm that can be caused by undertaking innovation too substantially or too soon as the firm tries to grow. Staying more faithful to the original template can be more favorable than moving away from it through innovation, especially in the early stage of firm growth. Szulanski and Jensen propose a negative relationship between innovation and growth in the early stage of growth, but a positive one (or at least diminishing returns from imitating) in the later stage when the firm has gained more

[10] The domination of the bull-imitation policy we observed might also be connected to the 'principle-based' as opposed to 'template-based' replication strategy put forward by Baden-Fuller and Winter (2007) (see also Winter, 2010). While following the template encourages imitation (or close copying) and to follow people 'who already know how to do it,' following principles, instead, encourages 'presumptive' adaptation and only use guidance from people 'who already know how to do it' to reach means-ends.

experience. Our findings may have implications for these views, albeit for a different setting, where suppressing innovation may not necessarily be the venture's policy to follow. Indeed, a bull-innovation policy (i.e., large investments in routine adaptation with large portions for innovation) should be beneficial when the venture's targeted new market is associated with improved replication effort efficiency, but a deteriorated economic environment. On the other hand, cash-constrained ventures should strive to implement a bear-innovation policy (i.e., small investments in routine adaptation with large portions for innovation) when the targeted market's economic environment deteriorates as compared to the source environment and the venture cannot afford to increase this investment, perhaps even having to decrease it. But even when the new environment gets better, business ventures should still favor a bear-innovation policy when efficiency in the replication effort is going to also be better yet the venture is forced to significantly decrease its routine adaptation investment.

6. Conclusion and Extensions

Our formal model enabled the identification of tradeoffs and helped us refine our theoretical arguments. Key to this model was the extent of the investment to adapt routines, considering the portion of this investment that went toward innovation, used to develop a typology of growth policies. Solving for a certainty equivalent (utility maximization) that considers proxies for both growth and failure potential, uncovered the crucial role played by (1) changes in the external economic environment of the targeted market as compared to the source environment, and (2) the replication effort efficiency or, in other words, changes in the efficiency of the innovation-relative-to-imitation investment to adapt the routines to be replicated in this new market. The refinement of a replication theory through our analysis of firm growth policies and their implications with respect to existing literature can be summarized by two testable hypotheses.

These hypotheses give a central role to the bull-imitation and bear-innovation policies, as also evoked in Table 5:

HYPOTHESIS 1. *When the economic environment of the newly targeted market improves over the source environment, the venture will generally favor a bull-imitation policy for its expansion, with one exception:*

if the venture cannot afford a greater investment in routine adaptation for the new market, even though its replication effort efficiency would be better in this new market, then a bear-innovation policy will be favored.

HYPOTHESIS 2. *When the economic environment of the newly targeted market deteriorates as compared to the source environment, the venture will generally favor a bear-innovation policy for its expansion, with one exception:*

if the venture can afford a greater investment in routine adaptation for the new market, even though its replication effort efficiency would be worse in this new market, then a bull-imitation policy will be favored.

These hypotheses also have implications for the management of established firms. With their fatter financial cushions, established firms are more likely to be able to afford a greater investment in routine adaptation for the new market than new business ventures can. Consequently, established firms would be best advised to adopt a bull-imitation policy and stick to it as they move from one new market to the next, even when the economic environment of the targeted market deteriorates as compared to the source environment. Under this policy, the established firm would copy in the targeted market its numerous routines already in place in the source environment. However, the large routine adaptation investment under such a policy, even with a relatively small portion for routine innovation, could still result in a considerable amount of new routines being created and the routines of best-performing firms, or those that the

established firm masters but new to a market, being implemented. That is, routine innovation could still take place in a much larger extent than it could in a financially-constrained venture.

Nevertheless, financially-constrained ventures could be less so with, for instance, a well-developed venture-capital market, as is the case in the U.S., U.K. and Israel for various technology sectors. Although a number of European countries (e.g., Italy) have smaller stock exchanges, Bertoni et al. (2011) show that venture-capital financing has been positively associated with the growth of new technology ventures in Italy. Bertoni et al. also suggest that, as European policy-makers attempt to increase the demand for venture capital (e.g., by increasing the birth rate of technology firms with subsidies) as well as its supply (e.g., through co-investment schemes or government ownership of such funds), more technology ventures are likely to emerge. Our hypotheses propose that the growth of these emerging firms rely on adopting a bull-imitation policy under which substantial routine innovation can be afforded.

