Autonomy in the workplace

Conceptualization and application of a social psychological construct in organizational economics

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Preface

In recent years, it has become more common and popular that companies devise incentive schemes including non-monetary components, rely on empowering and supportive leadership, and commit to mission statements and corporate social responsibility to attract employees. These methods are partly addressed in Behavioural Economics, which draws on psychology to answer economic questions of human decision making. For example, Behavioural Economics employs cognitive psychological findings to explain biases deviating from classical economics theory such as present bias and loss aversion, and social psychological considerations to inquire phenomena like inequality aversion and mission. This dissertation takes the new and powerful perspective of a person's social psychological need for Autonomy to examine these methods and advance Behavioural Economics.

Autonomy is a concept from Social Psychology and related to economic issues, albeit not specifically researched. Usually, economists associate the term Autonomy with a person's independence in choice and experiencing joy in undertaking an action which is termed intrinsic motivation. Decision rights and intrinsic motivation undoubtedly have strong motivational potential and have been scrutinized in the economic literature. Both, however, are based on a notion of free choice without external interference.

In Social Psychology's Self-Determination Theory Autonomy is a key concept in understanding human motivation. Self-Determination Theory defines Autonomy as a person's feeling of volition and freedom and identifies it as a person's basic need for her psychological well-being and functioning (Gagné and Deci, 2005). The economic understanding of having choice does not necessarily convert to a feeling of freedom as described in Self-Determination Theory. Indeed, choice can be overwhelming, and lower people's satisfaction (Schwartz, 2004) and motivation (Iyengar and Lepper, 2000). Also, intrinsic motivation as pure enjoyment of an action

is open to doubt in a work context where employees have to measure up to the externally assigned tasks of the job. Self-Determination Theory however understands incentives to instill different degrees of the feeling of Autonomy in an individual. When a person is committed to the work and workplace, she takes actions of her own volition and the degree of Autonomy is high. When rewards and punishments are employed to make her take an action, she experiences stress and pressure at work and the degree of Autonomy is low. Self-Determination Theory's definition of Autonomy is therefore related but distinct from its economic idea and offers valuable insights for economists. It opens up a new, more encompassing research agenda informed by Social Psychology.

This dissertation is a first step in this research agenda. I take the conceptual essence of Autonomy in Self-Determination Theory and adapt it to answer economists' questions. I make the case to resolve the contradictory evidence on interaction of incentives, incorporate Autonomy Support as a non-monetary incentive motivating innovation in a model, and explain how granting Autonomy influences whom a company can successfully recruit theoretically.

In Chapter 1, which is joint work with Florian Englmaier, we take up the seemingly contradictory evidence on the effectiveness of what economics terms intrinsic incentives. Experiments have not produced consistent evidence on interaction effects of intrinsic with extrinsic incentives, e.g. under which circumstances intrinsic motivation is crowded out. We derive important insights from Self-Determination Theory's concept of Autonomy to resolve these issues. We make the case that the standard distinction in economics between extrinsic and intrinsic incentives is too basic to explain the puzzling experimental evidence. Broadly speaking, extrinsic forces are understood to compel an individual to do something she does not want, and intrinsic forces to engage her in activities she wants to undertake anyway. Typically, the former is related to monetary and the latter to non-monetary incentives. We introduce the classification of incentives from Self-Determination Theory's Organismic Integration Theory. Its motivational continuum between Autonomy and Control offers meaningful insights for economic considerations on incentives because it allows individuals to feel a degree of volition in doing things she would not have chosen on her own accord which is apt for incentives in the workplace. The more autonomous a motivational force is, the more integrated the individual perceives it with her self, and the more volition she experiences when acting upon that

motivation. More autonomous incentives cause less pressure, uphold motivation even when their intensity abates, and have a positive impact on well being and performance (Gagné and Deci, 2005). More controlling incentives cause stress and pressure such that motivation declines when their intensity abates and have a negative impact on well being and eventually performance. We show that the economic distinction between extrinsic and intrinsic incentives does however not map into Control and Autonomy. Identity is regarded as an intrinsic incentive because it relies on actions resulting from an individual's self-understanding. We demonstrate its incorporation into the economic theory actually constitutes a controlling incentive, and that the specific design of a monetary incentive it is combined with can facilitate internalization or crowding out. We further juxtapose identity and mission incentives, which are often used interchangeably in economic parlance, and show that the latter is really a more autonomous motivation. Positive reciprocity and the gift exchange phenomenon serve as example for a monetary incentive. We explain that non reciprocal individuals are only motivated to mimic reciprocal ones in the long run, their motivation remains external. For them, generous wages are a controlling incentive, coercing them to exert high effort, and once the generous wages cease to exist so does their high effort. Reciprocal individuals however are autonomously motivated because repaying generosity is in accordance with their self. For these individuals it is suggested that the gift exchange equilibrium sustains disturbances in the long run.
Our considerations complement the understanding of the motivational force of incentives by themselves and in combination. Our paper contributes to resolve seemingly contradictory evidence on the effectiveness of intrinsic incentives, and offers an insightful perspective for economists.

In Chapter 2, which is joint work with Lion Henrich, we scrutinize how a principal should optimally provide Autonomy Support to an agent in order to foster innovative activity. Autonomy Support constitutes actions and behaviours of a supervisor that encourages choice and initiative, provides meaning and training, and refrains from pressuring the agent (Stone et al., 2009). Employees with everyday, hands-on experience of products and processes may discover and invent ways to improve them. For example, understanding customers' needs and trying to creatively meet them can lead to small but meaningful improvements in the

design of a product and consequentially its competitiveness. Companies can, however, only make limited use of monetary incentives to encourage these innovations; our literature review shows that these only incentivize target-oriented innovative solutions to problems but not creative, unconstrained innovation. Relying only on monetary incentives thus deprives a company of the full innovative potential of the workforce. However, these workers are not specifically employed for a creative task, and their work environment influences on the one hand whether they feel free to creatively think about novel ideas and improvements, and on the other, whether they feel safe to share their ideas and challenge the way things are done. Managing these workers appropriately is therefore crucial. Our focus is not on one specific management practice, but the behaviour of the leader that fosters and invites novel ideas, and we argue that leadership behaviour successful in instilling innovative activity is Autonomy Supportive. We develop a theoretical model in which the agent enters the firm with an initial level of Autonomy Support, e.g. from a previous employment. But Autonomy Support fades out over time: a single act of encouragement does not plausibly motivate innovation indefinitely. Investments in Autonomy Support, capturing ongoing leadership behaviour in a work relationship, must be made repeatedly, which we account for in a two period model generating different investment patterns. We find that the principal, after observing the agent's initial level, invests just enough to achieve a level of Autonomy Support in the agent that instills optimal innovative effort. This reflects that leadership behaviour must adapt to the needs of the specific employee to meet requirements; some people might need extensive investments in the form of skill training, for others short regular meetings are sufficient. Only for extremely low and high initial levels of the agent does the principal provide no Autonomy Support, either because the agent requires very high and costly investments or needs no additional Support to enable his innovative activity. The investment dynamics further depend on the principal's valuation of future periods and the discount rate of the agent's Autonomy Support. The principal starts the work relationship off with relatively high investments if she values future periods and knows that her Support has a lasting effect on the agent.

Our discussion highlights that Autonomy Support incentivizes innovative activity non-monetarily, and that actions and behaviours displayed by leaders constitute Autonomy Support. Organizational Economics largely focuses on management practices and their complementarities. Leadership behaviour and its impact have received much less attention in the liter-

ature. By conceptualizing leader behaviour theoretically our model contributes to filling this gap.

In Chapter 3, I contribute to bridging the gap between the standard assumption that granting workers Autonomy always leads to lower effort choices and firm profits, and real life examples where workers are given considerable leeway. I reconcile this disconnect by examining that many jobs comprise both strictly organized everyday tasks as well as malleable project related work that relies on agents to adapt and learn in a self organized way. I show with a theoretical model that granting Autonomy has an impact on the principal's ability to recruit agents whose personal Autonomy level makes them more apt at either everyday tasks or project management.

Agents are heterogeneous in their personal Autonomy level. Economic studies find that a proportion of people value Autonomy at work, and even opt for self-employment to achieve it. Self-Determination Theory states that some individuals have an Autonomy orientation, and select work environments that allow greater initiative. These individuals thrive when taking initiative and learning in a self organized way in project related work. In contrast, individuals with a Control orientation prefer an environment governed by controls like deadlines and rewards and do well at strictly organized tasks. Individuals with an Autonomy (Control) orientation experience personal costs when working in a (non) controlling firm, as the discrepancy leads to stress and reduced well-being. The novel contribution of my model is including this discrepancy and incorporating it in the form of mismatch costs to the agent.

A firm cannot have the best of both worlds, attracting workers who excel simultaneously at self-organized project work and dutifully complete structured everyday tasks. The principal must balance a trade-off: Choosing a more lenient organizational structure that leads to task inefficiencies but attracts workers with an Autonomy orientation who are better at project work, or choosing a more strict organizational structure that leads to increased training costs at project work but attracts workers with a Control orientation who are better at everyday tasks. The balance crucially depends on how much a mismatch hurts workers, on firm productivity and project training costs. When a mismatch results in high personal costs, the principal grants more (less) Autonomy if the project work (everyday task) is more important for her profits. At high training costs, she grants more Autonomy to specifically attract agents with a

stronger Autonomy orientation. Higher base firm productivity gives her the means to cater to agents with a higher discrepancy to her organizational structure.
The compelling picture emerging from my results gains importance as real world working environments involve more demanding workers and increasingly complex job designs. Companies adopt a particular degree of Autonomy granted as part of their recruitment strategy in order to be attractive to specific segments of the workforce.

The projects in this dissertation address different aspects of the current debate in economics on the value of work in a person's life, reflecting society's discussion on 'work-life balance'. In the big picture, the debate relates back to times when a person's occupation determined their identity, status, and ties to society, before simultaneously with the development of the economic discipline, a notion of work as mainly a production input took hold. In the past decades, jobs have changed yet again, and so have the feelings associated with work (Kaplan and Schulhofer-Wohl, 2018). People regard their jobs not merely as a means to earn money, but look for meaning and creating identity, aspects recognized in economics (e.g. Cassar (2018); Besley and Ghatak (2005)). The underlying theme in these considerations is that people strive to feel volition in their behaviours and actions: they want to feel that they want what they do. It is plausible to assume that this need gains importance as technology will inevitably change jobs further, and individuals fear a "perceived decline in job quality in terms of its effects on monotony vs creativity of work, individual sense of identity, power to act independently, and meaning of life" (Shiller, 2019). Taking the role of Autonomy into account by capturing it within principal-agent models gives Behavioural Economics a powerful tool to address these questions.
This dissertation extracts the essence of a vast body of research on Autonomy, captures it in a clear and tractable way within theoretical models and applies it to questions in Organizational Economics. I provide meaningful insights with respect to the motivational capacity of economic incentives, innovation inspiring leadership behaviour, and talent attracting organizational structure. The workplace affects a person's feeling of Autonomy and consequentially well-being. Understanding that devising an incentive scheme with components that have a differential impact on Autonomy can undermine its overall motivational scope helps resolve the contradictory evidence on combined incentives. The intensity in which a leader displays

actions and behaviours that support a worker's feeling of Autonomy stimulates innovative activity. The degree of Autonomy granted in an organizational structure impacts whether and which parts of the workforce are willing to accept an employment offer.

These are initial steps in a bigger research agenda that examines the role of Autonomy in a variety of settings and incorporates it into economic models. Promising next steps are, for instance, Autonomy's impact on long term motivation and retention, and its function in mitigating stress that is caused by contradictory demands from different job aspects, e.g. for middle managers (Prins et al., 2015), or life dimensions, e.g. for working parents. By incorporating Autonomy as initiated in this research agenda economics contributes with its specific tools and perspective to an emerging need for policy recommendations and design of practices.

Chapter 1

An alternative categorization of intrinsic and extrinsic motivation: Uncovering the interactions between incentives*

1.1 Motivation

It is a truth universally acknowledged that people react to incentives. Incentives are a cornerstone in economic theory models and have proven to be effective empirically. For a long time, these incentives were understood to be only financial. But in the past decades, economics has incorporated non-financial incentives in models, such as fairness (Fehr and Schmidt, 1999), identity (Akerlof and Kranton, 2005) or mission (Besley and Ghatak, 2005).
The different incentives are usually distinguished as being either extrinsic or intrinsic. Thereby, extrinsic includes all incentives associated with money, such as efficiency wages, bonus tournaments or career opportunities. Other incentives, such as inequality concerns, status incentives or identity, are usually named intrinsic incentives. The key feature that seems to drive this classification is the answer to the question of whether money (potentially) changes hands at some point. This rather rough distinction however makes it hard to make statements

* This paper is based on joint work with Florian Englmaier (LMU).

about the interaction between extrinsic and intrinsic incentives, because not all intrinsic incentives work through the same channels and even extrinsic incentives may trigger more than the money-maximizing channel. Research on whether extrinsic and intrinsic incentives interact as substitutes (Carpenter and Gong, 2016), complements (Kruglanski et al., 1975), or crowd each other out (Gneezy and Rustichini, 2000; Dwenger et al., 2016) has thus so far not been clear-cut.

In this paper, we introduce the advanced classification of motivation from social psychology's *Organismic Integration Theory* (OIT) (Deci and Ryan, 1987, 2002) to the economic context. OIT spans a motivational continuum between autonomy and control, where individuals experience volition under autonomous incentives and pressure under controlling incentives. OIT organizes incentives with an increasing degree of autonomy into the categories External Regulation, Introjected Regulation, Identified Regulation, Integrated Regulation and Intrinsic Regulation. Further, incentives can be internalized or de-internalized to reflect a higher or lower degree of autonomy.

This article is intended as a review article offering new insights, and not as an exhaustive literature survey. We therefore draw on examples highlighting the importance of thoroughly understanding the motivational capacity of different incentives, as autonomy is associated with higher well being and performance (Gagné and Deci, 2005). We show that identity, although labelled an 'intrinsic' incentive in economics, can be controlling. Positive reciprocity and gift exchange, although hinging on a monetary component, can be perceived as rather autonomous. Purely monetary incentives, depending on their specific design, can be more controlling or autonomous, and can be partially internalized.

Using the vast body of research and conceptual lessons from a related discipline, we incorporate the essence of its results - that incentives differ in their motivational force and impact on an individual's well being - and adapt it to understand seemingly contradictory evidence of interaction effects of different incentives. We thereby contribute to the greater discussion on intrinsic and extrinsic motivation in economics. In the following sections, we provide a short recap on the most prominent extrinsic incentives in economics and introduce OIT in its greater theoretical framework of Self-Determination Theory (SDT) in order to outline the categorization system. We then scrutinize the literature of identity and mission, and positive reciprocity and gift exchange. Finally, we discuss pay for performance schemes and conclude.

1.2 Classic extrinsic incentives in economics

This section recaps the most pervasive incentive schemes studied in economics: pay for performance, tournaments, and career concerns.

Economics is based on the finding that individuals react to incentives. A classic incentive is pay for performance, a monetary incentive that rewards higher effort with a piece rate or a higher bonus when a target is achieved. Specifically, this incentive is derived both on the premise that individuals react to incentives – a premise that few people would criticize – but also, that effort and the monetary bonus are positively correlated: the higher the bonus, the higher the effort will be.

Indeed, piece rates have shown to be effective in settings where the effort exerted is measurable and can be clearly attributed to a single person. In a principal agent model, pay for performance helps overcome the moral hazard problem. The principal assumes that the agent shirks whenever possible, but can either not observe the agent's actual choice or cannot verify it in court. Therefore, the principal makes the wage contingent on observable output instead of effort. However, even high effort does not fully ensure high output, and the agent is typically assumed to be risk averse. For the principal, this leads to a situation where he must trade-off the incentive effect of his wage scheme with the insurance he must provide to his agent. Lazear (2000) shows that after a pay for performance scheme is introduced, both productivity and profits of a carglass company increase. He also finds that pay for performance works in two ways: first, through worker selection and second, as a monetary incentive.

Workers self-select into jobs with pay for performance schemes when they can thrive in a competitive environment. The ability to thrive in a competitive environment is conditional on workers' talent and capability. There is evidence that after a deregulation of the banking sector, more competition leads to higher managerial talent in CEO positions which results in a stronger positive pay-performance relationship (Hubbard and Palia, 1995). Higher wages also attract more capable individuals to apply for positions in political office (Ferraz and Finan, 2009). But it is not only actual ability that drives the selection effect. Dohmen and Falk (2011) show in a lab experiment that individuals who report higher self-assessment and a lower risk aversion tend to sort themselves into pay for performance schemes rather than flat wage schemes. Larkin and Leider (2012)'s experimental research shows that overconfident

individuals prefer convex over linear incentive schemes, and argue that for some tasks and work environments this self-selection may reduce the wage bill. It is thus the combination of talent and self-assessment that is relevant for the selection effect. While it is plausible to assume that talent informs an individual's self-assessment, and the two should thus be positively correlated, Larkin and Leider (2012) indicate that overconfidence is persistent, although rationally individuals who are overconfident but not talented are better off not trying to compete in a pay for performance environment but leaving the company once they realize that their talent is insufficient (Lazear, 2000).

For those in the scheme, conditional pay does provide an incentive to increase effort even outside manufacturing jobs. Lavy (2009) finds that incentivized teachers prepare their students better for matriculation exams. They achieve this by enhanced tracking of students, more after-school teaching and teaching in smaller groups, mirroring both more "quality" and more "quantity" of effort provided. This distinction is important, as it highlights the necessity to clearly condition the bonus on the outcome to be achieved. Counselling students for better test scores may require both a quantity and a quality dimension, but overall monetary incentives seem to perform best on quantity measures (Jenkins Jr et al., 1998).

Tournaments are an extrinsic incentive in a setting of multiple agents and one principal where an agent's contribution to overall output can be assessed, the principal can incentivize agents by compensating them on their relative performance among each other. Because these tournaments for boni are won through relatively best performance, agents have an incentive not only to increase their own output but to decrease the opponents' output (Lazear, 1989; Chen, 2003). When the principal cannot infer which agent contributed how much to the overall output, there is also a free-riding problem. The principal can decide to monitor them, which in addition to the costs may entail collusion with the supervisors.

Career concerns introduce a time dimension to the principal agent model and are in a sense a long-term tournament. The agent is aware that his performance will influence future promotions and therefore long-term wages. The prospect of climbing the organizational ladder can be a powerful incentive. If the company's structure naturally offers such a ladder, this incentive even comes at a low cost. If the company must structure an organizational setup as to include it in the incentive scheme, this might turn out to be costly. Risk aversion and discounting may reduce the availability of career incentives (Holmström, 1999). Furthermore,

problems arise when the agent aims to signal his ability that allows a promotion but reduces his present performance. This effect may prove especially detrimental when the agent has to choose which skills to learn, which potentially aggravates a moral hazard problem. Additionally, career incentives work implicitly. When they are non-contractible there is scope for the principal to renege his promise to promote the agent, when they are contracted, their motivational force may be mitigated. As Murphy and Jensen (2011) state, benefits that involve position or rank cannot be varied with performance. Once the worker has been promoted, it is difficult and costly to demote him if his performance falls short.

These classic financial incentives have been widely critiqued – not because they do not work, but because they may work rather too well. If not carefully designed for the specific setting, the incentives may actually lead workers to "play the game" and cause unintended consequences (Baker et al., 1988). For example, Ederer and Manso (2013) find that when the goal is to incentivize innovation, a payment scheme that tolerates failures in early stages and rewards long term success outperforms pay for performance and flat pay is most effective.

Therefore, while financial incentives can be highly effective, they cannot be the standard answer for non-standard employment situations. They may fit particularly well e.g. manufacturing jobs, where the effort can be measured and attributed to a single worker. In more "fuzzy" work environments, and one can claim that these have become and will become more important, they may become less effective, cause undesirable side effects, and should better be complemented or substituted with other incentives.

1.3 Using Organismic Integration Theory to categorize incentives in economics

In order to understand how people can be motivated by intrinsic and extrinsic incentives, and to research how these incentives interact, it is crucial to clarify how we use those terms. So far, the distinction in economics between intrinsic and extrinsic motivation is mostly made along the line of whether money changes hands, as wages are seen as a distinctively extrinsic incentive, while almost all other incentives are labelled as being intrinsic. However, studies reveal that these 'intrinsic' incentives must not necessarily share the same features, and are not

equally potent in instilling motivation. Also, intrinsic incentives differ in the way they interact with wage payments as extrinsic motivation. Therefore, it suggests itself to further scrutinize the incentives thus far labelled 'intrinsic' in economic research.

To do so, we employ the *Organismic Integration Theory* (OIT) from social psychology for categorization. OIT is a sub-theory of the greater *Self-Determination Theory* (SDT) framework, a "macrotheory of human motivation, emotion, and personality" (Vansteenkiste et al., 2010). SDT is well established and researches motivation from the social psychological point of view. We apply OIT because it offers an alternative categorization of incentives that goes beyond the distinction of extrinsic and intrinsic as used in economics and offers valuable insights for our discipline. The following paragraphs give a short introduction to the definitions and framework of SDT in general and OIT specifically.