In addition to empirically testing the above two hypotheses, multiple avenues for extensions to overcome this work's limitations exist. First, a simulation approach could be used to extend our theoretical argument by involving tradeoffs born from the competitive landscape over time. The simulation would include multiple firms (incumbents and new entrants) interacting in an industry where each would grow or die. Each firm could be endowed with a certain amount of investment for routine adaptation and a portion for innovation (perhaps randomly determined as it enters the landscape) and select its growth policy according to Table 1's typology. We could then evaluate how these policies fair with respect to each other, or else they could be randomly assigned to the set of firms. We could then also evaluate how new entrants fair with respect to their more established counterparts. The firm owner's decision could

again be based on a risk-adjusted wealth to capture a proxy for growth and failure potential, or both could be studied separately.

A second extension could make the investment in routine adaptation and the portion for innovation (or even the outcomes from this investment, i.e., replication effort) random. de Jong and Marsili (2006) maintain that, of roughly a third of small firms that have a formal plan for innovation, only half put aside a budget for innovation. Added to their lack of resources, this observation suggests that most new ventures may not have a 'budget for replication' either (although replication through franchising may overcome the resource scarcity problem; Combs et al., 2011). Instead, their owners must search for funding, not knowing whether they will be successful in generating it and/or generating enough; von Burg and Kenny (2000) noted that it took nearly two years for Network Systems, the first venture to offer local area networking, to receive venture capital funds. Furthermore, more investments (especially toward innovation) do not necessarily guarantee immediate better outcomes, because payoffs may lag in time. These new dimensions—randomness and delay—to refine our decision framework could also be addressed with simulation. The use of simulation has already produced some significant insights in the replication literature (see, e.g., Rivkin, 2001).

Although replication may not be the sole mechanism that can produce large-scale economic value from an original innovation, Winter (2010) contends that invention without innovation is not creating economic value, but innovation without replication is not creating *much* economic value. Our treatment of innovation has been on innovation in a firm's routines (i.e., by creating new routines, finding and implementing the best routines of high-performing firms, or implementing the routines mastered by the venture that are new to a market) rather than on its products or services. Nevertheless, such innovation is crucial in the context of replication

for new business ventures that typically lack already developed routines. New ventures also lack resources that can ease the need for innovation replicability, making it more likely an important competitive advantage. A third impediment common in new ventures is the lack of reputation or 'transferable reputation' given the need for "real uniformity in the customer experience" as replication takes place (Winter, 2010, p.101). While paying attention to these shortages, much is left to learn about the growth of new business ventures and innovation replicability.

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Figure 1. A replication framework