The core theory of SDT that introduces the underlying concept of 'needs' is the Basic Needs Theory. It specifies three basic psychological needs that people aim to satiate to fully function and develop in all life dimensions: autonomy, competence, and relatedness. Roughly speaking, autonomy refers to the freedom in acting, competence to the capability of doing it well, and relatedness to doing so in a positive and responsive environment. Basic Needs Theory acknowledges that these three are not an exhaustive list of all needs a human being wants to satisfy, but limits itself to these three in order to describe as many phenomena as possible with as few needs as possible. When these basic needs are satisfied, a person functions well in her environment. When the basics needs are thwarted, a person seeks coping mechanisms such as finding needs substitutes. However, need substitutes are experienced as less rewarding on top of the costs incurred to maintain them (Vansteenkiste et al., 2010). An example for a need substitute in an economic setting is the following scenario: a highly educated worker is given a simple task where he cannot use his skills and experience his competence. He could easily manage the task, but this is not satisfying for him. A bored worker may or may not fulfill the task, but he would search for other contexts to satisfy his need for competence, such as taking on hobbies. He may even use his skills to retaliate for the need thwarting and redirect his efforts to hurt the firm.

SDT is very specific in its use of the term 'intrinsic': An "intrinsically motivated activity is performed for its own sake - that is, the behaviour is experienced as inherently satisfying"

(Vansteenkiste et al., 2010). Cognitive Evaluation Theory states that the needs for autonomy and competence must be satisfied such that intrinsic motivation for an activity can emerge. In contrast, 'extrinsic' motivation as used in SDT refers to any motivation that arises to attain a goal associated with the activity, not because of interest in the activity itself. The crucial distinction in SDT between extrinsic and intrinsic motivation is therefore that extrinsic motivation always hinges on a contingency. Please note carefully that this distinction between intrinsic and extrinsic motivation is different to the one usually employed in economics. Economics uses the categories of extrinsic and intrinsic motivation in a rather sloppy way: incentives that involve money tend to be labelled extrinsic, all others intrinsic.
For example, economics terms motivation that arises from status concerns as being intrinsic, but in the SDT framework, this is an extrinsic motivation because it relies on a contingency. From this angle, economics studies only extrinsic motivation. Let us now focus on what the SDT framework has to offer for economic analysis.

> The crucial distinction in Self-Determination Theory between extrinsic and intrinsic motivation is that extrinsic motivation always hinges on a contingency. In this view, economic incentives are always extrinsic.

OIT provides a structure to categorize extrinsic and intrinsic motivation in economic terms, as it focuses on what SDT calls extrinsic motivation: "extrinsic motivation is needed for activities that are not in themselves enjoyable, but are perceived to be necessary to achieve a separable outcome" (Vansteenkiste et al., 2010). Therefore it deals with all those kinds of motivation economics is concerned with. In a workplace, agents exert effort in order to achieve the separable outcome of e.g. earning a wage, achieving a reputation or status (also: an intrinsically motivated activity in SDT is not experienced as costly by the agent, and effort costs are a key component when economists think about worker motivation). The categorization is constructed on the basis of the degree to which an individual perceives the extrinsic motivation to be autonomous or controlling. Autonomy refers to a feeling of freedom and volition (Gagné and Deci, 2005). Note that in contrast to the colloquial use of the term, autonomy does not describe individualism or independence. Rather, "a person is autonomous when his or her behaviour is experienced as willingly enacted and when he or she fully endorses the actions in which he or she is engaged and/or the values expressed by them. People are therefore most

autonomous when they act in accord with their authentic interests or integrated values and desires" (Chirkov et al., 2003).

The four categories of motivation are, starting with the most controlled and ending with the most autonomous: External Regulation, Introjected Regulation, Identified Regulation, and Integrated Regulation.

1. *External Regulation:* "people are motivated to obtain a reward or to avoid punishment" (Vansteenkiste et al., 2010), as soon as external force cedes, people will not maintain their motivation, and the motivation does not spill over to other tasks. Example: a worker puts in just enough effort to avoid being fired.

2. *Introjected Regulation:* "people are motivated to comply with a partially internalized contingency to gain pride and self-esteem, or to avoid feelings of guilt and shame" (Vansteenkiste et al., 2010). The difference to External Regulation is that the pressure does not come from external forces, but that people put the pressure on themselves. Again, motivation is hard to keep up. Controlling oneself is also very energy-sapping. Example: a worker puts in just enough effort to not be identified as the slowest worker.

3. *Identified Regulation:* "people understand and endorse the personal value and significance of a behaviour and, as a result, experience a sense of freedom in doing it", "identified regulation is guided by personal values and self-endorsed commitments" (Vansteenkiste et al., 2010). Example: a worker manages a boring, tiresome task because he understands its importance for the firm and/or coworkers, and he cares about the firm and/or coworkers, because he wants to keep a promise, or lives by the golden rule 'do unto others as you would have others do unto you'.

4. *Integrated Regulation:* "involves a synthesis of various identifications to form a coherent and unified sense of self, a process that likely requires considerable effort, reflection, and self-awareness" (Vansteenkiste et al., 2010). Example: a person wants to be helpful to everyone. Then he will not only help his family and friends, but widens that circle to colleagues and people he may not like or who treated him badly. In order to live up to that sense of self to be helpful, he must repeatedly own up to the unavoidable many situations where he does not succeed and work on himself to improve.

Table 1.3.1 provides an overview for the four extrinsic categories of motivation that can be more controlled or more autonomous, as well as intrinsic motivation in the sense of SDT. Further, people have a natural tendency to incorporate what they are exposed to into a self-regulation (Gagné and Deci, 2005). This process is termed internalization and describes the development to shift the perceived locus of causality from external to internal, thus to gain a feeling of autonomy instead of being controlled. This tendency to internalize the circumstances in their self-regulation allows people to experience greater need satisfaction, and thus, higher well-being.

Consider a person in a regular office environment. If the person only works to maintain a living and feels pressure to reach this aim, the locus of causality is external. The worker experiences this as being controlled and behaviour is externally regulated. But the worker can internalize this pressure by finding a way to make sense of it. Instead of processing the pressure to be external, the person tells herself an internal narrative about how ashamed she would be if she couldn't maintain herself, and experience an ego-boost if she manages it. The pressure is internalized, but the locus of causality is still external: behaviour is regulated by introjection of the pressure. Both External Regulation and Introjected Regulation are therefore controlled motivation. The worker can however find other ways to make sense of her situation. If she

Table 1.3.1: Motivational continuum in SDT, adapted from Vansteenkiste et al. (2010)

	External regulation	**Introjected regulation**	**Identified regulation**	**Integrated regulation**	**Intrinsic regulation**
Motivational intensity	High	High	High	High	High
Motivational force	Expectations, rewards, and punishment	Guilt, shame, and self-worth contingencies	Personal valuation and relevance	Harmonious and coherent commitment	Enjoyment, pleasure, and interest
Internalization	No	Partial	Almost full	Full	Not required
Underlying feelings	Stress and pressure	Stress and pressure	Valuation and freedom	Valuation and freedom	Valuation and freedom
Locus of causality	External	External	Internal	Internal	Internal
Type of motivation	Extrinsic	Extrinsic	Extrinsic	Extrinsic	Intrinsic
	Controlled		Autonomous		
	Extrinsic				Intrinsic

finds value in the work that she does, for example because it contributes to something that she believes to be worthwhile, the locus of causality is internal. At least to some degree, she wants to do what she's doing and thus experiences greater satisfaction of the need of autonomy. Her work resonates with her as a person and thus, the regulation of her work behaviour is identified. If the person understands her work to be part of her life and her part in the world, giving her an opportunity to express her being in it, including all advantages and drawbacks, then her behaviour at work is integrated in her as a person. Both Identified and Integrated Regulation are thus autonomous regulation. The distinction of the two can be imagined between a job that she likes and a vocation. Nota bene: even the most internalized extrinsic motivation is not intrinsic motivation in the SDT framework, as even in a vocation the activity is dependent on a separable outcome.

While internalization describes the tendency to process motivation in a way to feel more autonomous, changes in the activity, the motivational force, or the environment can also lead to a change in the opposite direction. Consider the example of blood donations. There is a host of possible motivations for donating blood: adhering to society's norms (Introjected Regulation), acknowledging the importance of blood donations (Identified Regulation), or expressing one's self as giving in this respect (Integrated Regulation). However, when blood donors are offered monetary compensation, it changes how a donor can make sense of his motivation. In the most extreme case, they may feel that they do it 'only for the money' (External Regulation). But even to a lesser degree, compensation shifts the locus of causality outwards, leaving the blood donor with a more controlled feeling than before, and thwarting their need satisfaction. Indeed, economic studies have found evidence that blood donors donate substantially less when offered compensation (Gneezy and Rustichini, 2000). They do, however, donate again more when the compensation is high enough, indicating that high financial incentives leave less room to internalize blood donations and are clearly externally regulated. This point is emphasized in Benabou and Tirole (2003) who argue that strong financial incentives signal to the agent what the principal thinks of him, here, that he would not donate blood willingly and must be externally motivated to do so.

The basic need for autonomy is therefore important for internalization of motivation and life satisfaction, and is naturally enforced by feeling competent. Whereas in the above examples these needs can stand separately in a work environment, Relationship Motivation Theory

states that they must also be satisfied to build and maintain healthy relationships. The satisfaction of the need relatedness is not enough for individuals to thrive in an environment, including a work environment.

Ryan et al. (2010) research the weekend effect for adult workers. They find that the difference in psychological and physical well-being between weekdays and the weekend is fully explained by differences in relatedness and autonomy, and that the difference is smaller for people in workplaces that provide more relatedness. Deci and Ryan (2014) stress that "Human nature thus declares interpersonal relatedness to have primacy, and families, institutions, and cultures must provide the pathways for this need to be satisfied if their constituents are to be well".

Let us briefly summarize the key concepts. *Self-Determination Theory* uses definitions for intrinsic and extrinsic motivation that are distinct from the ones employed in economics. Activities that are intrinsically motivated are perceived as interesting and enjoyable in themselves, whereas activities that are undertaken to achieve a separable outcome must be extrinsically motivated. For the purpose of this chapter, the latter are of interest for economists, who study how people can be motivated to perform tasks that people do not undertake without incentives. Economists can view these incentives to be extrinsic, with which they usually mean monetary, or as what they call intrinsic, with which they mean incentives that do not involve money or other material benefits. *Organismic Integration Theory* allows an alternative categorization of extrinsic motivations according to the degree of autonomy that they provide: External Regulation, Introjected Regulation, Identified Regulation, and Integrated Regulation. While autonomy and control are used for contrast, Basic Needs Theory states that autonomy is only one of the three basic needs autonomy, competence, and relatedness, and that the three are correlated. Autonomy and competence are necessary for intrinsic motivation as used in SDT to evolve, and these two needs are also crucial for the internalization of extrinsic needs (Vansteenkiste et al., 2010). Satisfaction of the need for relatedness, such as a supportive group, can also facilitate internalization. Shifts can also happen in the opposite direction, when autonomy and/or the correlated needs for competence and relatedness are thwarted. Bearing this in mind, we now turn to incentives as used in the economic context. We examine the literature on identity, an incentives that is usually considered 'intrinsic', posi-

tive reciprocity and the gift exchange phenomenon, which comprises 'intrinsic' and 'extrinsic' components, and re-examine monetary incentives. We derive conclusions of how the incentive can be categorized in the OIT framework and scrutinize whether theoretical assumptions or experimental setups may have caused a shift between the categories, highlighting that 'intrinsic' and 'extrinsic' does not simply transfer to autonomous and controlling. Further, our considerations inform us how different incentives interact.

1.4 Identity Economics in the Organismic Integration Theory framework

At first sight, identity lends itself to be classified as a motivation under Identified Regulation. In this section, we introduce the concept of social identity, the most influential economic model that incorporated identity, and empirical findings from economic studies and scrutinize how identity as used there fits into the OIT framework. We show that although identity is typically regarded as an intrinsic incentive in economics, its mechanism is more subtle both in theory and in empirics. We also include a distinction to mission incentives, which is often used interchangeably with identity in the economic discourse.

1.4.1 Identity Economics: Theory

In a first approach to incorporate identity, the seminal paper by Akerlof and Kranton (2000) builds on the social psychology literature, specifically Social Identity Theory. Social Identity Theory, introduced by Turner (1978), is a standing concept in social psychology. It researches the collective aspect of social identity, in other words the consequences when an individual identifies with a social group, to understand intergroup relations. A social identity in Social Identity Theory is not an arbitrary group of people. Social identity is "part of an individual's self-concept which derives from his knowledge of his membership of a social group (or groups) together with the emotional significance attached to that group" (Tajfel and Turner, 1979).

Two building blocks of Social Identity Theory are categorization and identification. They enable an individual to make sense of his surroundings and grant him distinction from social groups he does not identify with, and inclusion within the social groups he does identify with.

Categorization and identification yield him the benefit of knowing who he is, namely, member of a group emotionally significant to him. As Social Identity Theory is concerned with social groups in the dimensions such as race, gender, or social status, and changing these social groups is hard if not impossible, this benefit is non-contingent on a behaviour.[2] Nonetheless, individuals within a social group may cooperate and adhere to certain behavioural norms that enforce the distinctiveness of their social group. Another component of Social Identity Theory is social comparison. The intergroup relations scrutinized in Social Identity Theory are within a rather rigid social valuation system.[3] This social valuation system consequently also ranks social groups according to the behavioural norms across these social groups.[4] Akerlof and Kranton (2000) explain differences in economic outcomes on the basis of Social Identity Theory that cannot be explained by economic reasoning alone, giving examples of women in a male dominated workplace or impoverished individuals and their choice to participate in the workforce. These examples square well with the findings from Social Identity Theory, as these are groups are clearly categorized in a social valuation system.

> Social Identity Theory researches intergroup relations, where a social identity is part of an individual's self-concept because the individual attributes emotional significance to the group identity. Its building blocks are categorization, identification, and social comparison.

In Akerlof and Kranton (2005) the authors transfer the reasoning to the workplace and formalize an economic model on identity. Their utility function includes a lump sum utility of group membership and an element that decreases utility stronger the more the individual deviates from the group behavioural norm. The social group in this setup is the workplace; the behavioural norm is a high effort level. They distinguish between insiders and outsiders in the workplace, and they assume outsiders have the behavioural norm of a low effort level. This utility function, in short, describes how an individual aims to abide by the group behavioural norm in order to reap the maximal benefit of group membership in a trade-off with the costs of the behavioural norm. In this model, insider workers require a lower wage differential be-

[2] There is little one can do about being born white. One way for a white person to process this group membership is to regard other white people positively irrespective of their behaviour, so as to see herself positively.
[3] When a group within a society has long had a specific role and a social rank, then changes of social ranks require long term changes in the entire society, e.g. in the Indian caste system.
[4] When a social group is ranked low, their norm behaviour is ranked low as well.

cause the lump sum utility compensates them partly for the higher effort costs, and low effort is more costly because of punishment for deviation. In contrast, outsider workers must be compensated with a higher wage differential for high effort because they deviate from their group specific behavioural norm, eating away their lump sum utility.

At this point, some general remarks are in order. In contrast to Social Identity Theory, Akerlof and Kranton (2005) focus on intragroup behaviour, not intergroup dynamics. There is also no social comparison in their model - they do not make any assumptions with respect to the relative evaluation of insiders and outsiders, and thus about the levels of lump sum identity utility in the respective social groups. Furthermore, they treat the behavioural norm and social identity as interchangeable. In their application to economics, they regard the company as the social group unit. As outlined above, Social Identity Theory researches intergroup behaviour in long-standing valuation frameworks, where changing groups is close to impossible. Changing one's workplace is easier than changing one's gender, resulting in less pressure on the individual to view his employing company as his social group.[5] This stresses the importance of the norm in their model. It is the norm behaviour that individuals coordinate on to form a social group that gives them identity utility. The difference between identifying with a social group and with a norm will be further scrutinized below. Furthermore, the norm in their model is exogenously determined, while in Social Identity Theory norms evolve endogenously to ensure distinction and inclusion. Finally, the distinctive difference in the norm is not the kind of behaviour, but the level of effort. This implies that the effort level must be observable, or it could not serve social group cohesion.

Together, this informs us that the results from Social Identity Theory can only be transferred to a workplace setting when the theoretical background is the same and must be adjusted where necessary. Specifically, it must be clarified whether insiders and outsiders of a company are indeed identified on the basis of their effort provision, how large the lump sum utility from belonging to either social group is, and how the norms within each group evolve.

We now approach the question of how identity, which is usually regarded as an intrinsic incentive, fits into the alternative categorization of the Organismic Integration Theory framework.

[5] Social psychology has also established that different social identities become salient in different contexts, and that people tend to order their identities hierarchically with a view to their importance (Callero, 1985). The social identity "being female" is likely salient in more contexts than "being employed at x".

Social Identity Theory researches intergroup conflict between individuals who identify with an emotionally relevant social group. Their social group membership induces diverging behaviour that fosters inclusion within their group and distinction from another group. But it does not predict which behaviour evolves for which group, and it only explains why people view group behaviour of their own group favorably and that of the other negatively. It does, however, not clarify whether group members adopt the group behaviour because they fear expulsion or punishment, or whether they whole-heartedly adopt it with a sense of freedom. OIT classifies behaviour dependent on the degree of autonomy it provides to the individual. Identification with a social group and identification with a specific behaviour may come together, but they are not necessarily the same: If a person identifies with the behaviour of working thoroughly, and others around him work the same way, he may regard them as being like-minded individuals and view them positively. But this does not inescapably mean that he sees them as his social group. If a person identifies with her work group with low work morale, she regards them positively and may downplay their behaviour. But that does not inescapably mean that she associates herself with mistake-ridden work behaviour. For the classification of Akerlof and Kranton's identity model, we must account for the identification with the norm behaviour and the identification with the social group separately.

> The most prominent model of identity in economics in Akerlof and Kranton (2005) hinges on an individual's utility from group membership and disutility when deviating from the group's exogenously given norms. Identity here is an incentive under External or Introjected Regulation. The concept does focus on intergroup relations.

As argued above, in the workplace setting described in Akerlof and Kranton (2005) cohesion of a social group is achieved through an exogenous norm. The cost of a norm deviation results in group cohesion, and is in fact a punishment device. From an OIT point of view, an exogenously imposed norm leaves no autonomy and corresponds to behaviour under External Regulation. Further, the deviation cost can be interpreted as guilt when not adhering to the norm, and guilt avoidance when adhering. Therefore, the norm can be understood as Introjected Regulation if the deviation parameter is individual-specific. In itself, a norm, especially if imposed with sanctions, cannot be associated with Identified Regulation.

OIT recognizes that behaviour can be internalized, meaning being perceived as more autonomous. "[I]nternalization is facilitated by explicit or implicit endorsement of behaviours of significant others" (Gagné and Deci, 2005), in short, when the individual's need for relatedness is satisfied, even if the behaviour itself is not autonomous. Social Identity Theory defines a social identity as "part of an individual's self-concept which derives from his knowledge of his membership of a social group (or groups) together with the emotional significance attached to that group" (Tajfel and Turner, 1979). This emotional significance of one's social group translates into satisfaction of one's need for relatedness. The original definition of social identity therefore allows for an internalization process. The lump sum identity utility in Akerlof and Kranton (2005) reflects the well-being that an individual receives from his social group membership. In their model, it counterbalances the increased effort costs from aiming to adhere to the norm effort level. But it does not change the perception of the behaviour itself. For internalization in the sense of OIT, a strong feeling of relatedness decreases the cost of low-autonomy behaviour *and* gives the individual well-being. In Akerlof and Kranton (2005), this social identity related well-being is eaten up. Therefore, this model of social identity is in line with External or Introjected Regulation.
We conclude that identity, although regarded as an intrinsic incentive in economics, is controlling in the OIT framework, and therefore externally regulated.

1.4.2 Identity Economics: Empirics

We now turn to empirical evidence on social groups in a workplace setting to scrutinize our result from the theoretical perspective. In Akerlof and Kranton (2005) workers are paid a flat wage. This is not the case in the following studies that are based on social groups, and we thus cannot look at identity as an incentive in isolation. It does, however, display that the presence of social groups has a very nuanced impact on the effectiveness of monetary incentives. It also shows that individuals within a social group need not coordinate on a common behaviour when it is in the group's best interest.
We focus on a sequence of studies by Bandiera, Barankay and Rasul conducted at a company that employs seasonal workers for picking fruit. Worker productivity is measurable per worker and as the workers not only live but work in close proximity, personal ties evolve.

Bandiera et al. (2005) observe that workers on the fruit picking farm internalize social preferences only when they can monitor each other. Social preferences - taking into account the negative externality one imposes on co-workers – can be measured as the company switches from an individual-level relative incentive, where the comparison group are all workers on the same field on the same day, to individual-level piece rates. The effect is stronger the more mutual friends are in a picking unit. The design suggests that within the social group of workers, mutual friend circles form social sub-groups that coordinate on common performance behaviour. Their finding that having more friends in one's work unit reduces productivity under relative incentives implies that workers have coordinated on a low-level common performance behaviour. Putting oneself in the worker's position, one can imagine that this workplace does little to satisfy the need for autonomy or competence, making satisfaction of relatedness within the friend circle more important and advancing therefore internalization of the common behaviour. Bandiera et al. (2005) find that after a switch from relative incentives to individual-level piece rates performance increases and that in the new setting the share of friends within the work unit has no additional impact.

This allows concluding that the presence of a social group, the friend circle, renders the individual-level relative incentive ineffective when it is designed such that individuals must turn against members of their social group. In Bandiera et al. (2005), workers decided not to turn against their friends but against the firm: They "played the game" by coordinating on a common effort level which here led to an overall decrease of productivity. Whether this was achieved by peer pressure or silent agreement among friends, in other words, whether the norm behaviour was agreed upon more or less autonomously cannot be clearly answered. However, as the need for relatedness remained satisfied, the decision was probably executed autonomously, even if at a personal cost. In the same experimental setting, Bandiera et al. (2010) find that workers who are more able than their friends decrease effort and forego payment to conform to the norm, and workers who are less able exert more effort. In that study, the ability distribution of workers is such that the average productivity increases. Overall, the relative incentives are ineffective but the social group's coordinated behaviour is internalized by the satisfied need of relatedness and thus Identified Regulated. The individual-level piece rates on the other hand do not put the workers in conflict with their social group. Workers enjoy the benefits of both working within a friend circle and for their own material gain. Further, the social

group might facilitate internalization of the externally imposed incentive, rendering it an Introjected or even Identified Regulation on the individual level.

> When social groups endogenously coordinate on norms and are emotionally significant to the individual, internalization is facilitated. Additional individual-level monetary incentives are only effective if they do not interfere with either the norm or the emotional significance of the group. Then, the social group may spur internalization (being complementary); otherwise one erodes the effectiveness of the other (crowding out).

One interesting question that arises is which measures a company can take such that social groups coordinate on a high effort behaviour. In this experiment nothing conduced workers to coordinate on high performance for the social group's sake. The company furthermore was obviously unsuccessful in inspiring a common social group within all workers, as only friendship ties matter. Another interesting approach would be to use individual-level relative incentives only in comparison to non-team members, here for example of a team on the previous day.

Bandiera et al. (2013) use the same setting to scrutinize team incentives. They complement piece rates on team-level production first with a rank incentive and then with a tournament on the team level. In addition to effort provision, individuals can also choose the team composition after the first week of random team assignment. After the intervention, they find the teams to be more similar in their ability, which suggests that the status incentives of introducing a rank system helps teams to form groups and coordinate on the dimension of ability rather than their friend circle. For the rank incentive alone they find a decrease in average productivity that is driven by the lowest performing groups, whereas with the additional bonus they find an increase in average productivity that is driven by the highest performing groups.

> Team-level incentives introduce social comparison based on ability and can change the norm on which social groups coordinate. While the emerging norms may or may nor be favorable, internalization of newly formed groups is likely weak.

The piece rates on team-level production do not interfere with membership of the social group. Each member contributes to the benefit of all, and this might cause free-riding as

well as peer pressure among the team of friends. The feeling of relatedness within the friend circle can sustain both situations: being more lenient towards under-performing friends than one would be towards unrelated co-workers, but also being motivated to exert higher effort not only for oneself but the group as a whole. Piece rates on the team-level leave ample room for feeling autonomous. At worst, the peer pressure to abide by a team norm would render it Introjected Regulation. In the presence of friends, however, internalization is likely to occur and lead to motivation under Identified or Integrated Regulation.

Introducing information about the relative ranks of different teams adds the dimension of social comparison, and this impacts the other two building blocks from Social Identity Theory, namely categorization and identification. Beforehand, teams were of equal value, and the worker chose the one most appealing to him, specifically, the team with friends that would satisfy his need for relatedness. Social comparison becomes an issue once the company clearly expresses what determines one's rank, and what determines categorization. In light of Social Identity Theory, workers have a clear incentive with the ranking system to re-coordinate teams based on ability. The workers in low ranking groups are disincentivized by being categorized and identified as less able workers and being placed on the bottom of the social comparison. They also loose their friends' support, reducing their feeling of relatedness. The social comparison also inadvertently introduces a norm behaviour for each group. Where individuals formerly had an incentive to exert effort also on the group's behalf, for low performing this behaviour would now deviate from the norm behaviour attributed to their group. High performing individuals cannot support their friends under the scheme, but essentially compete against their team mates as they fear being sorted out if they underperform. In either case, motivation is Introjected Regulated, and internalization is inhibited.

The tournament incentive, adding a financial incentive to the ranking system, intensifies the situation. The social comparison is augmented by the monetary reward. Low ability workers have even less incentive to try harder, as this would only move them to a higher category that still receives no reward. The norm in the high ability teams however is reinforced through the financial acknowledgment, their superior social ranking cemented. In the Akerlof and Kranton (2005) model, their lump sum utility has increased. With OIT in mind, high performing workers may face a stronger norm, but they can view their co-workers more positively because the social comparison allows them to do so. This feeds into relatedness to them and a degree

of internalization only for high ranking individuals of the Introjected Regulation.

The ranking scheme design and the overall ability distribution was such that average productivity decreased. However, one can think of other situations where ranking groups would be less detrimental. For example, the company can introduce a ranking system that only gives information in which quartile a team is ranked. This would mitigate the strength of the social comparison, and allow friends to group within a quartile, which would at least support relatedness within team composition. This would combine less controlling norms and the advantage of emotional attachment to one's team, rendering it an overall autonomous motivation and, in essence, capturing Akerlof and Kranton (2005) model for the workplace.

Additionally, it is interesting that those teams that do not regroup are unaffected by the rank incentive and increase productivity only in light of the tournament. As described above, teams made up of friends coordinate on a common behaviour where high performing individuals may decrease their effort and low performing individuals may increase their effort to reach the team's norm. With the rank incentive, this behavioural norm remains unaffected because they focus on their team that satisfied their need of relatedness, which is supposedly less satisfied in the teams that formed on ability. With the tournament however all group members have an incentive to work harder for the group's sake. The paper cannot clarify whether teams of friends became more productive because the behavioural norm for all members was shifted upwards or whether in light of a monetary incentive it was beneficial for all to have high ability members deviate from the norm. However, it did take the bonus to change the coordinated behaviour of teams of friends.

We can thus conclude that a company's choice of the incentive scheme can, but need not, provide the dimension on which social groups form. Here, the introduction of a rank incentive essentially serves as a measure for social comparison which is intensified when coupled with a monetary reward. This social comparison leads to a re-categorization of workers, and it also changes the strength of identification with the group which diminishes a feeling of relatedness for all workers. The incentive design affects groups differently depending on their ranking in this social comparison. Keeping in mind that workers in a team coordinate on a common behaviour, this specific incentive scheme only ever incentivized some teams to coordinate on high effort. One can think of different ability distributions leading to different results under the same scheme, but the fact remains that it is designed to pit social groups

against each other, not to incentivize each social group to perform at its best and maintain a positive feeling within each group.

1.4.3 A closer look at identity and mission

Both identity (Akerlof and Kranton, 2005) and mission (Besley and Ghatak, 2005) are classified as intrinsic incentives in the economic parlance. As in both cases workers group on what they have in common (identity or mission, respectively), they are even often used interchangeably in the economic discourse. Using the categorization from OIT we clearly juxtapose the two.
In Akerlof and Kranton (2005) a social group forms and maintains itself around a behavioural norm. In their workplace example, there is a group of company insiders with a high effort norm, and a group of company outsiders with a low effort norm. A norm itself is a controlling motivation, and the degree of non-autonomy is aggravated by punishment costs when deviating from the norm in their model. The social group in which the norm is embedded however allows for internalization. When the social group offers a high degree of relatedness, the individual experiences some degree of autonomy to abide by the strict norm. If the company outsider group is more supportive than the insider group, outsiders perceive their low effort as more autonomous than insiders perceive the high effort. In short, a social group with a controlling norm but strong group cohesion helps the individual to perceive the norm as rather autonomous.
Mission is used in Besley and Ghatak (2006) as an incentive, where mission alignment between agents and the principal leads to better performance. A mission in itself leaves ample room for autonomy. Although the mission is clear, is does not prescribe which behaviour to exhibit in order to achieve that goal. Furthermore, the common mission leads to cohesion within the company, allowing for a group feeling to emerge. Any behaviour that leads to progress towards the common goal is endorsed. This constitutes autonomy support and enables strong internalization. Therefore, a mission incentive is more autonomous than a social identity incentive based on a norm, which leads to better performance and well-being of the employees (Gagné and Deci, 2005).
Consider the case where the social identity based on a norm is coupled with a piece rate, such that the norm is to manufacture a certain quantity. Those workers who achieve the quan-

In contrast to Akerlof and Kranton (2005)'s identity model, Besley and Ghatak (2006)'s model of mission specifies only the goal, not behaviour or deviation punishment. Mission is thus an autonomous incentive under Identified or Integrated Regulation.

tity easily and could work more than the norm now face the trade-off between making more money and losing a feeling of group union. Those workers who have difficulty now have double an incentive to try to reach the norm. But this does not mean that the norm should be set extremely high: if the fraction of workers for whom the norm quantity is basically unachievable is too big, the norm cannot be upheld to maintain the social group because a feeling of union cannot emerge, leaving all workers with a very controlling incentive that leads to poorer performance and lower well-being of the workers.

1.5 Positive Reciprocity and Gift Exchange in the OIT framework

Reciprocity describes a mutual exchange: a kind action is positively reciprocated with a kind action, an unkind action is negatively reciprocated with an unkind action. For this chapter, we focus on positive reciprocity, where a gift (the kind action) is answered with a gift. The term gift exchange was first coined in Akerlof (1982) to describe the phenomenon that wages and effort levels in many work relationships are higher than economic models would predict. It is important to note that the underlying assumption of the term gift exchange as used in economics applies to long term employment relationships. The pattern of gift exchange is also observed in the lab evidence, there usually with a view to positive reciprocity. Often in economic parlance, gift exchange and positive reciprocity are used synonymously. We investigate the pattern of the gift exchange phenomenon, and show that it is associated with positive reciprocity in the short term, but hinges on additional specifics in the long term. This distinction is crucial to understand the motivational force of generous wages in our categorization. Thus, we attribute positive reciprocity to the gift exchange pattern in the short term, and only call the long term situation gift exchange, as intended by Akerlof (1982).

The distinction between short-term positive reciprocity and the long-term gift exchange phenomenon is crucial for understanding the motivational force of generous wages.

1.5.1 Positive Reciprocity: starting off the work and incentive relationship

Under short term relationships we understand one shot employment contracts with no or very few repetitions, as well as lab and field evidence over a short period of time. For positive reciprocity to occur, the first action to take place must actually be kind or at least perceived to be kind. In most settings, the first to act is the employer, and the dimension in which he can display kindness is to set a generous wage. The initial generous wage is indeed a gift, because a gift is defined as "something bestowed or acquired without any particular effort by the recipient or without its being earned" (dictionary.com). In order to constitute a gift, a truly kind action, not only must the wage be generous but it must be unconditional. If the work contract specifies an expected high effort level along with the generous wage, the supposed gift is perceived as compensation and thus becomes a bonus instead.

A gift is something effortlessly and unconditionally acquired, not earned: it is a truly kind action.

The response to the employer's kind action depends on the type of worker. He can be either selfish or reciprocal. Lab evidence suggests that a sizable fraction of subjects behaves reciprocally even if it is costly to them (Falk et al., 1999). This means that the generous wage operates as an incentive only for the reciprocal worker. For him, a true gift certainly does not entail external pressure; therefore it is an autonomous motivation. As it further gives room for the worker to express who he is (i.e., a reciprocal person), the worker's positive reciprocity is an Integrated Regulation. Note that it cannot be an Intrinsic Regulation because the worker's reaction is still conditional on the employer's action. In contrast, the generous wage comes to nothing for the selfish worker: he takes the wage but is not induced to provide higher effort, its motivational value is void. And even if he was to mimic a reciprocal worker to receive the higher wage in future periods, he perceives the gift and his mimicry as External Regulation: without the increased stakes on the table, he wouldn't 'sell out' to behave reciprocally.

We are aware that this strong reliance on the term of a 'true gift' is an idealization: gifts are given in a social context. They express gratitude, attention and appreciation. Tradition, hierarchies and expectations of the future relationship dictate gift giving. Gifts can even be used to gain power over the recipient. The discussion of the ideal gift however serves as a sound backdrop when we now turn to the specific qualities of the work environment for gift giving.

As Levitt and List (2007) review, in the laboratory gift exchange game "the first mover requests a desired effort, or quality, level in return for the 'wage' or 'price' offer." The same is true in a short term work contract or lab and field experiments: the worker is aware that the generous payment comes with strings attached. Therefore, the 'gift' is not a true gift as outlined above; it is indeed rather a token. Nonetheless, the employer's generosity can still be perceived as a kind action that can be reciprocated instead of merely an exchange of high effort in return for money if he goes to a length to make it kind.

First, he can make it a point not to explicitly remind the worker of the exchange they partake in, as this would essentially make the gift a bonus that is paid in advance. Gneezy and List (2006) show that a surprise increase of an hourly wage leads only to a short-term effort increase for both a data entry and a donation collection task. Gilchrist et al. (2016) present a data entry field experiment, where the unconditional and unexpected hourly wage increase leads to an increase in effort. In contrast, Esteves-Sorenson (2017) addresses potential confounds in the gift exchange literature and indeed finds that a higher piece rate increases effort, but an unexpected gift envelope with money even slightly decreases effort. This contrast however can be reconciled in our framework. In the first two studies, the additional pay fell like manna from heaven and was either explained by unexpected additional funds or not explained at all. Esteves-Sorenson (2017) however presents the gift envelope with these words: "We have a thank you gift, in the amount of $ 8 per hour in addition to the $ 12 per hour pay. We will give this gift for the hours you work today and we will also give you the same gift on each of the next two shifts." This wording specifies the gift being clearly conditional on the hours worked for the time of work – reminding the workers of an exchange between work and the supposed gift which turns it into a bonus. DellaVigna et al. (2016) argue in a large scale, comprehensive experiment that a monetary gift has only a small impact on performance. They grant however that the gift treatment was introduced in the last rounds after multiple other treatments. In

light of our framework, it is unlikely that the workers perceived this gift as coming with no strings attached but expect that it is supposed to influence them in some way. Stanca et al. (2009) present evidence that reciprocity is stronger when a strategic motivation of the principal can be ruled out: when there are definitely no strings attached. The experimental work of Orhun (2018) highlights that the more likely a strategic motive is behind a kind action, the less is it reciprocated. In a similar vein, Fehr et al. (1993) present a one-sided auction, where buyers' generous offers are reciprocated with high quality offered by the sellers. The setup did not leave room for the buyers to request high quality, therefore offers were given in the hope of high quality but not conditional on it. This point is strengthened by the theoretical literature. Fehr and Falk (1999) explain that contracts in positive reciprocity experiments are often incomplete, because the specification of the expected gift in return would inhibit reciprocity, in other words, it would render the supposed gift to become a bonus. The same line of argument explains why intention-based models fare better than outcome-based models at predicting behaviour in positive reciprocity settings: the intentions reveal whether the generous wage is indeed a gift or a bonus. Setting piece rates influences the employer's and employee's perception of the situation (Irlenbusch and Sliwka, 2005). In short, when the employee is explicitly reminded of the work relationship and wage-effort exchange in it, it is more likely he perceives the gift as a bonus and finds himself under External, not Integrated Regulation.

Second, the received gift must be a gift in the employee's eyes. On the one hand, the wage must be high enough to constitute a gift. Abeler et al. (2010) present evidence that reciprocity occurs when the wage is generous in comparison to the employee's ability. Englmaier and Leider (2010) find that high ability workers reciprocate even after receiving a small initial gift, while low ability workers reciprocate only with a high initial gift. This indicates that workers rationalize whether, given their ability and the associated effort cost, the wage is high enough to be perceived as an actual gift. On the other hand, the employee is more ready to perceive a payment as a gift when it is presented as such. Kube et al. (2012) show that productivity is increased more by origami-folded money than by money alone. In a similar spirit, Bradler and Neckermann (2019)'s design reveals that an unexpected thank you card increases effort roughly to the same extent as an unexpected monetary gift – they are both perceived as a gift. When the two are given together however, it has no impact on performance. Why would that be? A thank you card along with money can easily be perceived as a receipt by the employee,

he re-evaluates the intended gift to be a bonus. When the same amount of money is origami-folded along with the thank you card, performance increases beyond the single gifts. Bradler and Neckermann (2019) conclude that it is the personal time and effort invested in the money presentation that increases effort significantly, or in our words, the care that the employer took to make it appear a gift in the employee's eyes. The "personal touch" takes the presented gift out of the money-effort exchange frame and into a social frame and turns a potential bonus into an actual gift. Although Esteves-Sorenson (2017) makes a point in presenting the money as a personal gift, the accompanying wording turns the gift envelope rather into an additional contract paragraph in the eyes of the employee. Toussaert (2017) shows in a noisy trust game that trust is reciprocated by trust the more credible the trust signal is. Similarly, the more credible the gift-giving action is, the more likely is positive reciprocation. All this highlights that the employer needs to ensure that the employee perceives the gift as a gift such that positive reciprocity can occur.

> In a work context, a generous wage is an advance bonus, not a gift, and thus External Regulation. However, an employer can facilitate the worker perceiving it as a kind action and thus, internalizing it to a higher degree of autonomy.

Third, the employee must actually be able to show his reciprocity. Specifically, a reciprocal and rational employee returns high effort only if he knows it is a gift for the employer. Hennig-Schmidt et al. (2010) show that efforts increase only when the employee knows the cost and surplus generated. Similarly, Englmaier and Leider (2012) present evidence that for both high and low wages employees exert higher effort when they know this will translate into a bonus for the employer. While these studies emphasize the impact on the manager's or total surplus, Charness et al. (2004) offer a comprehensive payoff table for both employer and employee. This shifts the social frame to a market frame, making it hard even for a reciprocal employee to rationalize his effort as being an actual gift to the employee. Indeed, they do not find reciprocity in this setup. Englmaier and Leider (2010)'s work additionally indicates that the degree of reciprocity matters: for a given ability and gift size, effects are higher for more reciprocal workers. This sheds light on the necessity to design a workplace where a reciprocal employee can give an actual gift back.

For a true gift, we have derived that the motivation is an External Regulation for the selfish employee and an Integrated Regulation for the reciprocal employee. The gift in a work relationship is clearly a reward and thus an External Regulation for both types of employees. But the employee's type determines how strongly the employer's kind action impacts the internalization process. The selfish employee feels pushed towards meeting the expectations and the motivation remains controlled. The reciprocal employee can still express himself (as a reciprocal type) and experiences volition while exerting high effort. His response becomes an Identified or Integrated Regulation, and is therefore autonomously regulated.

> In a short term situation, reciprocal individuals choose to respond with a kind action to express who they are, and are autonomously motivated to do so under Identified or Integrated Regulation. Non-reciprocal individuals are under External Regulation and have no motivation to repay the gift in kind.

Our discussion so far reveals that positive reciprocity as an incentive depends both on the employer's intention and the worker's type. In economic parlance, positive reciprocity with a true gift is either clearly 'extrinsic' or 'intrinsic'. It also clarifies that even in the absence of additional bonus schemes, the revealed intention can crowd out the 'intrinsic' motivation: when it becomes apparent that the gift comes with 'strings attached', even the reciprocal worker perceives it as the bonus it is, and instead of autonomous motivation, controlled motivation occurs. Most work relationships are to some extent framed within a market-like interaction: an employee is paid for the work he does. However, the employer can succeed at establishing his payment of a high wage as actually kind and unconditional, which enables the reciprocal worker to internalize the payment. As shown, he can do so by refraining from referring to the gift in a market-based context, ensuring that it is actually a gift in the employee's eyes, and designing the workplace such that the reciprocal employee feels he gives an actual gift back.
Our understanding of the gift is very much in line with the way the gift exchange argument was first introduced in economics. In his seminal paper, Akerlof (1982) emphasizes the norm underlying the 'gift' exchange and thus acknowledges the nature of the behaviour: the gift acts as a token to support the normative behaviour in a long term work relationship. We turn to these situations in the following segment.

1.5.2 The Gift Exchange phenomenon: long term incentives

As clarified above, we use the term gift exchange explicitly for long term work relationships. In the long run, the participants learn more about the true type or true intentions of the others. Specifically for work relationships, the worker cannot be doubtful in the long run that the employer wants to reap profits in order to keep the company going, and that his effort is required and expected to ensure this. Again, neither the generous wage nor the high effort is a true gift. However, they can serve other mechanisms that enable the gift exchange phenomenon.