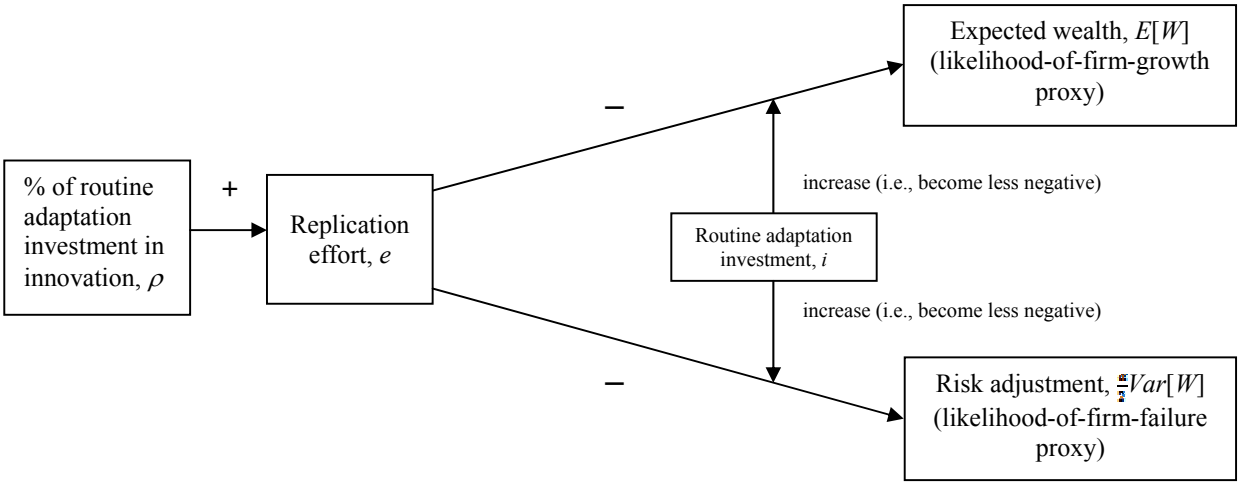


Table 1. Venture and growth policy typologies

		(a) Labeling of ventures		(b) Labeling of growth policies	
		Routine adaptation investment, i		Routine adaptation investment, i	
		Low	High	Low	High
Innovation effort, ρ	High	Bear-innovator	Bull-innovator	Bear-innovation	Bull-innovation
	Low	Bear-imitator	Bull-imitator	Bear-imitation	Bull-imitation

Table 2. Sensitivity of the (optimal) innovation effort

An increase in	Notation	Innovation effort ρ^*	Reasons
Routine adaptation investment	i	↓	Increases the replication effort, thus diminishing the utility from a lower expected wealth as well as the disutility from the variation in this wealth, which tradeoff can be offset by allocating less innovation effort to bring back down the replication effort
Productivity of the routine adaptation investment	θ	↓	
Elasticity of the innovation effort	a	↓	
Elasticity of the routine adaptation investment	b	↓	
Mean percentage of change in wealth due to external effects	μ_X	↓	Diminishes only the utility from a higher expected wealth, which can be offset by allocating less innovation effort and thus bringing back up this utility
Marginal wealth from firm-based factors (aggregated)	ω	↑	Augments the utility from a higher expected wealth as well as the disutility from the variation in this wealth (and at a faster rate), which tradeoff can be offset by allocating more innovation effort
Standard deviation of the change in wealth due to external effects	σ_X	↑	Augments only the disutility from the variation in the wealth, which can be offset by allocating more innovation effort and thus bring back down this disutility
Venture owner's risk attitude	α	↑	

Legend: ↓ represents a decrease in ρ^*; ↑ represents an increase in ρ^*

Table 3. Impacts on the (optimal) innovation effort from simultaneous parameter changes

	Scenario 1 *The venture faces improvement in both the new environment and the replication effort efficiency*		**Scenario 2** *The venture faces improvement in the new environment but deterioration in the replication effort efficiency*		**Scenario 3** *The venture faces deterioration in the new environment but improvement in the replication effort efficiency*		**Scenario 4** *The venture faces deterioration in both the new environment and the replication effort efficiency*	
	Parameter change	Impact on ρ^*	Parameter change	Impact on ρ^*	Parameter change	Impact on ρ^*	Parameter change	Impact on ρ^*
i	a) ↑ enough b) ↓ enough	↓ ↑	— or ↑	— or ↓	— or ↓	— or ↑	a) ↑ enough b) ↓ enough	↓ ↑
θ	↓	↑	↑	↓	↓	↑	↑	↓
a	↓	↑	↑	↓	↓	↑	↑	↓
b	↓	↑	↑	↓	↓	↑	↑	↓
μ_X	↑	↓	↑	↓	↓	↑	↓	↑
ω	—	—	—	—	—	—	—	—
σ_X	↓	↓	↓	↓	↑	↑	↑	↑
α	—	—	—	—	—	—	—	—