First, a generous wage and a high effort at the start of a work relationship constitute the short term positive reciprocity situation described above. In the long run, repetition of this behaviour entails repeated game effects. Positive reciprocity and repeated game effects are mutually reinforcing (Gächter and Falk, 2002) and ensure that employer and employee coordinate on a good equilibrium (generous wage, high effort) which displays the gift exchange phenomenon instead of a bad one (low wage, unemployment). A positive reciprocity situation in the beginning facilitates the gift exchange phenomenon to arise, but to conclude that positive reciprocity and the gift exchange phenomenon are the same is wrong: it does not matter for the long-run gift exchange phenomenon whether the employees are actually positively reciprocal or not. The attainable payoff differential from a work relationship under gift exchange is a sufficient incentive for selfish employees to mimic reciprocal ones (Gächter and Falk, 2002). If the share of employees that are reciprocal or mimic to be reciprocal is high enough, then the generous wage, high effort equilibrium is stable in the long run. In similar spirit to the paragraph on short-term reciprocity, Dur (2009) shows theoretically that the long-term gift exchange phenomenon can also arise if the initial gift is not money, but attention. In either case, an actually reciprocal employee in a gift exchange situation is motivated under Integrated Regulation, whereas a selfish employee pretending to be reciprocal is motivated under External Regulation. The ritualized gift giving is only the long term outcome of initial positive reciprocity and not a display of long term positive reciprocity.

Second, as outlined in the section afore, positive reciprocity hinges on an actual gift, and only then it can kick off the gift exchange phenomenon. In a long-term relationship, the employee will not compare his wage to the market clearing wage, such as a minimum wage, but to a wage customary to the industry. Only if the wage or material benefits are generous in comparison

to the industry average, will the employee regard them as a kind action. Specifically, Kuvaas (2006) finds in a study of knowledge workers in different Norwegian companies that it is the level of the base pay, not the bonus, that is positively related to self-reported job performance and affective commitment to the company. Bonus payments are inherently conditional on performance, and thus cannot be perceived as a gift serving as a base for the gift exchange phenomenon. Additionally, equality considerations can feed into the gift exchange pattern. The employee may not only compare his wage to the industry standard, but also in comparison to the cut that the employer keeps to himself as this reveals his intentions.[6]

Third, long-term repetition allows both employers and employees to refrain from regularly reassessing their benefit from the gift exchange phenomenon. Rather, to behave as such becomes a norm, which has been shown to support long-term gift exchange (Fehr et al., 1998). The fact that employees behave more reciprocally if they observe co-workers doing so (Gächter et al., 2012) helps sustain the norm even in the presence of selfish workers and hence the gift exchange phenomenon. We know that norms are on the control-side in our categorization spectrum. It therefore depends on how the norm is presented. With a pressuring norm, both reciprocal and selfish workers are shifted to Introjected Regulation, because it promotes a feeling of entitlement to high exerted effort and high wages which in fact is a bonus system. Consider a 'typical' business consultancy: although both the wages and the effort are very high, economists don't draw on this as an example for the gift exchange phenomenon. It seems to be self-evident that the pressuring norms in these companies forbid the high wages and effort to be interpreted as gifts. With a non-pressuring norm, a reciprocal worker can still experience Identified Regulation.

Fourth, the repeated display of positive reciprocity builds up reputation. The employer signals that he is generous; the employees signal their capability of high effort (or what is called indirect reciprocity in Engelmann and Fischbacher (2009)). Reputation also helps sustain the gift exchange pattern in the long run, as more capable workers are inclined to apply to a high effort norm company, and their ability to achieve high effort levels enables the high effort norm company to keep wages generous. Further, reputation provides an additional reward. Phan et al. (2010) show in a repeated trust game where individuals play with partners of different

[6] Robert Bosch supposedly said: "I don't pay good wages because I have a lot of money; I have a lot of money because I pay good wages."

degrees of trustworthiness that "the brain's reward center selectively responds to monetary rewards received from partners with a reputation for cooperative play, but fails to respond to identical monetary rewards from partners who lack a reputation for cooperation". This finding is specific to the long term gift exchange, evidence from surveys suggest that positive reciprocity and trust are, if at all, weakly correlated (Dohmen et al., 2008): it takes long term gift exchange to develop trust and to form social capital (Dolfsma et al., 2009).

> Long term employment relationships characterized by generous wages and high efforts constitute the gift exchange phenomenon. Initiated by a positive reciprocity situation, the relationship is reinforced by mechanisms applying in the long term (e.g. reputation and development of trust, repeated game effects and emergence of norms). Reciprocal workers are still motivated under Integrated or Identified Regulation. Selfish workers may find it beneficial to mimic reciprocal ones, and remain under External Regulation. After a disturbance, short term positive reciprocity allows maintaining the gift exchange phenomenon only for reciprocal workers.

Fifth, we turn to the situation where the gift exchange pattern potentially breaks down because one party does not honor the implicit contract by cutting the wage or not exerting the required effort level in one round. From a purely rational point of view, the parties can only return to the good equilibrium of the gift exchange if the one-time loss is outweighed by the future rent of the payoff differential and if neither party is committed to a trigger strategy. But in a more realistic setting, the employer can choose to fire a non-performing employee or an employee can quit after sub-level payment: the game would not be repeated at a low equilibrium but terminated, which entails search costs to find replacement. We argue that positive reciprocity becomes once again important for the gift exchange in such a situation. The looming breakdown of the gift exchange induces employer and employee to consider their relationship thus far. As outlined above, the intentions and the trustworthiness of both parties have become apparent, and the parties evaluate the former behaviour of the other as either kind or unkind. If the employee regards the former high wages as kind and the employer as trustworthy to return to the high wage level as quickly as possible, he will be more likely to tolerate a short-term wage cut, e.g. if it helps survival of the business after a negative shock to the company. If the employer assesses prior work behaviour as kind and the employee as trustworthy to return to his usual performance as quickly as possible, he will be more likely to tolerate a short-term

performance drop of the employee, e.g. because of family issues. In a potential break-down, positive reciprocity comes back into play: if past behaviour of the other party is assessed to be kind, the reciprocal party reacts positively by upholding the relationship. This reaction itself is kind and helps reversion to the gift exchange pattern of the deviating party. Positive reciprocity thus helps sustain the long-term gift exchange. Selfish parties, however, will let the gift exchange break down: Selfish workers leave the 'sinking ship' and selfish employers try to find a way to get rid of the worker. Rough spots in the employment relationship therefore allow for re-selection of reciprocal agents who have built up social capital. The behaviour in a potential break-down impacts reputation and can have spillover effects: the signal that a coworker is not let down and in emergency signals kind behaviour of the employer to other reciprocal employees, which strengthens the gift exchange pattern. But it does not have to be a blow that makes employees reconsider the past behaviour: Bellemare and Shearer (2009) show that the one time increase of pay for tree planters leads to stronger reciprocal behaviour of long-term workers.

1.6 Monetary incentives

We start with the most commonly used incentive, a pay for performance measure, or piece rate, at the individual level. Pay for performance incentives are rigid: it is clear what needs to be done and what the worker gets out of it. Still, it may leave a degree of autonomy. If the piece rate is designed such that the worker can more than just scrape a living by an achievable amount of work, he feels that it is up to him how much work to put in to earn a good wage. In short, he feels more autonomously motivated. If however the piece rate is such that he has trouble to achieve the amount of money that allows him to make a living, he feels controlled. A pay for performance design that as in the former case leaves a degree of autonomy generates a pattern fitting the gift exchange model (Akerlof, 1982). Lazear (2000)'s carglass example illustrates this. After the introduction of piece rates it becomes apparent whether the worker can achieve the flat pay level from before or not. If he does, or even exceeds this target, his need for competence is satiated. This in turn diminishes the feeling of control and he can take pride from his ability – his motivation is under Introjected Regulation. Someone who barely or does not make this target will experience outward pressure, mentally and materially. This per-

son is not able to satiate his needs in this work environment and prefers to leave the company. The selection effect of a pay for performance scheme is thus driven by the amount of money a worker can expect to make in this environment, and amplified by his prospect to fulfill his needs and internalizing the reward system. The incentive effect of pay for performance actually strengthens the idea that a higher incentive leads to ever higher effort: for those workers capable of exerting high effort, more money comes along with higher need satisfaction that promotes performance. Financial incentives thus also work through Introjected Regulation for those workers who can meet and exceed the targets.

> Pay for performance hinges on clear contingencies and is a controlling incentive. The specific design determines whether it is External Regulation (rewards/ punishment) or allows partial internalization to Identified Regulation (self-worth/pride).

Money alone thus operates as External or Introjected Regulation. When it triggers further motivational channels, it may however become more internalized. It has been shown that status concerns, such as 'employee of the month' badges, increase productivity. Giving out costless but soundly names may however not be feasible in every context – managers who themselves give out these badges would likely not positively react to receive them themselves. But having word go around that they received a bonus may actually do the same trick. If this strengthens the leadership position they see themselves in, they can attribute personal value beyond the material to the bonus they receive, making it Identified Regulation. Working in groups that offer social support and promote common goals can also facilitate internalization. Taking into account that these contextual differences can shift the 'extrinsic' incentive from the External up to the Identified category in OIT displays how the former economic approach to understand combinations of incentives have been futile: not only do financial incentives influence 'intrinsic' motivators, they are themselves changed in their motivational capacity.

Our discussion on the gift exchange phenomenon and positive reciprocity augments this finding on contextual differences. We have clarified that a generous wage is actually an advance bonus that would come under External Regulation because it hinges on future effort provision. The employer must put in additional effort in order to create a positive reciprocity situation: credibly obscuring or abstaining from strategic considerations and presenting the generous wage. Indeed, these are the kind actions that a reciprocal worker responds to, not the gener-

ous wage per se. In combination, they complement each other such that a reciprocal worker chooses high effort exertion out of a feeling of volition under Integrated Regulation. A selfish worker perceives the advance bonus both in the short and long run under External Regulation.

> The design of monetary incentives are subject to contextual differences and can cause a change of context, which in turn affects the perceived degree of autonomy and internalization.

The outline on social identity further shows that the motivational capacity of monetary incentives is not only dependent on their design and context, but that they may change the context itself. The introduction of a team-level incentive scheme that neither interfered directly with the group's norm nor with the emotional significance of the group by exogenously prescribing it did still change the prevalent dimension on which groups form: ability, as key to higher earning under the new incentive scheme. And through this indirect channel it changes both norms and emotional significance of the social groups, the context. The effectiveness of the individual-level incentive scheme depends on whether it is at odds with the group level context of norm and emotional significance.

1.7 Concluding Remarks

In this paper, we introduce the motivational continuum between Autonomy and Control from *Organismic Integration Theory* and apply it to selected economic incentives with a view to clarify their motivational power in combination with monetary incentives.
With respect to identity as an incentive, we show that its incorporation in the theoretical literature reflects a controlling incentive. The individual derives utility from group membership, but deviation from the group's exogenously prescribed norm behaviour results effectively in a punishment. If the group does not strongly reinforce norm obedience, the individual by itself may choose a different action. While inspired by the work on intergroup relations, identity economics focuses on intragroup dynamics. Scrutinizing the empirical literature suggests that monetary incentives that are in line with endogenously formed norms can be more smoothly internalized, and monetary incentives that contradict the group's emotional significance or

endogenous norm are less effective or undermine the value attributed to group membership. Our considerations highlight how under different circumstances combining two incentives work well together or lead to crowding out and resolve the seemingly contradictory evidence. We also clearly juxtapose identity from mission incentives: mission incentives set only the goal, but not the behaviour and actions to be taken, and does not rely on norm obedience. In contrast to identity, mission is therefore an autonomous incentive.

We demonstrate how monetary incentives have different motivational capacity, depending on the employee's and employer's actions, as well as the context. We distinguish between positive reciprocity in the short and the gift exchange phenomenon in the long run. In the short run, non reciprocal workers are not motivated by a generous wage. Reciprocal workers repay the gift as to express their reciprocity under an autonomous motivation. Employers can facilitate internalization by curtailing the market exchange in the background of the gift exchange. With reinforcing mechanisms in the long run, non reciprocal workers have an incentive to mimic reciprocal ones, but they remain under a controlling motivation as they only 'play the game'. Our discussion informs the general issue of monetary incentives, which dependent on the context, can be partially internalized and perceived as autonomous. Our paper elucidates how the standard classification of incentives into the categories 'extrinsic' and 'intrinsic' is too basic to scrutinize their motivational capability, and informs our understanding about how different incentives interact.

Chapter 2

Autonomy Support and Innovation*

> "We don't need bosses. We need servant leaders.
> We need people to serve their teams and let their teams
> come up with the best ideas."
>
> V. Narasimhan, CEO Novartis
> in an interview with Gharib (2019)

2.1 Introduction

The aim of this paper is to demonstrate optimal investments dynamics in leadership behaviour that fosters innovation. Our focus is the intensity in which an innovation encouraging leadership behaviour must be displayed over time and not one specific management practice. Management practices matter for an organization's success (e.g., Bloom et al. (2013); Bloom and Van Reenen (2010)), and economics has generally focused on beneficial complementarities between different practices (e.g., Ichniowski et al. (1995), Ichniowski and Shaw (1999)). Rather little research in organizational economics (with the exception of e.g. Hermalin (1998)) focuses on the individual and how she ensures successful implementation of the practices: the leader and her behaviour. Non-monetary incentives that enrich the traditional economics' toolkit of bonus schemes, e.g. providing workers with meaning to their job and raising awareness that their impact matters has been shown to increase worker motivation (Cassar and

* This chapter is based on joint work with Lion Henrich (LMU).

Meier, 2018; Levitt and Neckermann, 2014), are conveyed through the leader and her behaviour towards the workforce. Ichniowski and Shaw (2003) find that in less traditional and productivity enhancing practices, line workers interact more with supervisors and co-workers. As the effectiveness of management practices depends on their perceived quality and not their quantity (Edgar and Geare, 2005), attributes of leadership behaviour that embody them are of particular interest.

Innovation is one important contributor to an organization's long term competitiveness and success. Monetary incentives work for constrained problems but seem ineffective for open, unconstrained innovation characterized e.g. by a lack of ex ante specified goals (Charness and Grieco, 2018). In general, management practices stimulate innovative activity (Shipton et al., 2006), but we are unaware of work on non-monetary incentives specifically aiming at encouraging innovative activities of the workforce. We argue that leadership behaviour can be such a non-monetary incentive that instills innovative activity.

Workers in a hierarchical work relationship, who are not specifically employed to innovate, refrain from sharing novel ideas if they fear questioning the status quo and resulting negative consequences for themselves. They will speak up if they believe their ideas, and potentially critique, is welcomed and taken seriously by management. The leadership behaviour of their supervisor can create a safe space where workers feel free to come up and share novel ideas.

This kind of leadership behaviour is captured by the concept of Autonomy Support. Self-Determination Theory is an established construct in Social Psychology, and Autonomy herein is defined as a feeling of volition and freedom that a person experiences e.g. at work (Gagné and Deci, 2005). Autonomy Support is the degree to which the social context enables this feeling, which in our model is the leadership behaviour of the principal. Autonomy Support strikes a balance between providing structure and granting freedom of thought, as it creates a safe space for experimentation and failure (Pisano, 2019) which inspires innovation, unleashes creative thinking and encourages workers to communicate their novel ideas.

Kaizen is an example for an Autonomy Supportive leadership behaviour, and has received much attention in operations management of the manufacturing sector for some time (see e.g. Singh and Singh (2009) for a review). In the Kaizen philosophy, supervisors train workers in methods and Kaizen tools, invite ideas and offer feedback in a non-judgemental way, aiming at developing their workers to share their contributions for improvement and innovation

in a safe environment (Quality-One International, 2015). Toyota adopted this innovation encouraging management style with a view to continuous improvement and lean management, which resulted in a strong comparative advantage over a competitor relying on controlling incentives (Helper and Henderson, 2014). Operations management and people management go hand in hand for a company's success (Bloom et al., 2015). We focus on the intensity in which Autonomy Support must be provided, whether it be in operations or people management practices, that encourages heterogeneous workers to thrive in innovative activities without a monetary component.

We formalize Autonomy Support in a principal-agent model as an investment in leadership behaviour over time, as single interventions fade out eventually. We derive optimal investment patterns in Autonomy Support that incentivize effort in creative, small scale innovation of the workforce at the bottom of the hierarchy. The patterns are co-determined by the initial Autonomy Support levels of the agent and the rate at which support fades, as well as the benefit-cost ratio and time discount factor of the principal. We find that the principal invests in Autonomy Supportive leadership behaviour for almost all parameter constellations. Only if the agent comes with extremely low or high initial levels of Autonomy Support does she refrain from investment. We demonstrate that the principal engages in Autonomy Supportive leadership behaviour in accordance to the agent's need to be lifted up as to become active in innovation. Thereby, we contribute to the literature of managing innovation and the literature on economic incentives with a view to the current debate on work and whether monetary rewards are sufficient for performance (Shiller, 2019).

We proceed as follows. First, we show the limited effectiveness of monetary incentives to foster small scale innovation. We then introduce the concept of Autonomy Support review the literature on how it incentivizes innovative activity of the workforce. We then derive the theoretical model to trace optimal investments in Autonomy Support over time. We analyze the resulting investment patterns and derive policy recommendation and future avenues for research. Lastly, we conclude.

2.2 Limited effectiveness of monetary incentives for small scale innovation

Small scale innovation describes small step improvements of products and processes. It is also typically associated to originate from the part of the workforce who are not specifically employed to innovate, but employees who find creative ways to improve a product or process they are involved in. Small scale innovation can have an important impact on profits. For example, a Walmart worker's idea to use lighter one-step stools for loading trucks will save $ 30 millions in costs from inefficient packing (Thomas, 2019). Customer needs to adapt a product are identified through personal interaction of customer service executives (Bilsland and Cumbers, 2018). While small scale innovation may be of particular interest to small and medium sized companies that cannot maintain an R&D department (Rammer et al., 2009), it is interesting for companies of all sizes to encourage small scale innovation.

An important question then is whether small scale innovation can be incentivized financially. The seminal paper of Manso (2011) displays how an incentive scheme designed to tolerate early failure and reward late successes does indeed encourage innovation, a result that is backed up by a lab experiment in Ederer and Manso (2013). It is important to note that the authors speak of innovation in terms of the contrast between exploitation and exploration. Whether an agent is incentivized to exploit a given business situation or to explore a set of business opportunities: neither qualifies as a creative, unconstrained situation. The recent experimental literature suggests that monetary incentives increase the effort exerted and the quantity and quality of ideas, but do not have an impact on creativity or originality. In fact, they may even reduce creativity (Erat and Gneezy, 2016; Laske and Schröder, 2017). Gibbs et al. (2017) find that with monetary rewards fewer individuals submit more ideas, suggesting a trade-off where people refrain from sharing small and possibly far fetched ideas. The differential impact of monetary incentives on the number of ideas generated and their degree of creativity highlights that the innovation term is used broadly from new combinations of known elements to creative, out of the box approaches. Charness and Grieco (2018) distinguish between constrained and open creativity, and conclude that financial incentives only work for constrained tasks. We adopt this distinction for the remainder of this paper.

Further, we know that incentive schemes must be carefully designed as to avoid unintended consequences. One major factor is the measurability of effort or output on which the mon-

etary incentive is conditioned. But small scale innovation that improves products and processes is hard to measure, in contrast to the launch of new products and techniques. For example, small process improvements are likely to be tested at some departments and then phased in for the entire organization, making it difficult to disentangle department effects. Continuously changing the production process with small improvements is likely to be disruptive, such that a product is relaunched with a set of small improvements as, for instance, Ikea's 'new' Billy bookshelf. This renders it impossible to trace better performance to one improvement alone. Toyota's productivity increase from Kaizen in the 1980s is attributed to its general ability to foster small scale innovation (Helper and Henderson, 2014), but not to one single improvement.

The operability of financial incentives for small scale innovation is therefore limited in addition to their inability to encourage open and creative ideas. This problem is amplified for the workforce on the ground whose core job is not to contribute ideas. These workers are the ones experiencing the production process first hand, have insight knowledge about the product and work in customer service, which makes them acutely aware of potential problems. But a variety of reasons can restrain them to voice a novel idea: they may fear repercussion for challenging the status quo (Zhou and George, 2003), worry that an idea that does not work out signals inability for the job, or are afraid that a successful idea can render their job useless. In order to unleash the small scale innovation potential of their workforce, companies must acknowledge and address these concerns, a task monetary incentives are unfit for.

2.3 How Autonomy Support incentivizes innovation

Leadership behaviour is key for fostering small scale, open innovation of the workforce. Different management practices coalesce in providing a safe space for workers to raise their ideas and concerns, as well as welcoming and encouraging their ideas are characterized by this leadership behaviour. This holds particularly true for workers who are not specifically employed for creative, innovative tasks, such as shop floor workers and customer advisers. These typically work within an organizational structure of controlling guidelines, work processes, and deadlines that does not give space for ideation. The pressure they experience prevents creative thinking, and "Numerous attempts at creativity get killed in their infancy because employees

fall victim to these emotions" [caused by pressure] (Zhou and George, 2003). The authors make the case that a key determinant for creativity in the workplace is leadership and a supervision style that manages the workers' emotions through empowerment and encouragement. However, providing complete leeway, or no structure at all is unlikely to excite a worker to engage in some innovative activity that actually results in improvements for the company. Pisano (2019) rectifies this misunderstanding of an innovative organizational culture to be just encouraging by emphasizing the balance that management must strike to truly innovative improvements: there must be tolerance for failure, but not for incompetence; there must be a willingness to experiment, but in a highly disciplined way; there must be collaboration, but with individual accountability; there must be flat, but strong leadership: an innovative organizational culture, he writes, must be "psychologically safe but brutally candid".
The leadership behaviour in an innovative organizational culture that achieves this balance is one of Autonomy Support. We introduce the concept of Autonomy Support and provide a literature review underlining its impact on innovation.

2.3.1 Autonomy Support

Autonomy Support is a concept from Self-Determination Theory. The underlying concept of Autonomy refers to a feeling of volition and freedom (Gagné and Deci, 2005) when engaging in an activity. Autonomy is thus overlapping but distinct from both its colloquial meaning of independence or the economic concept of intrinsic motivation. The latter two describe a person who chooses independent of others, or chooses what he wants. Autonomy however means that a person experiences a feeling of freedom while doing something even if the person may not have chosen it for himself. This is particularly important for the work environment as a worker has essentially never complete, independent choice of what to do. But he can experience a feeling of Autonomy because he is not controlled at work, or finds value in his work and work environment. It seems perspicuous that a feeling of volition and freedom positively underpins creative thinking, and most people who ever tried to think out of the box

under pressure and control (the opposite of Autonomy in Self-Determination Theory) would agree.[2]

> Autonomy Support then is "the degree to which socializing agents take the target individual's perspective; act in ways that encourage choice and self-initiation; provide meaningful rationales and relevance; and refrain from using language or displaying behaviors that are likely to be experienced as pressure toward particular behaviors" (Benita et al., 2014).

Autonomy Support goes beyond one or multiple specific management practices. The overall leadership behaviour of the supervisor that permeates management practices however can be Autonomy Supportive. Reflecting the definition of Autonomy Support, Stone et al. (2009) expatiate the following points outlining how practitioners can create autonomous motivation in the long run:

- Asking open questions including inviting participation in solving important problems
- Active listening including acknowledging the employees' perspective
- Offering choices within structure, including the clarification of responsibilities
- Providing sincere, positive feedback that acknowledges initiative, and factual, non-judgmental feedback about problems
- Minimizing coercive controls such as rewards and comparisons with others
- Develop talent and share knowledge to enhance competence and autonomy

Indeed, this constitutes the balance of a successful the management style as described in Pisano (2019). We now turn to the empirical evidence of how such an Autonomy Supportive management style facilitates innovative activity of the workforce in real life.

[2] Assume the example of a PhD student. He may research on whatever he chooses (independence), but that does not necessarily mean that he is motivated, or successful. What does help him succeed is Autonomy Support. Autonomy Support may come in the form of a supervisor who (a) enables and encourages him to take initiative and choose, (b) offers advice, (c) shares his/her perspective and experience when solving problems, and/or (d) offers the 'bigger picture'.

2.3.2 Literature review: Autonomy Support and innovation

Our introductory example of Toyota's Autonomy Supportive management style Kaizen ticks all boxes of Stone et al. (2009)'s list above. Workers are trained in statistical methods and the structure of the Kaizen process and Kaizen events such that they can make full use of it (Helper and Henderson, 2014; Quality-One International, 2015). They also receive feedback and encouragement both from their supervisor and colleagues (Helper and Henderson, 2014). Besides the continuously displayed leadership behaviour, Toyota organized regular Kaizen events structured to invite and harness ideas and provide room to improve them. These events can be designed for broader knowledge gathering or brainstorming in a specific field, but in all cases, it is the task of the management to provide structure and create a safe environment (Early, 2012). Helper and Henderson (2014) attribute Toyota's increased productivity at a time when its rival's GM productivity decreased to the small scale innovation incentivized by this leadership behaviour.

Autonomy Support is however not a direct result from an adopted management style alone, but conditional on the behaviour of the individual leader, such that differences within a company can arise. Amabile et al. (2004)'s study on the impact of perceived leadership support on creativity showcases a vivid example for Autonomy Support, scrutinizing the widely diverging impact of two 'extreme' micro-managing team leaders in a firm. Both individuals are micro-managing in the sense that they are closely monitoring their team. One uses this management practice only to communicate top level decisions down to them, which puts pressure on the team. The other uses monitoring for immediate exchanges on upcoming challenges, consults the team in decisions and ensures smooth cooperation between team and top management. There is no independence in choice in either team, but in the latter the micro-manager displays Autonomy Support in his leadership behaviour. As a consequence, the authors find that this team engages successfully in innovative activities. The controllingly monitored team however is unsuccessful. They further record a positive and a negative spiral in each team respectively. Autonomy Supportive leadership behaviour manifests itself over time and has a lasting effect. The leader invests over time in the relationship with its team to constitute a coherent behaviour. Besides the time component, this example pinpoints that Autonomy Support encompasses both "instrumental and socioemotional support" (Amabile et al., 2004)

and that Autonomy Support and a tight structure are not mutually exclusive. One might argue that because of the structure, the leadership behaviour of the Autonomy Supportive team leader was particularly important. This case also demonstrates that leadership behaviour is not conditional on one specific management practice.

A leader achieves a structure that creates a safe space such that a feeling of Autonomy and innovative activity can arise by, for example, specifying only "issues to avoid" (Van de Ven, 1986), fostering a feeling of ownership (Dorenbosch et al., 2005) that leads to identification with a leader such that workers follow (Yoshida et al., 2014). Psychological safety promotes creativity, as shown e.g. in part time graduate students (Kark and Carmeli, 2009), and contributes to a firm's financial success through innovation, e.g. in a study of 163 Turkish firms (Akgün et al., 2009). Mumford et al. (2002) conclude that if a leader balances structure and encouragement (being both "cheerleader" as well as "the most demanding critic"), workers "can express their creative capacity". Interestingly, Zhou and George (2001) find that an Autonomy Supportive work environment encourages even dissatisfied workers to be creative. It allows them to use channels to change something about their current situation. At the team level, a leader provides and develops "a safe psychosocial climate and appropriate group processes" (West, 2002) on both the individual and the team level through consultative participation, clarifying objectives and encouraging positive feedback. The team members can then reinforce Autonomy Support among one another (Gagné and Deci, 2005). The team leader's role is "orchestrating" these efforts (Mumford et al., 2002), and like a conductor, becoming part of the group and ensuring that the members work harmoniously together. In the health care sector, for example, this has been shown to increase quality of work and innovation (Borrill et al., 2000).

An Autonomy Supportive leadership is beneficial also for workers who have a personal tendency for creativity. Indeed, it falls short to assume that personal creativity alone achieves innovative activity (Mumford et al., 2002). Rather, personal creativity and an appropriate work context complement each other in accomplishing this goal (Janssen et al., 2004). In the absence of non-controlling and supportive supervision creativity and patents actually decrease (Oldham and Cummings, 1996). Creativity of workers unsure of their capabilities is unleashed when management builds their confidence and serves as a role model (Tierney and Farmer, 2002), pointing towards the importance of Autonomy Support for blue collar workers. More

complex jobs are assumed to spur worker's interest and creativity. Even for those Shalley et al. (2009) show that Autonomy Support has a positive impact on creativity regardless of whether workers have a high or low degree of Autonomy or work in complex or less complex jobs. For low Autonomy and less complex jobs the effect is just more pronounced.

As with other incentives, Autonomy Support must be properly designed and applied to ensure the desired effect and prevent unintended consequences. It is insufficient to give workers pro forma choice as to create an illusion of Autonomy. Experiments indicate that when workers' decisions are not taken seriously it discourages effort: when workers are delegated to choose which project to implement, but the leader overrules their decision, effort levels and transfers (Sloof and von Siemens, 2019; Corgnet and Hernán González, 2013) plummet. A successful manager must be able to change one's mind when involving workers in the decision process (Corgnet and Hernán González, 2013). Leadership behaviour that is perceived as insincere or intrusive has a negative impact on innovative behaviour (Bammens, 2016). Autonomy Support must also specifically aim at encouraging innovation. Ohly et al. (2006) find that while Autonomy Support inspires personal initiative, it does not increase creativity and innovation, and ascribe this finding to the fact that supervisor support was not clearly targeted at innovation. The company's system of processing suggestions might have been misused to communicate complaints.

This review highlights that Autonomy Support encompasses a variety of actions and behaviours of a leader, which can be displayed in a different operations and human management practices. Autonomy Supportive leadership behaviour must be authentic and offer both instrumental and emotional support. A one time Autonomy Supportive intervention is unlikely to have a believable lasting effect, and fades over time. Therefore, it must be reinforced and renewed. Regular efforts to provide Autonomy Support are necessary, and different behaviours or intensities may be required at different points in time. While companies like Toyota incorporate a management style that targets at Autonomy Support, it eventually comes down to the quality of the leadership behaviour of the principal in question. We formalize these notions in our model.

2.4 A model of investments in Autonomy Support

2.4.1 Model setup

We investigate optimal investments in providing Autonomy Support of a principal with a view to incentivize innovative activity of the worker. We expect optimal investments to vary over time, as leadership behaviour and actions required differ. For example, extensive methods training or occasional feedback require behaviour of different time intensity. We choose a two period model to incorporate this notion in a principal-agent model. It allows us to keep the model as tractable as possible whilst capturing the dynamic aspect of Autonomy Support investments.

For the purpose of the research question, we concentrate only on innovative activity i of the agent as inventivized through Autonomy Support by the principal. When the agent (he) engages in innovative activity i the probability for his efforts to result in a successful innovation increases according to the probability function

$$Pr(i) = \frac{i}{1+i}$$

with $Pr(i) \in [0,1)$ for $i \geq 0$.

The agent experiences effort costs from innovative activity, which decreases in the amount of Autonomy Support available to the agent. Prior discounted and current Autonomy Support constitute this available amount. The discount factor δ accounts for the fact that Autonomy Support investments fade out over time. A one period intervention does not carry indefinitely into future periods with the same motivational power. We factor in the Autonomy Support provided previously, either in employment or personal relationships, by assuming a personal consolidated start level $\bar{s}$ of an agent. Alternatively, the start value can be interpreted as the agent's personal autonomous motivation level for innovation prior to employment (Shalley et al., 2009). Different agents therefore have different initial levels of $\bar{s}$. The total value of

Autonomy support $\bar{s}_1$ and $\bar{s}_2$ available to an agent in periods $t = 1,2$ is therefore given by

$$\bar{s}_1 = \delta \bar{s} + s_{a,1}$$
$$\bar{s}_2 = \delta^2 \bar{s} + \delta s_{a,1} + s_{a,2}$$

denoting the sum of the discounted start value $\bar{s}$ and the principal's investments in the prior, discounted, and the current period.

The payoff the agent experiences from successful innovation is denoted as v_A and normalized to one. We understand this payoff to be the utility derived from being creatively active and seeing one's innovative activity come to fruition, not as a monetary reward. Taken together, the agent's utility as a function of his innovative activity i for periods $t = 1,2$ are

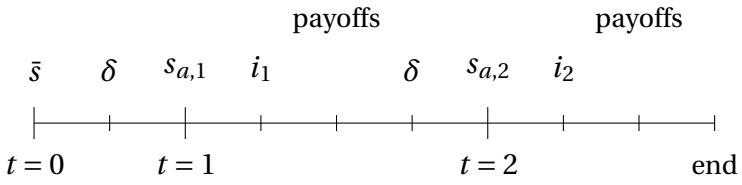
$$U_A(i,1) = v_A \frac{i}{1+i} - \frac{i}{\delta \bar{s} + s_{a,1}} \qquad = v_A \frac{i}{1+i} - \frac{i}{\bar{s}_1} \tag{2.1}$$
$$U_A(i,2) = v_A \frac{i}{1+i} - \frac{i}{\delta^2 \bar{s} + \delta s_{a,1} + s_{a,2}} \qquad = v_A \frac{i}{1+i} - \frac{i}{\bar{s}_2} \tag{2.2}$$

The principal (she) receives a payoff v_P when the agent's innovation is successful, and bears costs $c(s_{a,t}) = \alpha s_{a,t}$ from providing Autonomy Support at time t. α denotes the principal's marginal cost. Alternatively, it can be interpreted as her ability to provide Autonomy Support. The principal is forward looking and accounts for the fact that Autonomy Support provided in period 1 impacts innovative activity and thus innovation profit in both periods. The principal discounts her profit in period 2 with β and includes it in her first period considerations. The profit functions for periods $t = 1,2$ are

$$\Pi_P(s_{a,1},1) = v_P \frac{i}{1+i} - \alpha s_{a,1} + \beta \Pi_P(s_{a,2},2) \tag{2.3}$$
$$\Pi_P(s_{a,2},2) = v_P \frac{i}{1+i} - \alpha s_{a,2} \tag{2.4}$$

We assume that the principal can perfectly observe the initial amount of Autonomy Support $\bar{s}$ the agent enters the work relationship with. We look at situations in which the benefits from Autonomy Support and its associated costs are such that the principal considers investment. We achieve this by assuming that the benefit-cost ratio satisfies $\frac{v_P}{\alpha} > 2$. The time line of the model is as follows. In each period, the agent's total Autonomy Support is depreciated before

the principal has the opportunity to invest anew. Based on the currently available Autonomy Support level, the agent chooses his innovation effort, and the payoffs of the period are realized.



The principal seeks to maximize her profits from innovation by optimally investing in the agent's Autonomy Support. We solve the maximization problem via Backward Induction because profits are time-interdependent through the investment choices.

2.4.2 Solving the model

Solving for period $t = 2$

While the principal takes future effects of her own current investment into account, the agent is backward looking. He considers each period separately and only takes past investments in his available Autonomy Support into account. In period $t = 2$, he maximizes $U_A(i,2)$ from Equation (2.2) by his choice of innovative activity i, resulting in

$$i_2^* = (\delta^2 \bar{s} + \delta s_{a,1} + s_{a,2})^{\frac{1}{2}} - 1 \tag{2.5}$$

The agent's innovative effort i_2^* depends on his initial Autonomy Support level, the discounted previous and the current Autonomy Support investment by the principal. The agent only becomes active if there is overall enough Autonomy Support. If previous Autonomy Support is low or heavily discounted such that $\delta^2 \bar{s} + \delta s_{a,1} = 0$, no innovative activity takes place if the principal does not sufficiently invest in the current period $t = 2$. If the previous Autonomy Support is high and/or is only mildly discounted, innovative effort is exerted even if the principal does not invest in the current period at all, with $s_{a,2} = 0$.

The principal maximizes $\Pi_P(s_{a,2},2)$ from Equation (2.4) in order to derive her optimal investment $s_{a,2}$, which results in

$$s^*_{a,2} = \left(\frac{\upsilon_P}{2\alpha}\right)^{\frac{2}{3}} - \delta^2\bar{s} - \delta s_{a,1} \geq 0 \tag{2.6}$$

$s^*_{a,2}$ increases in profit υ_P from successful innovation and decreases in the marginal cost parameter α for providing Autonomy Support. The benefit-cost ratio $\frac{\upsilon_P}{\alpha}$ also comes into play when determining if the principal invests at all in the second period. Only if the agent's initial Autonomy Support level and previous investment is low or heavily discounted such that it does not exceed the benefit-cost ratio $\frac{\upsilon_P}{\alpha}$, does the principal choose a positive investment $s_{a,2} > 0$. Otherwise, the principal does not need to replenish the stock of Autonomy Support and chooses $s_{a,2} = 0$.

The principal's profit in period $t = 2$ when she engages in current Autonomy Support investments $s^*_{a,2} > 0$ is

$$\begin{aligned}\Pi^*_{P,2}(s^*_{a,2}|s^*_{a,2} > 0) &= \upsilon_P \frac{\left(\frac{\upsilon_P}{2\alpha}\right)^{\frac{1}{3}} - 1}{\left(\frac{\upsilon_P}{2\alpha}\right)^{\frac{1}{3}}} - \alpha\left(\frac{\upsilon_P}{2\alpha}\right)^{\frac{2}{3}} + \alpha(\delta^2\bar{s} + \delta s_{a,1}) \\ &= \upsilon_P - 3\alpha\left(\frac{\upsilon_P}{2\alpha}\right)^{\frac{2}{3}} + \alpha(\delta^2\bar{s} + \delta s_{a,1})\end{aligned}$$

and for her optimal choice of $s^*_{a,2} = 0$

$$\Pi^*_{P,2}(s^*_{a,2}|s^*_{a,2} = 0) = \upsilon_P - \frac{\upsilon_P}{(\delta^2\bar{s} + \delta s_{a,1})^{\frac{1}{2}}} > 0$$

Solving for period $t = 1$

The agent maximizes his utility $U_A(i,1)$ of period $t = 1$ in Equation (2.1) by choosing

$$i^*_1 = (\delta\bar{s} + s_{a,1})^{\frac{1}{2}} - 1 \geq 0$$

The agent's innovation effort in period $t = 1$ increases in both his initial Autonomy Support level and the principal's investment in the current period.

When maximizing $\Pi_P(s_{a,1}, 1)$ in Equation (2.3), the principal takes this and the discounted future impact of her investments in period $t = 1$ for the subsequent period into account. Her optimal investment choice is

$$s^*_{a,1} = \left(\frac{v_P}{2\alpha(1-\beta\delta)}\right)^{\frac{2}{3}} - \delta\bar{s} \geq 0 \tag{2.7}$$

Her investment increases when the benefit-cost ratio increases and increases in how strongly she values future periods, as described by β. The effect of the agent's discount parameter δ is ambiguous and will be part of the discussion on the different investment patterns. Contingent on the parameter constellation, the principal may or may not invest in Autonomy Support in period $t = 1$.

The resulting profit in period $t = 1$, if she invests in Autonomy Support in both periods such that $s^*_{a,1} > 0$ and $s^*_{a,2} > 0$, is

$$\begin{aligned}\Pi^*_{P,1}(s^*_{a,1} > 0) = v_P - \frac{1}{\frac{v_p}{(2\alpha(1-\beta\delta)}^{\frac{2}{3}}} - \alpha\left(\frac{v_p}{(2\alpha(1-\beta\delta)}\right)^{\frac{2}{3}} + \alpha\delta\bar{s} \\ + \beta\left[v_P - 3\alpha\left(\frac{v_P}{2\alpha}\right)^{\frac{2}{3}}\right] + \beta\delta\left(\frac{v_p}{(2\alpha(1-\beta\delta)}\right)^{\frac{2}{3}}\end{aligned} \tag{2.8}$$

and for $s^*_{a,1} = 0$

$$\Pi^*_1(s^*_{a,1} = 0) = v_P - \left(\frac{1}{\delta\bar{s}}\right)^{\frac{1}{2}} + \beta v_P\left(\frac{1}{\delta^2\bar{s}}\right)^{\frac{1}{2}} \tag{2.9}$$

2.4.3 Results: Autonomy Support investment patterns

We derive the investment patterns that emerge depending on the parameter constellations of the benefit-cost ratio $\frac{v_P}{\alpha}$, the agent's depreciation rate of Autonomy Support δ, and the principal's discount factor β of future profits.[3]

The first broad distinction for the different patterns is the relationship between the agent's and principal's future benefits from investing in Autonomy Support in the current period. The

[3] The specific derivations for each case are stated in the Mathematical Appendices A.1 and A.2.

condition core to this distinction is given by

$$\frac{1}{\delta} - \sqrt{\delta} \lessgtr \beta \tag{2.10}$$

as depicted in Figure 2.4.1, where $\frac{1}{\delta} - \sqrt{\delta} = \beta$ is delineated.