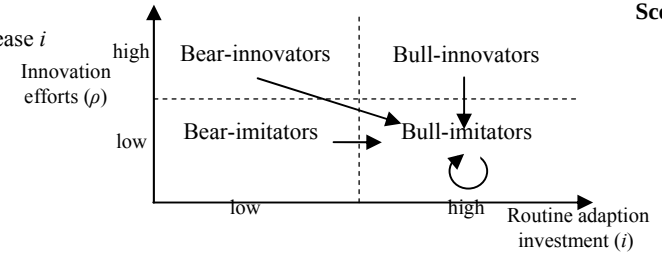
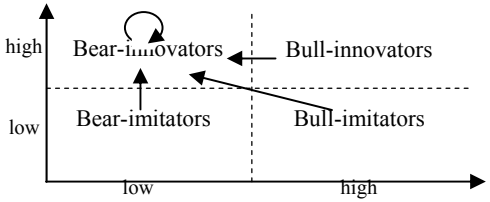
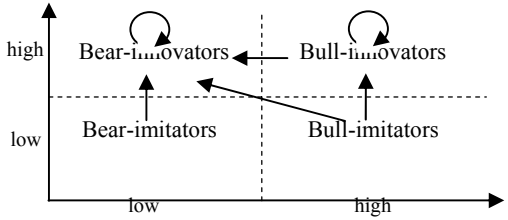
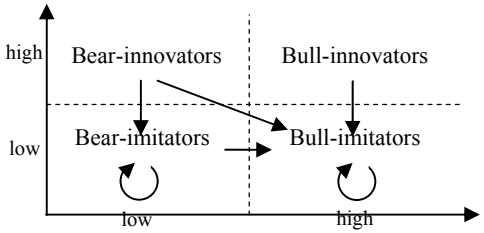
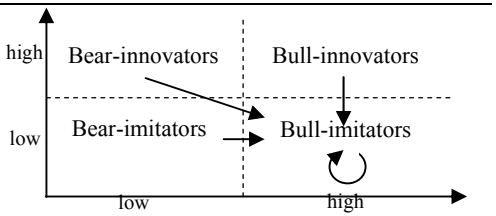
Legend: ↓ represents a decrease; ↑ represents an increase; — represents no change

Table 4. The dynamics of growth policies

Investment policy (i,ρ)		Economics of the new environment	
		Improving (μ_X increases and/or σ_X decreases)	Deteriorating (μ_X decreases and/or σ_X increases)
Replication effort efficiency	Improving (θ, a and/or b decrease)	**Scenario 1** a) Increase the routine adaptation investment (i) sufficiently (to counteract the impact of the improved efficiency in replication effort[1]) but decrease the portion of that investment that goes toward innovation (ρ) b) Decrease the routine adaptation investment (i) sufficiently (to counteract the impact of the improved external economic environment[2]) but increase the portion of that investment that goes toward innovation (ρ)	**Scenario 3** Do not increase (i.e., stay as is or decrease) the routine adaptation investment (i) but increase the portion of that investment that goes toward innovation (ρ)
	Deteriorating (θ, a and/or b increase)	**Scenario 2** Do not decrease (i.e., stay as is or increase) the routine adaptation investment (i) but decrease the portion of that investment that goes toward innovation (ρ)	**Scenario 4** a) Increase the routine adaptation investment (i) sufficiently (to counteract the impact of the deteriorated external economic environment[3]) but decrease the portion of that investment that goes toward innovation (ρ) b) Decrease the routine adaptation investment (i) sufficiently (to counteract the impact of the deteriorated efficiency in replication effort[4]) but increase the portion of that investment that goes toward innovation (ρ)

[1] Since $\partial\rho^*/\partial i$, $\partial\rho^*/\partial\theta$, $\partial\rho^*/\partial a$ and $\partial\rho^*/\partial b$ are all negative, a sufficient increase in i will counteract the positive impact on ρ^* from a decrease in θ, a and b.
[2] Since $\partial\rho^*/\partial i$ and $\partial\rho^*/\partial\mu_X$ are negative but $\partial\rho^*/\partial\sigma_X$ is positive, a sufficient decrease in i will counteract the negative impact on ρ^* from an increase in μ_X and a decrease in σ_X.
[3] Since $\partial\rho^*/\partial i$ and $\partial\rho^*/\partial\mu_X$ are negative but $\partial\rho^*/\partial\sigma_X$ is positive, a sufficient increase in i will counteract the positive impact on ρ^* from a decrease in μ_X and an increase in σ_X.
[4] Since $\partial\rho^*/\partial i$, $\partial\rho^*/\partial\theta$, $\partial\rho^*/\partial a$ and $\partial\rho^*/\partial b$ are all negative, a sufficient decrease in i will counteract the negative impact on ρ^* from an increase in θ, a and b.

Table 5. Illustrating the dynamics of growth policies

Investment policy (i,ρ)	Economics of the new environment: Improving (μ_X increases and/or σ_X decreases)	Economics of the new environment: Deteriorating (μ_X decreases and/or σ_X increases)
Replication effort efficiency: Improving (θ, a and/or b decrease)	**Scenario 1** a) can increase i  b) cannot increase i  	**Scenario 3** 
Replication effort efficiency: Deteriorating (θ, a and/or b increase)	**Scenario 2**  	**Scenario 4** a) can increase i  b) cannot increase i