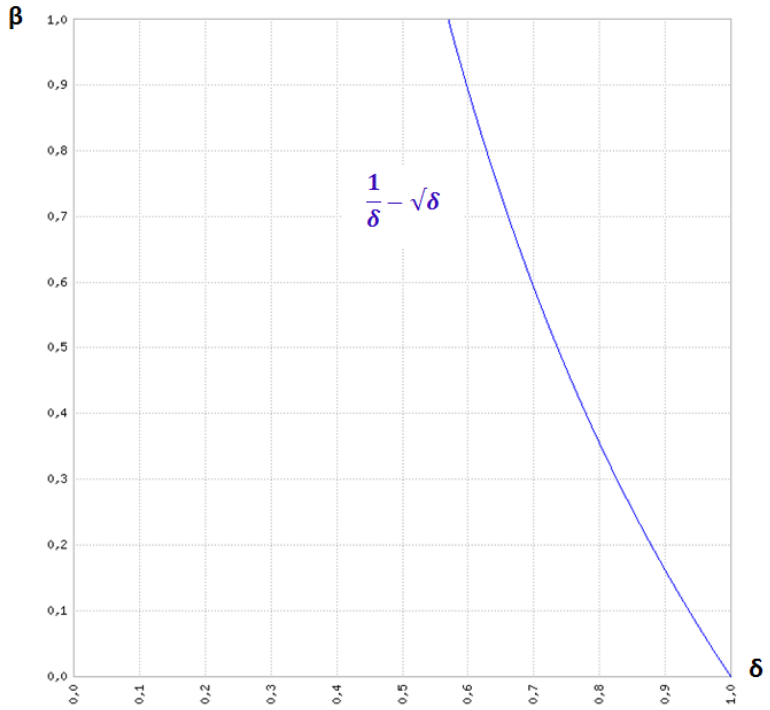


Figure 2.4.1: β- δ relationship

To the left of this line, $\frac{1}{\delta} - \sqrt{\delta} > \beta$ holds when either δ or β, or both simultaneously are low. The agent discounts Autonomy Support at a high rate, and investments fade out strongly. The principal does not value future payoffs highly. Intuitively, this translates to lower incentives to invest in Autonomy Support and results in lower investments.

To the right of this line, $\frac{1}{\delta} - \sqrt{\delta} < \beta$ holds when β and δ are simultaneously high. This means that the agent discounts Autonomy Support at a low rate, and investments last. The principal values future payoffs strongly. Investing in the current period is beneficial for both. Intuitively, this translates to higher incentives to invest Autonomy Support and results in higher investments in the given period.

In accordance with this distinction, we now describe the specific investments for low and for high future benefit investment patterns.

Low future benefit investment patterns under $\frac{1}{\delta} - \sqrt{\delta} > \beta$

Pattern I: Investment in each period

The principal chooses a positive investment in period $t = 1$, $s^*_{a,1} > 0$, if the initial Autonomy Support amount $\bar{s}^i$ does not exceed (derived from Equation (2.7)) a threshold of

$$\frac{1}{\delta}\left(\frac{\nu_P}{\alpha}\frac{1}{2(1-\beta\delta)}\right)^{\frac{2}{3}} > \bar{s}^i \tag{2.11}$$

This means that the benefit-cost ratio $\frac{\nu_P}{\alpha}$ of innovation is high enough to interest the principal in encouraging innovative activity. However, the initial Autonomy Support amount is so low that she chooses to invest in the first period. After the depreciation of $s^*_{a,1}$ (in Equation (2.7)) the principal further invests $s^*_{a,2} > 0$ in period $t = 2$, if Equation (2.6) satisfies

$$\begin{aligned} s^*_{a,2} &= \left(\frac{1}{2}\right)^{\frac{2}{3}}\left(\frac{\nu_P}{\alpha}\right)^{\frac{2}{3}} - \delta^2\bar{s} - \delta s^*_{a,1} \\ &= \left(\frac{1}{2}\right)^{\frac{2}{3}}\left(\frac{\nu_P}{\alpha}\right)^{\frac{2}{3}}\left(1 - \delta\left(\frac{1}{1-\beta\delta}\right)^{\frac{2}{3}}\right) > 0 \end{aligned}$$

which is always true for $\frac{1}{\delta} - \sqrt{\delta} > \beta$ as assumed for this section.
Rearranging the time-interdependent profit function of period $t = 1$ (Equation (2.8)) yields a lower bound of $\bar{s}^i$ that ensures positive expected profits from innovative activity for the principal:

$$\bar{s}^i \geq \frac{\nu_P}{\alpha}\frac{1}{\delta}\left[3\left(\frac{1}{2}\right)^{\frac{2}{3}}\left(\frac{\nu_P}{\alpha}\right)^{-\frac{1}{3}} - 1\right]\left[\frac{1+\frac{\beta\delta}{\alpha}}{(1-\beta\delta)^{\frac{2}{3}}} + \beta\right] \equiv X_{\Pi_{P1,1}} \geq 0 \tag{2.12}$$

The initial amount of Autonomy Support $\bar{s}^i$ must exceed this threshold, otherwise the principal does not find it optimal to add to it in the first and subsequent second period. Intuitively, there must be some, but not too much Autonomy Support of the agent to build on such that the principal, although inclined to invest little, finds it optimal to invest in both periods. In Figure 2.4.2, we see that depending on the initial Autonomy Support, the principal matches her investment such that the agent achieves the $\bar{s}_1$ necessary to optimally exert effort in innovative activity. The higher the initial level, the less must the principal touch it up. The emerging

patterns are steadily decreasing (Pattern Ia in Figure 2.4.2) or hump-shaped (Pattern Ib).
The agent's utilities in the respective periods are

$$U_A(i^*,1) = 1 - \frac{2}{\left(\frac{v_P}{2\alpha(1-\beta\delta)}\right)^{\frac{1}{3}}} + \frac{1}{\left(\frac{v_P}{2\alpha(1-\beta\delta)}\right)^{\frac{2}{3}}}$$
$$U_A(i^*,2) = 1 - \frac{2}{\left(\frac{v_P}{2\alpha}\right)^{\frac{1}{3}}} + \frac{1}{\left(2\frac{v_P}{2\alpha}\right)^{\frac{2}{3}}}$$

Pattern II: Investment only in second period

If the agent enters the company with an initial amount of Autonomy Support $\bar{s}^{ii}$ that exceeds the threshold in Equation (2.11), the principal does not invest in period $t = 1$ in the $\frac{1}{\delta} - \sqrt{\delta} > \beta$ environment. However, she does invest in $t = 2$ as per Equation (2.6) if

$$\frac{1}{\delta^2}\left(\frac{1}{2}\right)^{\frac{2}{3}}\left(\frac{v_P}{\alpha}\right)^{\frac{2}{3}} > \bar{s}^{ii} \tag{2.13}$$

or, phrased differently, if the initial Autonomy Support amount is sufficient to encourage innovative activity in the first period, but not in the second period.
The agent's utilities become

$$U_A(i^*,1) = 1 - \frac{2}{(\delta\bar{s})^{\frac{1}{3}}} + \frac{1}{(\delta\bar{s})^{\frac{2}{3}}}$$
$$U_A(i^*,2) = 1 - \frac{2}{\left(\frac{v_P}{2\alpha}\right)^{\frac{1}{3}}} + \frac{1}{\left(2\frac{v_P}{2\alpha}\right)^{\frac{2}{3}}}$$

Pattern III: No investment

If the agent's initial amount of Autonomy Support $\bar{s}^{iii}$ exceeds the threshold in Equation (2.11), such that

$$\bar{s}^{iii} \geq \frac{1}{\delta^2}\left(\frac{1}{2}\right)^{\frac{2}{3}}\left(\frac{v_P}{\alpha}\right)^{\frac{2}{3}} \tag{2.14}$$

it is sufficiently high to encourage innovative activity even if the principal does not invest in either period. The agent's utilities are

$$U_A(i^*,1) = 1 - \frac{2}{(\delta\bar{s})^{\frac{1}{3}}} + \frac{1}{(\delta\bar{s})^{\frac{2}{3}}}$$
$$U_A(i^*,2) = 1 - \frac{2}{\left(\delta^2\bar{s}\right)^{\frac{1}{3}}} + \frac{1}{\left(\delta^2\bar{s}\right)^{\frac{2}{3}}}$$

In contrast, if the initial level is so low that it falls short of the threshold $X_{\Pi_{P1,1}}$ in Equation (2.12), then the principal optimally chooses not to invest in either period and no innovation takes place. The agent's utilities then are

$$U_A(i^*,1) = 0$$
$$U_A(i^*,2) = 0$$

No investments for a high and a low initial amounts and the resulting development of Autonomy Support levels are depicted in Pattern IIIa and Pattern IIIb in Figure 2.4.2.

Pattern	Thresholds					Investment
IIIb			$\bar{s}$	$<$	$X_{\Pi_{P1,1}}$	no
I	$X_{\Pi_{P1,1}}$	$\leq$	$\bar{s}^i$	$<$	$\frac{1}{\delta}\left(\frac{v_P}{\alpha}\frac{1}{2(1-\beta\delta)}\right)^{\frac{2}{3}}$	$t=1,2$
II	$\frac{1}{\delta}\left(\frac{v_P}{\alpha}\frac{1}{2(1-\beta\delta)}\right)^{\frac{2}{3}}$	$\leq$	$\bar{s}^{ii}$	$<$	$\frac{1}{\delta^2}\left(\frac{1}{2}\right)^{\frac{2}{3}}\left(\frac{v_P}{\alpha}\right)^{\frac{2}{3}}$	$t=2$
IIIa	$\frac{1}{\delta^2}\left(\frac{1}{2}\right)^{\frac{2}{3}}\left(\frac{v_P}{\alpha}\right)^{\frac{2}{3}}$	$\leq$	$\bar{s}^{iii}$			no

Table 2.4.1: Thresholds for low future benefit investment patterns

Table 2.4.1 displays an overview of the thresholds for all low future investment patterns. For given parameter values the principal prefers investing only in the second period when the agent's initial level of Autonomy Support is high enough.

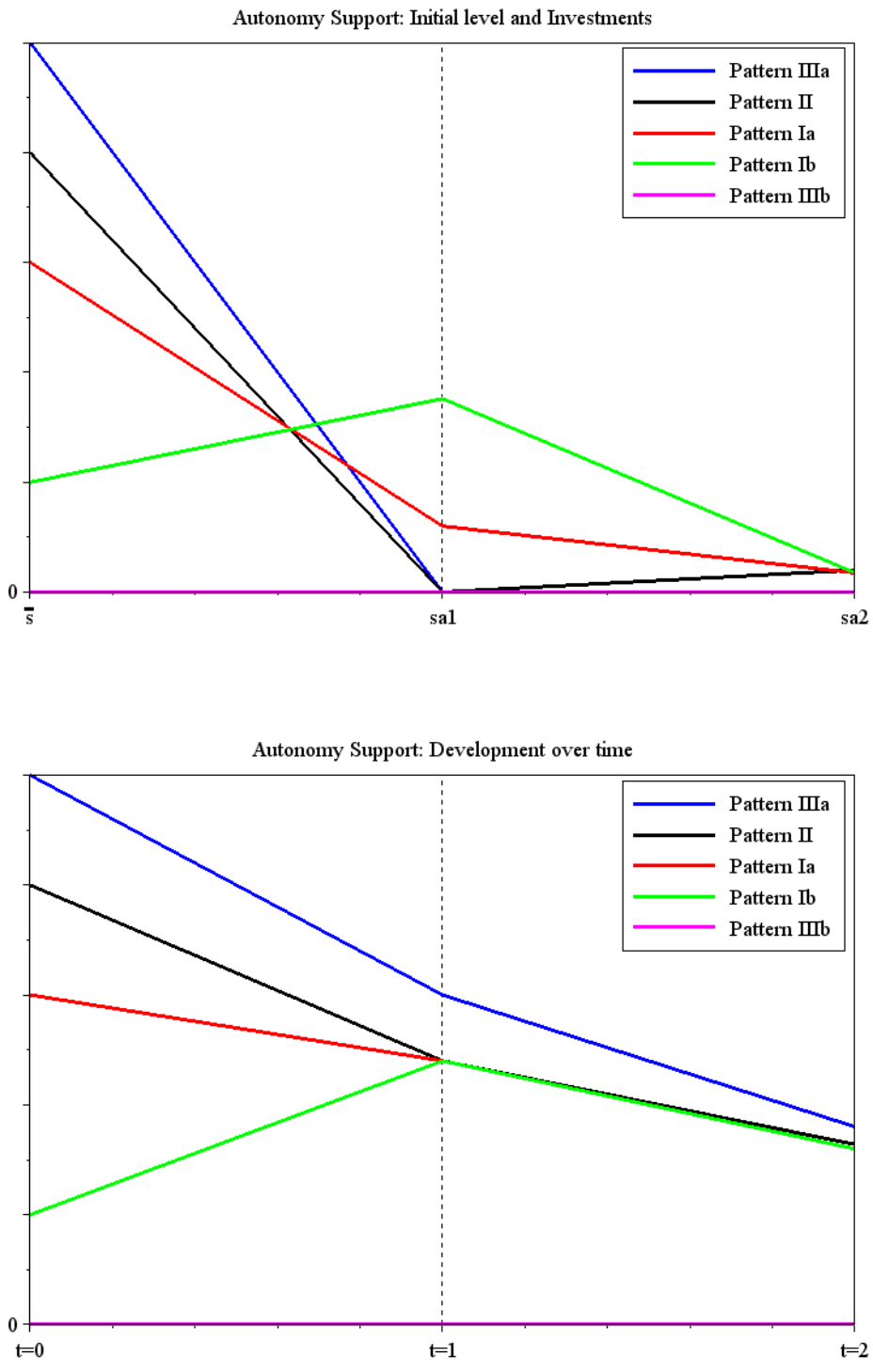


Figure 2.4.2: Development of Autonomy Support for low future benefit investment patterns

High future benefit investment patterns under $\frac{1}{\delta} - \sqrt{\delta} \leq \beta$

Pattern IV: Investment only in first period

With the relationship $\frac{1}{\delta} - \sqrt{\delta} \leq \beta$, it holds that

$$\begin{aligned} s^*_{a,2} &= \left(\frac{1}{2}\right)^{\frac{2}{3}} \left(\frac{v_P}{\alpha}\right)^{\frac{2}{3}} - \delta^2 \bar{s} - \delta s^*_{a,1} \\ &= \left(\frac{1}{2}\right)^{\frac{2}{3}} \left(\frac{v_P}{\alpha}\right)^{\frac{2}{3}} \left(1 - \delta \left(\frac{1}{1-\beta\delta}\right)^{\frac{2}{3}}\right) \leq 0 \end{aligned}$$

and the principal always optimally chooses $s^*_{a,2} = 0$.

Further, the principal invests in Autonomy Support in period $t = 1$ only if

$$\frac{1}{\delta}\left[\frac{v_P}{2\alpha}\left(1 + \frac{\beta}{\sqrt{\delta}}\right)\right]^{\frac{2}{3}} > \bar{s}^{iv} \tag{2.15}$$

however, this equation takes a different value than in Pattern I.

Inserting $s^*_{a,1}, s^*_{a,2}$ in the time interdependent profit function of period $t = 1$, we can derive a lower bound $X_{\Pi_{P1,2}}$ that ensures that the principal invests in $t = 1$:

$$\bar{s}^{iv} \geq \frac{1}{\delta}\frac{v_P}{\alpha}\left[\left(\frac{1}{2(1-\beta\delta)}^{\frac{2}{3}}\left(\frac{v_P}{\alpha}\right)^{-\frac{1}{3}}\right)(2(1+\frac{\beta}{\sqrt{\delta}})^2 + 1) - (1+\beta)\right] \equiv X_{\Pi_{P1,2}} \tag{2.16}$$

The resulting utilities for the agent are

$$\begin{aligned} U_A(i^*, 1) &= 1 - \frac{2}{\left(\left[\frac{v_P}{2\alpha}\left(1 + \frac{\beta}{\sqrt{\delta}}\right)\right]\right)^{\frac{1}{3}}} + \frac{1}{\left(\left[\frac{v_P}{2\alpha}\left(1 + \frac{\beta}{\sqrt{\delta}}\right)\right]\right)^{\frac{2}{3}}} \\ U_A(i^*, 2) &= 1 - \frac{2}{\left(\left[\delta\frac{v_P}{2\alpha}\left(1 + \frac{\beta}{\sqrt{\delta}}\right)\right]\right)^{\frac{1}{3}}} + \frac{1}{\left(\left[\delta\frac{v_P}{2\alpha}\left(1 + \frac{\beta}{\sqrt{\delta}}\right)\right]\right)^{\frac{2}{3}}} \end{aligned}$$

The principal matches his investment to the agent's initial level in the first period such that he exerts optimal innovative effort in both periods. With varying initial levels, the pattern for development over time can take the shape of Pattern IVa or Pattern IVb, steadily decreasing or hump-shaped, as depicted in Figure 2.4.3.

Pattern V: No investment

If the initial Autonomy Support exceeds the threshold in Equation (2.15)

$$\bar{s}^{\nu} \geq \frac{1}{\delta}\left[\left(\frac{\nu_P}{2\alpha}\right)\left(1+\frac{\beta}{\sqrt{\delta}}\right)\right]^{\frac{2}{3}} \tag{2.17}$$

then it sufficiently big to encourage innovative activity in both periods without investments by the principal. In contrast, if the initial amount of Autonomy Support is so small that it falls short of the threshold in Equation (2.15), the principal does not find it worthwhile to invest in Autonomy Support at all. For high or low initial levels, the investments are depicted in Patterns Va and Vb in Figure 2.4.3, respectively.
The resulting utilities are as in Pattern III, albeit with parameters satisfying $\frac{1}{\delta} - \sqrt{\delta} \leq \beta$.

Table 2.4.2 displays an overview of the thresholds for high future benefit investment patterns. For given parameter values the principal prefers investing only in the first period when the agent's initial level of Autonomy Support is high enough.

Pattern	Thresholds					Investment
Vb			$\bar{s}$	$<$	$X_{\Pi_{P1,2}}$	no
IV	$X_{\Pi_{P1,2}}$	$\leq$	$\bar{s}^{i\nu}$	$<$	$\frac{1}{\delta}\left[\frac{\nu_P}{2\alpha}\left(1+\frac{\beta}{\sqrt{\delta}}\right)\right]^{\frac{2}{3}}$	$t=1$
Va	$\frac{1}{\delta}\left[\frac{\nu_P}{2\alpha}\left(1+\frac{\beta}{\sqrt{\delta}}\right)\right]^{\frac{2}{3}}$	$\leq$	$\bar{s}^{\nu}$			no

Table 2.4.2: Thresholds for high future benefit investment patterns

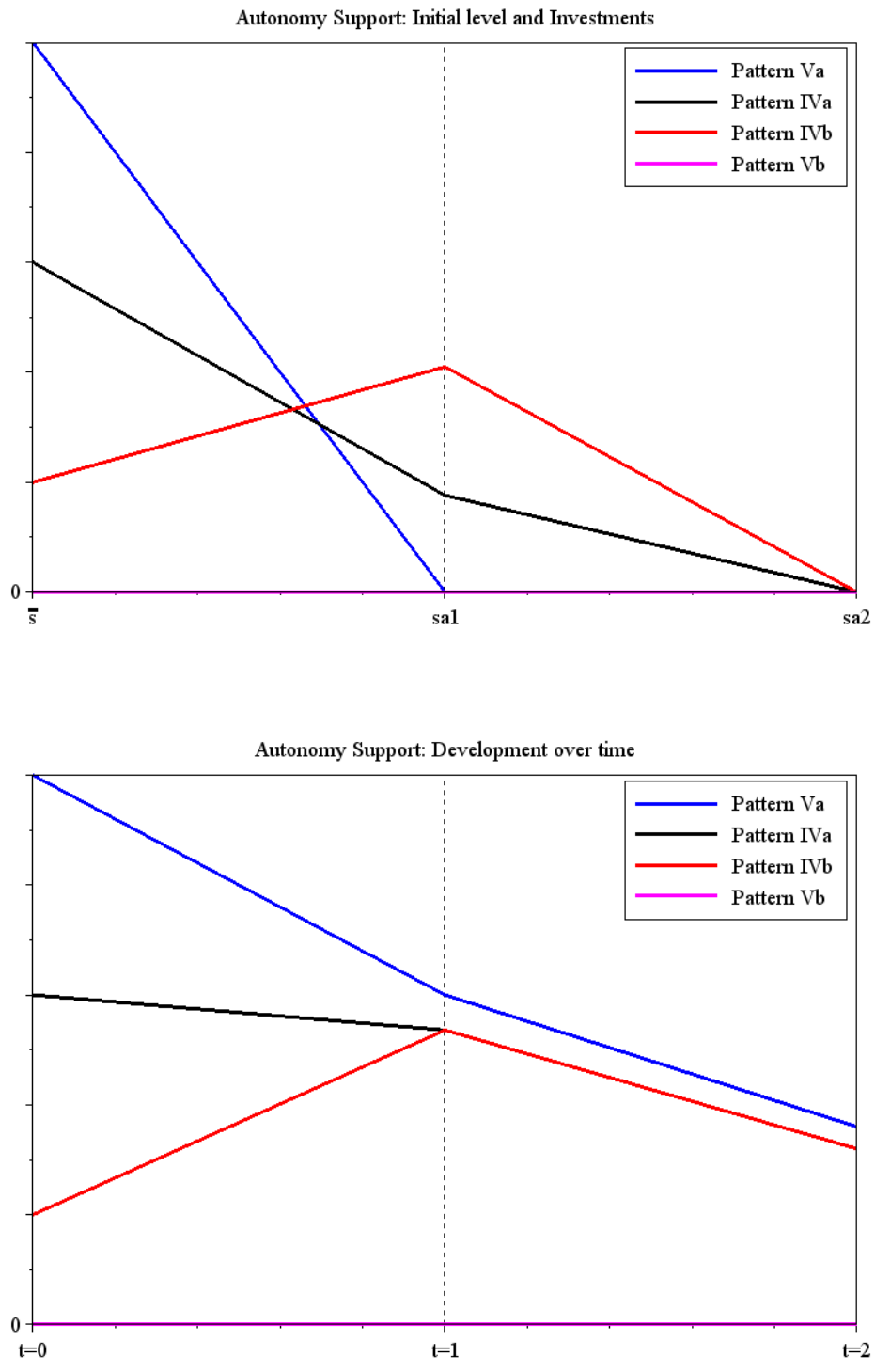


Figure 2.4.3: Development of Autonomy Support for high future benefit investment patterns

2.5 Discussion and implications

More attractive investments in Autonomy Support, let that be because of higher payoff v_P or lower cost α, naturally result in higher investments, and potentially investments in more time periods, as can be seen in Tables 2.4.1 and 2.4.2.

For both β-δ relationships and a given benefit-cost ratio $\frac{v_P}{\alpha}$, we find a certain substitutability[4] between $\bar{s}$ and the principal's investments, following the literature that investments additively impact a worker's creative inclination (Hagger et al., 2015). The more the agent feels encouraged to be active in innovation at the start the work relationship, the less must the principal invest in order to maintain that motivation. Substitutability does not infer, however, that for individuals with high initial levels Autonomy Support investments are futile. Even for rather high levels of initial Autonomy Support we find positive investments in at least one period by the principal. This reflects the finding that it cannot be taken for granted that workers creative at the beginning of a work relationship remain so (Mumford et al., 2002).

In those cases where the agent's initial level and the level required to achieve the optimal innovation effort choice do not diverge too strongly, the principal matches their difference with her investment as depicted in Figures 2.4.2 and 2.4.3. The difference is co-determined by the rate at which the initial level and further investments are depreciated as well as the valuation of the principal for future periods. Our model hence captures the notion that individuals have different Autonomy Support requirements to succeed at different points in time, and that appropriate intensity of Autonomy Support investments position them to be successful (Shalley et al., 2009).

For those situations where the principal only invests in one of the two periods, the β-δ relationship determines in which period the investment is done. When the principal's valuation of the next period exceeds the depreciation term ($\frac{1}{\delta} - \sqrt{\delta} \leq \beta$), she invests 'in advance' in the first period such that the Autonomy Support given carries over to the second period and still encourages innovative activity. This reflects a result in the innovation management literature that Autonomy Support in the form of encouragement is particularly important at early stages of an innovative project, while Autonomy Support in the form of partaking in the deci-

[4] The model with complementarity between the initial level and investments is derived in the Mathematical Appendix A.3. We show that complementarity only eliminates the u-shaped Pattern II and no investment Pattern V for high initial levels of Autonomy Support.

sion process and control over the implementation becomes more important in later periods (Axtell et al., 2006). It seems plausible to assume that the latter is less time-intensive for the principal and can be described by her lower investments in Autonomy Support at the later period. This is also in accordance with a situation where the principal has a high valuation of future periods: if she manages the entire project from the first creative idea up to the implementation, she likely is forward looking and rather invests in advance instead of supporting her worker only at later stages of the project.

We observe the possibility of a u-shape of Autonomy Support investments in Pattern IIb when either or both of β and δ are low ($\frac{1}{\delta} - \sqrt{\delta} \geq \beta$). Although relying on the agent's initial level in the first period, the principal touches up the depreciated Autonomy Support in the second period. This result is surprising: intuitively, one expects that the principal refrains from investments in the last period of the work relationship. The expected profit from innovation in the second period is enough for her to make that investment nonetheless. Considering the notion that the principal only provides Autonomy Support as required to achieve innovative activity, the principal can optimally decide to let initial levels deteriorate and invest only in the last period. As this result is possible even when the principal has all information and acts rationally, it stands to reason that this case gains importance when the principal is not fully informed. For example, a principal in a company that has not done Autonomy Support before may not be fully aware of the potential benefits v_P from innovative activity or the actual costs α of providing support, or how quickly Autonomy Support discounts at rate δ. In the course of managing her workforce, she learns about these dimensions and adjusts her optimal investment decision accordingly.

We find that the principal optimally chooses not to invest if the agent's initial Autonomy Support level exceeds a high threshold (Equations 2.14, 2.17), that allows innovative activity without any investments. These thresholds are key: the principal does not choose to invest because she does not see worth in Autonomy Support, but for a given benefit-cost ratio $\frac{v_P}{\alpha}$ that co-determines the thresholds it is not optimal for her to do so. This adds nuance to the notion that some companies rely on agent's creativity because they do not want to invest (Mumford et al., 2002). Instead, they may not find it optimal, and workers still exert innovation effort. On the reverse, the benefit-cost ratio may not allow the principal to invest and build up Autonomy Support in agents that arrive with a very low initial level.

The intuition of the investment dynamics of our two period model can easily be transferred to a multiple period model. Investments then carry over to more than one subsequent period and positively influence the principal's profit potentially longer. As in our two period model, the principal only aims for a lower level of innovative activity i in the last period. With more periods, her investments in earlier periods are higher and fade out towards the end of the relationship. The distinction in our results with respect to the β-δ relationship becomes less important. In either case, we expect a wave pattern of investments. In the low investment case, the principal restocks the Autonomy Support depreciated from the previous period, and in the high investment case, the principal invests in advance and lets it depreciate in the next period. But this only matters for the initial investments. Afterwards, the principal ensures the optimal long term innovative effort by maintaining it with her investments. This means that at some point, the principal replenishes the depreciated Autonomy Support even of an agent with a very high initial level. In the intermediate periods of the model, we expect rather stable expected profits and utilities from innovative activity. The picture is less clear for agents who enter the company with such a low level of Autonomy Support that in our version, the principal refrains from investment. With more periods, the threshold for not investing would be lower, as the principal would forego more profits over time. This renders it potentially interesting to build such a worker's Autonomy Support 'from scratch'. Considering real life employment relationships and life cycles, this seems plausible. Only under the conceivably worst starting condition do investments in Autonomy Support not positively impact a person's activity and unleash creative potential. The notion that growth is inherently possible, and desirable, for everyone is perfectly in line with Self-Determination Theory.

Thus far, the depreciation rate is assumed to be agent-specific. However, we can also understand δ to be an environmental variable. Supervisors' choice of providing Autonomy Support has a strong impact on workers' innovative efforts that can diverge even within a company (Amabile et al., 2004), and Autonomy Support is relationship-specific between supervisor and worker. If the company has an organizational structure prone to disrupting this relationship, e.g. a tendency for unexpected job rotation or restructuring, at least part of the Autonomy Support is lost because it is not necessarily attributed the company, but the specific supervisor. The company then influences innovative activity not only through investments via the supervisor, but also whether it allows these investments to last. This suggests that δ as an

environmental variable is correlated with investments in Autonomy Support: the more easily the organizational structure disrupts supervisor-worker relationships, the more important become supervisors' investments. This interpretation can be incorporated in the model by allowing investments in Autonomy support to also influence a period-specific depreciation rate.

Our model further indicates that agents with varying start values of Autonomy Support derive similar utilities from being innovatively active. Only those with start values so high that they prevent further investments thrive above, while those with start values so low that no investments are made have no utility. This underlines our understanding that people value being allowed to be creative, but also adds to the bigger notion that they value being autonomous: not only appreciating results, but also the processes that lead to results (Benz and Frey, 2008). Transferring our findings to real world scenarios indicates that for longer relationships, reflected in a multiple period scenario, Autonomy Support is more likely provided continuously. The first investment, as in the first period of our model, depends on the β-δ relationship. When they are high, such that both parties expect high future benefits, the supervisor engages in sizable Autonomy Support investments right from the start. When one or both are low, the principal anticipates low future benefits, such that the first investment is rather small. As such, high Autonomy Support investments can be understood as part of an on-boarding process where both parties expect the work relationship to last. We believe that screening for Autonomy Support in the recruitment process occurs even in the absence of specific measurements. Previous Autonomy Support is reflected in previous behaviours and choices of the agent, which may at least be in part observable, e.g. in the CV or recommendation letters. In an ongoing work relationship, the current need for Autonomy Support investments may be detected by employing questionnaires for perceived Autonomy Support (Hagger et al., 2007; Mageau et al., 2015) such that the principal can react to it. Even creative workers are in need of an Autonomy Supportive leadership behaviour (Mumford et al., 2002) to preserve their efforts. Regarding the benefit-cost ratio, companies may be concerned about costs in training team leaders in Autonomy Support[5] as to introduce Autonomy Support. We would expect trained team leaders to then actually have a lower marginal cost α. Even then, assessing the potential benefit from small scale innovation v_P is hard, especially when a company has no prior

[5] Fixed costs do not change the results of our model, but slightly shift the thresholds.

experience in innovating. We believe this may be the most constraining factor in providing Autonomy Support. In the example of Toyota and its opponent GM, GM apparently did not believe its workforce capable of innovation resulting in profits, such that the thought of providing Autonomy Support may have never occurred.

In this paper we focus on investments in Autonomy Support that encourage innovative activities. Autonomy and Autonomy Support however have been generally found to positively impact well-being and performance of individuals (Gagné and Deci, 2005). A natural extension of our model is therefore to include a standard task. We make the case that Autonomy Support must be properly designed to be encourage innovation. But as this involves looking deeply into the task at hand and how to improve it, it seems obvious that even Autonomy Support tailored towards innovative activity would to some extend spill over to effort in the standard task. As this increases the principal's profits from innovation and regular business from the same investments, it amounts to an increase in v_P in our model, resulting in higher investments, investments in more periods, and investments for agents with smaller initial amounts of Autonomy Support. The interaction between standard and innovative task could, for example, be captured by allowing successful innovation to directly reduce effort costs in the standard task. Additionally to the agent's benefit from innovation v_A, currently the utility from being active, this generates a direct utility advantage. Generally, a model incorporating the standard task needs to include a monetary exchange. As shown in the literature review, monetary incentives do not facilitate generating creative ideas, posing the interesting question of whether innovation efforts should be compartmentalized as to not be perceived to have monetary rewards.

2.6 Conclusion

Our research contributes to the discussion on optimal management practices. Instead of isolating the effect of a single management practice, we focus on the impact of Autonomy Supportive leadership behaviour on innovative effort. Leadership behaviour is not contingent on a specific management practice, it can or cannot arise within one structure (Amabile et al., 2004), but may more readily appear in a management practice designed for support, such as in our introductory example of Toyota's Kaizen. Nonetheless, Autonomy Support fosters a

feeling of Autonomy, an innovative action, only when given frequently, and in accordance to the worker's need. Providing this Autonomy Support is therefore an investment on behalf of the supervisor.

In this paper, we demonstrate the optimal investment patterns in Autonomy Support over time that fosters small scale innovation. Small scale innovation describes creative, unconstrained innovative efforts of an agent. We review research showing that monetary incentives are restricted in their effectiveness for unconstrained innovation but that an Autonomy Supportive leadership behaviour successfully instills innovative efforts. Leadership behaviour unfolds over time, as a single intervention's effectiveness fades out over time. Informed by the literature, we build a two period model of the principal's optimal investments in Autonomy Support. We find that when the principal values future benefits from innovative effort, she tends to invest already in the first period. When future benefits are not strongly valued, the principal tends to retouch depreciated Autonomy Support levels in the second period. Our model also suggests a certain substitutability between investments and the agent's initial Autonomy Support level, which he has accrued in previous (personal or professional) relationships. However, screening for agents with high initial Autonomy Support, or creativity levels, does not resolve the need to invest in Autonomy Supportive leadership behaviour, echoing the literature (Mumford et al., 2002). Expanding the results of our two period model indicates that even individuals with relatively high initial levels should be invested in at some point to preserve their innovative efforts. Workers endowed with almost zero initial Autonomy support receive no investments in our model; with a wide time horizon, investments in them become more likely.

One can argue that some supervisors already manage their workforce intuitively in this way. However, as a non-monetary incentive, Autonomy Support may have interactions with other incentives and should be provided consciously and in a structured way. As is the case with incentives in general, Autonomy Support must be tailored to be conducive to the desired outcome, in our case innovation, and given in the required intensity. Our research contributes thus to the discussion on non-monetary incentives, but we do not add yet another tool to the incentive toolbox. The concept of Autonomy Support touches upon motivation through decision rights, rewards, verbal praise and knowledge sharing, but encompasses these factors to feed into a feeling of Autonomy that successfully instills motivation (Gagné and Deci, 2005).

In this, Autonomy Support allows us to expand our understanding of how known incentives effectively work together. We further point towards time dependent need and effectiveness of incentives.

We also demonstrate that different leadership behaviour intensity can constitute optimal Autonomy Support, as optimal investments depend on the agent's initial level. Leadership of a team then entails that the same action inspires different levels of Autonomy Support for each group member. It is therefore the responsibility of the team leader to understand which actions and behaviours must be taken on a team and which on an individual level in order to provide the Autonomy Support needed for each team member. With an Autonomy Supportive leadership style, the supervisor outgrows the role of controlling the workforce; she becomes a service provider who helps her team achieve the best for the entire organization.

Chapter 3

Autonomy and Recruitment

3.1 Introduction

This paper investigates how granting Autonomy affects the principal's ability to recruit agents whose characteristics favour either efficiency in conducting everyday tasks or productivity in project management. We pinpoint how the principal's choice of granting Autonomy in the overall organizational structure can discourage successful recruitment exactly for those workers who are most valuable to her for a given job comprising project and task work. We demonstrate that a principal prefers granting Autonomy when project management is relatively more important to her expected profit, and when Autonomy-oriented agents experience high mismatch costs in a controlling organizational structure. Our work contributes to the discussion on strategic complements in Human Resource Management (e.g., Englmaier and Schüßler (2016)), with a view to recruitment.

Autonomy describes a person's feeling of volition and freedom (Gagné and Deci, 2005). Self-Determination Theory identifies it as one of the three basic needs (the other two being relatedness and competence) that must be satisfied for a person's psychological well-being and functioning. Autonomy is distinct from independence (separation from others) and authority (power over others), but can overlap with these concepts.[1] We rely in this paper on the definition from Self-Determination Theory because it allows us to inspect both a personal

[1] One can argue that a feeling of freedom arises in a person who can take care of herself independent of others, as well as in a person who exerts power over others rather than being controlled. Power over others has however not been found to be associated with a feeling of personal power (Leach et al., 2017).

preference for this feeling of Autonomy as well as organizational factors that influence it.

Self-Determination Theory states that people strive to feel more autonomous in their lives. Economic studies find that people strive for being autonomous in the work domain as this creates higher job satisfaction, and some realize this by choosing self-employment over a paid position at a company (e.g. Benz and Frey (2003); Lange (2012); Hurst and Pugsley (2011)). They are willing to incur a substantial income loss by being self-employed which is not explained by ability (Hamilton, 2000). One stream of literature in Self-Determination Theory shows that individuals differ with respect to what the source for their behaviour and motivation is. Individuals with an Autonomy orientation tend to initiate and control their own behaviour and choices, and choose contexts in which they feel self-determined, i.e. "select jobs that allow greater initiative" (Deci and Ryan, 1985). In contrast, individuals' behaviour under a Control orientation is governed by internal and external controls, such as norm obedience, rewards, monitoring and deadlines (Deci and Ryan, 1985).

Thus, both social psychology and economics suggest that people value a feeling of Autonomy, but that the valuation differs across people. Our model captures this heterogeneity by assuming that individuals have different preferences for the feeling of Autonomy. Specifically, we assume that an agent (he) prefers a certain degree of feeling autonomous, or put differently, has a personal Autonomy level A_A. A high level of personal Autonomy entails initiative and self-control in behaviour and is also associated with a proclivity for self-regulated learning (Niemiec and Ryan, 2009). Project based jobs, such as in consultancy or programming, often require that employees shape the project, introduce new approaches, and are willing to teach themselves additional skills. Individuals with a high level of personal Autonomy are more comfortable and efficient in such project based jobs. From a company perspective, the cost to train employees in project management in order to achieve the same productivity gain is lower for those individuals with higher personal Autonomy levels. At the same time, the work environment must allow and foster, not impair, individuals to act out their Autonomy level, such that they learn better (Fazey and Fazey, 2001; Liu and Fu, 2011).

Companies develop an organizational structure, especially when expanding, to standardize and simplify operational procedures. A strong organizational structure facilitates efficiency, accountability through documentation, and measurement of performance. Streamlining of operational procedures evolves gradually and for tasks that occur repeatedly and continu-

ously. Efficiency arises from the employer's control over and through the task, and does not allow for initiative and choice. A strict organizational structure avoids inefficiencies and corresponds to a low level of Autonomy granted. We describe the degree to which a firm grants Autonomy on the task level to employees as A_F, reflecting the rigidity of the organizational structure. Individuals with a Control orientation, in other words, with a low personal Autonomy level, prosper at strongly organized tasks. Project related work by nature cannot be as rigidly structured.

A mismatch between the Autonomy granted at a firm A_F and the agent's personal Autonomy level A_A results in private cost for the agent. When a Control oriented person finds himself in a work environment with little structure, demanding him to initiate and learn on his own terms, he experiences stress and overload. Individuals with a Control orientation seem to have more difficulty dealing with stress (Weinstein and Hodgins, 2009), e.g. being more likely to display road rage (Knee et al., 2001). In contrast, individuals with an Autonomy orientation derive well-being from Autonomy (Schüler et al., 2016). An Autonomy oriented person may feel curtailed to live out his zeal for initiative and choice in a strict - and in his perspective, confining - organizational structure, and experience frustration (Cottini and Lucifora, 2013). We assume that the further the agent's and the firm's Autonomy levels diverge, the higher is the emotional stress and private cost to the agent.

This mismatch between organizational structure and the agent's Autonomy level is decisive at the recruitment stage. A company may not be able to have the best of both worlds when jobs necessitate both project and task related work: employing an efficient, tight organizational structure at the everyday task level, and be an attractive employer for autonomous, driven project workers. The tension between the Autonomy levels translates into a trade-off for the principal. She can focus on reducing her cost by hiring agents close to her Autonomy level, thereby decreasing the probability that an agent accepts her contract offer, or expanding her recruitment profile and compensating agents further from her for their private cost. This trade-off becomes more nuanced when the efficiency in tasks from rigid organizational structures and the productivity in projects from autonomous agents have varying weight. It further demonstrates that a company must carefully choose its organizational structure that regulates the trade-off. Too stringent work processes suffocate its appeal to part of the workforce and chances for recruitment.

The issue of how organizational structures and job design affect recruiting and retaining workers increasingly gains momentum. Building on their extensive research on job design, Oldham and Hackman (2010) comment that "the design of work is now inextricably bound up with the structures and processes of organizational systems more generally." Changes in technology promise more flexibility such as working from home, but can also be used for stronger monitoring, e.g. on the website Upwork, which regularly takes screenshots of the freelancers to monitor their work (UpworkGlobal, 2019). Simultaneously, demands of potential employees change: A survey among German students (Ernst & Young, 2018) reveals that, apart from job security and income, flat hierarchies and the possibility for autonomous working are important factors in potential employers they look for. Companies can decide to meet these changes by changing the organizational structure to attract these workers. Novartis is an example for this, having recently introduced 'un-bossing' and its CEO Vasant Narasimhan placing emphasis on servant leadership (Gharib, 2019), or Google promising that 20% of work time are at free disposal to the worker.

The paper is structured as follows: We introduce the base model incorporating only the mismatch and demonstrate the trade-off arising from Autonomy considerations at the recruitment level. We then examine the distinct effects of productivity increases through the agent's initiative in project related work and efficiency gains through a clear organizational structure in task related work on the principal's optimal Autonomy positioning. The compelling picture when the two interact is presented. Lastly, we analyze our results, discuss their implications, and conclude.

3.2 A model of Autonomy in recruitment

We investigate the impact of Autonomy on recruitment in a principal-agent model. Both the Autonomy levels of the firm and the agent are uniformly distributed on the $[0,1]$ interval.
The time line of our model is as follows: first, the firm chooses an Autonomy level A_F from the interval. The principal (she) then chooses both the piece rate w and the flat payment w_0. They jointly determine whether the agent accepts the offered contract and the principal's profit conditional on the worker accepting the contract. Then, the agent's Autonomy level A_A is drawn. The agent (he) decides whether he accepts the contract offered by the principal or takes the outside option U_0, which we assume to be $U_0 = 0$.
The agent knows his own Autonomy level A_A and can observe the Autonomy level of the firm A_F. We capture the mismatch cost that the agent experiences when the two do not perfectly coincide with the absolute value function $|A_A - A_F|$. This displays that the personal cost of the agent is the same irrespective of whether his Autonomy level goes, at an equal distance, beyond or below the firm's Autonomy level. The mismatch costs parameter γ is the weight with which this mismatch enters the agent's utility function. The principal can only observe whether the agent accepts the contract, not a recruited agent's specific A_A.

3.2.1 Base case with Autonomy mismatch

In the basic setup of our model, only the mismatch of the Autonomy levels impacts the agent's utility function. We solve the model by backward induction.
The agent maximizes his utility via his effort choice

$$\max_e U(e|A_A, A_F) = (w_0 + we - \frac{1}{2}e^2) - \gamma|A_A - A_F| \tag{3.1}$$

given the principal's contract offer specifying the piece rate w and flat payment w_0. The agent optimally chooses an effort level equal to the piece rate

$$e^* = w \tag{3.2}$$

and accepts the contract if the utility he derives under his optimal choice exceeds his outside option (Individual Rationality constraint), which, without loss of generality, we simplify to be zero:

$$U^*(e^*|A_A, A_F) = w_0 + \frac{1}{2}w^2 - \gamma|A_A - A_F| \geq U_0 = 0 \tag{3.3}$$

The principal's profits comprise of revenue less wage payments to the agent

$$\max_{w,w_0} \Pi = (r-w)e^* - w_0 = r\,w - w^2 - \gamma|A_A - A_F| + \frac{1}{2}w^2 - U_0$$

such that she optimally sets the piece rate equal to the revenue and extracts a flat payment equal the agent's surplus

$$w^* = r \qquad\qquad w_0^* = \gamma|A_A - A_F| - \frac{1}{2}r^2 + U_0. \tag{3.4}$$

The principal makes a non-negative profit if

$$-w_0^* \geq 0 \Longleftrightarrow \frac{1}{2}r^2 - \gamma|A_A - A_F| \geq 0.$$

and the Individual Rationality constraint ensures that the wage bill is never negative

$$\textit{wage bill} = w_0 + we = w_0 + r^2 \geq 0 \Longleftrightarrow \frac{1}{2}r^2 + \gamma|A_A - A_F| \geq 0.$$

Feasible range

The higher the mismatch in Equation (3.1), the more must the agent be monetarily reimbursed for the mismatch in order to accept the principal's contract offer. As a first step we derive the Autonomy levels of those agents who would just be indifferent to accepting the contract. These Autonomy levels at the bounds confine the feasible range which describes the maximal probability to successfully recruit an agent. We include the principal's contract (w^*, w_0^*) from Equation (3.4) and rearrange the binding Individual Rationality constraint in

Equation (3.3) to obtain

$$|A_A - A_F| = |A_F - A_A| = \frac{r^2}{2\gamma}$$

which describes the distance from A_F to the outermost feasible A_A. This distance is valid to both sides of A_F, such that the feasible range is

$$\begin{aligned} \textit{feasible range} &= \bar{A}_A - \underline{A}_A \\ &= (A_F + \frac{r^2}{2\gamma}) - (A_F - \frac{r^2}{2\gamma}) \\ &= 2 * \frac{r^2}{2\gamma} \end{aligned}$$

As the principal can only observe if the agent accepts the contract, she cannot observe the specific A_A of a successful recruit and renegotiate the contract. Her expected profit under the feasible range

$$\begin{aligned} E[\Pi] &= \textit{feasible range} * \left[(r - w^*)e^* - w_0^*\right] \\ &= 2 * \frac{r^2}{2\gamma} * [(r - r)r - 0] = 0 \end{aligned}$$

is therefore zero.

Optimal range

If the principal wants to make non-zero profits, she faces a trade-off. On the one hand, she increases the flat payment she extracts in her contract offer (w, w_0). This makes the profit conditional from an agent accepting the contract positive. On the other hand, agents at the fringes of the feasible range do not accept the contract with the increased flat payment to the principal. This results in a smaller probability to successfully recruit a randomly drawn agent, which we call the recruitable range. We use the Individual Rationality constraint in Equation (3.3) that depends on the wage schedule to describe the recruitable range. The principal max-

imizes her expected payoff function via the wage schedule

$$\max_{w,w_0} E[\Pi] = \underbrace{2\left[\frac{w_0}{\gamma} + \frac{w^2}{2\gamma}\right]}_{\substack{recruitable \\ range}} \underbrace{\left[r\,w - w^2 - w_0\right]}_{\substack{conditional \\ profit}}$$

to balance the two forces on the agent of conditional profit upon accepting and probability of accepting the contract. The resulting optimal contract offer

$$w^* = r \qquad\qquad w_0^* = \frac{-r^2}{4}$$

determines the optimal recruitable range and thus the probability to successfully hire an agent to be

$$\begin{aligned} optimal\ range &= \bar{A}_A^* - \underline{A}_A^* \\ &= 2\left[\frac{w_0^*}{\gamma} + \frac{w^{*2}}{2\gamma}\right] \\ &= 2 * \frac{r^2}{4\gamma}. \end{aligned}$$

In combination, this optimal range and conditional profit generate a positive expected profit for the principal of

$$E[\Pi] = \frac{r^4}{8\gamma}.$$

With the assumed functional form of the mismatch, the flat payment to the principal doubles and the probability to successfully recruit is cut in half in comparison to the feasible range. This yields in contrast to the feasible range a non-zero expected profit. We find that the piece rate, and with it the agent's effort choice, remain unchanged.

Our results hold whenever the principal can fully realize the optimal range on the unit interval. Full realization of the optimal range means that she can attract as many agents with lower Autonomy levels (to her left on the unit interval) as agents with higher Autonomy levels (to her right on the unit interval) than her own A_F. Her A_F must therefore be within bounds inside the unit interval to ensure the optimal range is fully realized. We derive these bounds

from the fact that the agent furthest away from her must still be part of the unit interval.

$$\begin{aligned} \underline{A}_A &= A_F - \frac{r^2}{4\gamma} \geq 0 \quad \Longleftrightarrow A_F \geq \frac{r^2}{4\gamma} \\ \bar{A}_A &= A_F + \frac{r^2}{4\gamma} \leq 1 \quad \Longleftrightarrow A_F \leq \frac{4\gamma - r^2}{4\gamma} \end{aligned} \tag{3.5}$$

When the conditions in Equations (3.5) are not satisfied by the principal's A_F, the optimal range is truncated, diminishing the chances for successful recruitment. We derive the principal's optimal contract offer when her A_F is so small (on the left hand side of the unit interval, short: LHS truncated profit function) or so big (on the right hand side of the unit interval, short: RHS truncated profit function) that she cannot aim at recruiting as many agents to either side of her.

LHS truncated profit function

Having drawn a small A_F not satisfying Equations (3.5), the principal takes into account that she can use Equation (3.3) only to her right. To her left, she can recruit agents between $[0, A_F]$. She adjusts the recruitable range of her maximization problem and optimizes

$$\max_{w,w_0} E[\Pi] = \left[A_F + \frac{w_0}{\gamma} + \frac{w^2}{2\gamma} \right] \left[r\,w - w^2 - w_0 \right]$$

which leads to an optimal choice of the same efficient piece rate as in the untruncated range, but a larger extracted flat payment of

$$w^* = r \qquad\qquad w_0^* = -\frac{A_F\gamma}{2} - \frac{r^2}{4}$$

resulting in an expected profit of

$$E[\Pi] = \frac{A_F^2\gamma}{4} + \frac{A_F r^2}{4} + \frac{r^4}{16\gamma}$$

RHS truncated profit function

Similarly, having drawn a high A_F that does not satisfy Equations (3.5), the principal considers that she can only attract $(1 - A_F)$ of the workforce to her right while using Equation (3.3) to her left. With an adjusted recruitable range she maximizes

$$\max_{w,w_0} E[\Pi] = \left[(1 - A_F) + \frac{w_0}{\gamma} + \frac{w^2}{2\gamma}\right]\left[r\,w - w^2 - w_0\right]$$

leading to again a larger extracted flat payment and unchanged piece rate

$$w^* = r \qquad\qquad w_0^* = -\frac{(1 - A_F)\gamma}{2} - \frac{r^2}{4}$$

and an expected profit of

$$E[\Pi] = \frac{(1 - A_F)^2\gamma}{4} + \frac{(1 - A_F)r^2}{4} + \frac{r^4}{16\gamma}$$

Implications of an Autonomy mismatch

The basic setup of our model demonstrates the relationship between an Autonomy mismatch and recruitment considerations. The principal is confronted with a workforce heterogeneous in Autonomy and must account for a potential mismatch. Agents with a mismatch must be compensated to accept the contract, but the principal can leverage the circumstance to her advantage. She designs her contract offer to be attractive to agents closer to her Autonomy level, thereby consciously choosing to limit the probability of a successful hire. Simultaneously, she can extract higher flat payments from those agents her contract is interesting to. The agent's optimal effort choice and piece rate remain undistorted. Only through her recruitment policy the principal achieves a higher expected profit. This recruitment policy is influenced by the productivity and mismatch cost parameters.

The higher productivity r, the more valuable is the firm. The principal pays a larger piece rate and extracts a larger flat payment from the agent. The overall effect of the wage schedule increases the optimal range and probability to successfully recruit. In Figure 3.2.1 we see that an increase in r shifts the expected profit function up. The principal fits the enlarged optimal

range into the unit interval, which it potentially exceeds, by choosing the midpoint $A_F = 0.5$. For lower r, she achieved the maximal expected profit at different A_F around this midpoint. The higher the mismatch cost parameter γ the more does the Autonomy mismatch matter to the agent. The pain from mismatch decreases the principal's probability to recruit an agent and reduces the optimal range. The principal pays the same piece rate and extracts the same flat payment in the intermediate untruncated profit function, but the flat payment at the truncated ones increases. We see in Figure 3.2.2 that an increase shifts the expected profit functions down. The smaller optimal range can be accommodated more widely around the midpoint as γ increases.

A principal's 'extreme' organizational structure close to the bounds limits her chance of a successful recruitment. She makes up for that by proposing an even higher flat payment extraction. What constitutes an extreme A_F depends on the Equations in (3.5). The smaller revenue r and the bigger the mismatch cost parameter γ is, the smaller the range of principal's Autonomy levels that delimit the optimal range.

At $r^2 \geq 2\gamma$, productivity outweighs the mismatch costs such that the principal always wants to win the entire workforce (recruit with probability 1) and the optimal range exceeds the unit interval. The principal is best off when choosing the midpoint $A_F = 0.5$. At $r^2 \leq 2\gamma$, the Autonomy mismatch is significant such that the principal optimally chooses an intermediate A_F satisfying the bounds in Equations (3.5) that allow her to realize the full optimal range. Interestingly, low productivity and more consequential mismatch costs give the principal some leeway around the midpoint that still yield the same highest profit achievable in the parameter configuration. The intuition is that a principal knows that she cannot attract the entire workforce. Different intermediate Autonomy levels make her company most attractive to different segments of the workforce, albeit all of them carry the same probability for successful recruitment.[2]

[2] This result offers a starting point for a thought experiment. Assume for a moment that labour supply is infinite. In an industry C with high productivity r_C and a workforce with low mismatch costs γ_C for all workers, all firms would optimally choose the same Autonomy level $A_F = 0.5$. In contrast, an industry D with lower productivity r_D or a workforce with higher mismatch cost γ_D would generate firms that achieve the same, albeit lower, profit by choosing different intermediate Autonomy levels.
If we then allow for our industry D to have two firms that face a limited labour supply, these firms can use their choice of Autonomy levels to compete for workers. We would expect that they choose Autonomy levels at the bounds of the untruncated profit function in order to differentiate from their rival. This would lead to the interesting situation where two companies in an industry make the same profits under very different organizational structures.

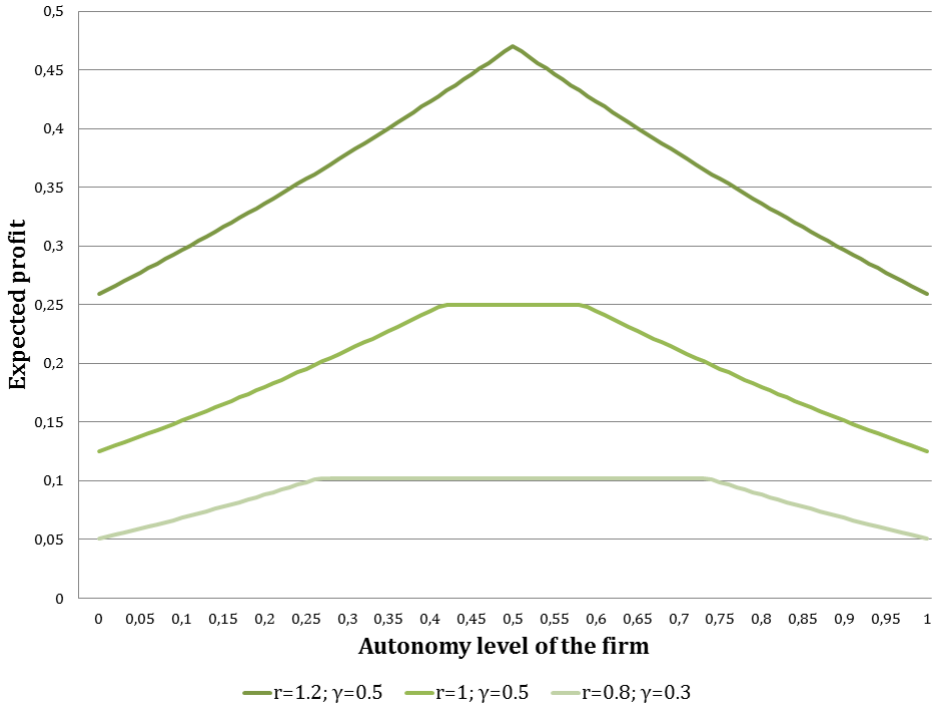


Figure 3.2.1: Expected profits for different levels of productivity r with Autonomy mismatch

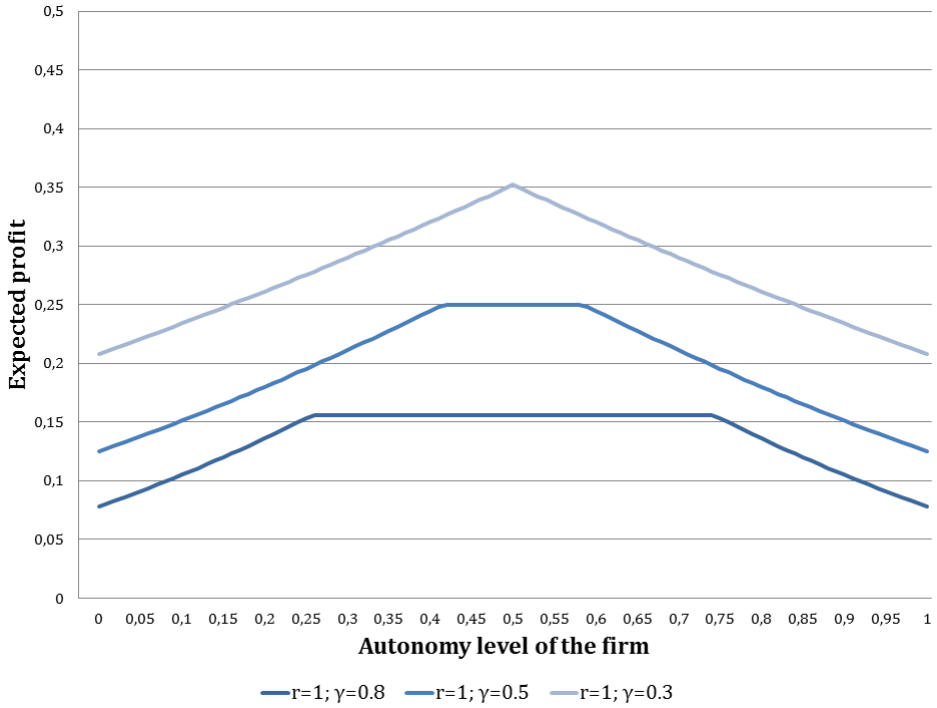


Figure 3.2.2: Expected profits for different mismatch costs γ with Autonomy mismatch

3.2.2 Productivity gains at project level through agent's Autonomy

Recent studies indicate that students who choose work for autonomous reasons experience lower anxiety and higher interest (Black and Deci, 2000), and that self-directed learning has a significant positive impact on learning behaviour in the workplace (Raemdonck et al., 2014). This suggests that agents with an Autonomy orientation show more initiative and are more self-organized in learning, making it easier for them to achieve higher productivity in project related work. In our model, this translates to the principal spending less for training an agent in project management the higher that agent's Autonomy level.

We assume that with appropriate training, every agent can achieve the same higher productivity r' in projects, with $r' = r(1+\phi)$, where ϕ is a project productivity parameter. But the base training cost K_0 for project training is reduced when the principal recruits more autonomous agents. She knows that the more Autonomy she grants, the more she is an attractive employer to these agents. Her expected training costs thus depend on the agent she expects to hire at a given Autonomy level A_A, and we capture this by assuming that the base training cost K_0 scales down with a higher A_A to $K_0(1-A_A)$.

The agent maximizes his utility by choosing his effort level according to Equation (3.2). When the principal can realize the full optimal range, she expects a successfully recruited agent to have an Autonomy level of

$$E[A_A] = \frac{1}{2}\left(\bar{A}_A - \underline{A}_A\right) = A_F$$

such that her trade-off between probability to recruit and conditional profit includes the project productivity increase and expected training costs subject to the agent's expected Autonomy level

$$\begin{aligned}\max_{w,w_0} E[\Pi] &= 2\left[\frac{w_0}{\gamma} + \frac{w^2}{2\gamma}\right](r(1+\phi)w - w^2 - w_0) - K_0(1-E[A_A]) \\ &= 2\left[\frac{w_0}{\gamma} + \frac{w^2}{2\gamma}\right](r(1+\phi)w - w^2 - w_0) - K_0(1-A_F)\end{aligned}$$

resulting in

$$w^* = r(1+\phi) \qquad\qquad w_0^* = -\frac{r^2(1+\phi)^2}{4}$$

and an eventual profit of

$$E[\Pi] = \frac{r^4(1+\phi)^4}{8\gamma} - K_0(1-A_F).$$

LHS truncated profit function

At a small A_F, the principal expects a hired agent to have an Autonomy level of

$$E[A_A]_{LHS} = \frac{1}{2}\left(\bar{A}_A - \underline{A}_A\right).$$

The left bound of the LHS recruitable range is zero, the right bound depends on the wage schedule such that

$$E[A_A]_{LHS} = \frac{1}{2}\bar{A}_A = \frac{1}{2}\left[A_F + \frac{w_0}{\gamma} + \frac{w^2}{2\gamma}\right]$$

such that the principal maximizes

$$\max_{w,w_0} E[\Pi] = \left[A_F + \frac{w_0}{\gamma} + \frac{w^2}{2\gamma}\right](r(1+\phi)w - w^2 - w_0) - K_0\left[1 - \frac{A_F}{2} - \frac{w_0}{2\gamma} - \frac{w^2}{4\gamma}\right]$$

which yields

$$w^* = r(1+\phi) \qquad\qquad w_0^* = -\frac{A_F}{2} - \frac{r^2(1+\phi)^2}{4} + \frac{K_0}{4}$$

and a profit of

$$E[\Pi] = \gamma\left[\frac{A_F}{2} + \frac{r^2(1+\phi)^2}{4\gamma} + \frac{K_0}{4\gamma}\right]^2 - K_0.$$

RHS truncated profit function

The principal at a high A_F expect a successful recruit to have an Autonomy level of

$$E[A_A]_{RHS} = \frac{1}{2}\left(1 - \underline{A}_A\right)$$

The right bound of the RHS truncated is one, the left bound depends on the wage schedule such that

$$E[A_A]_{RHS} = \frac{1}{2}\left(1 - \underline{A}_A\right) = \frac{1}{2} - \frac{1}{2}\left[A_F - \frac{w_0}{\gamma} - \frac{w^2}{2\gamma}\right]$$

and the principal optimizes

$$\max_{w,w_0} E[\Pi] = \left[(1-A_F) + \frac{w_0}{\gamma} + \frac{w^2}{2\gamma}\right](r(1+\phi)w - w^2 - w_0) - \frac{K_0}{2}\left[(1-A_F) + \frac{w_0}{\gamma} + \frac{w^2}{2\gamma}\right]$$

leading to

$$w^* = r(1+\phi) \qquad\qquad w_0^* = -\frac{(1-A_F)}{2} - \frac{r^2(1+\phi)^2}{4} - \frac{K_0}{4}$$

and a profit of

$$E[\Pi] = \gamma\left[\frac{1-A_F}{2} + \frac{r^2(1+\phi)^2}{4\gamma} - \frac{K_0}{4\gamma}\right]^2.$$

Implications of productivity gains in projects and Autonomy mismatch

In our model incorporating both Autonomy mismatch costs as well as project related productivity gains and training costs, the principal's recruitment strategy becomes more interesting. In addition to the trade-off between the probability for successful recruitment and conditional profit, she also accounts for the reduced costs in training an autonomous agent in project management.

The productivity gains in project management training make the firm more valuable. The principal pays a higher piece rate and extracts higher flat payments. Accounting for the fact that an Autonomy mismatch impedes the successful recruitment of the more valuable agents, the principal wants to set the firm Autonomy level as high as possible such that it attracts the most autonomous agent at $A_A = 1$. When the optimal range does not exceed the unit interval such that profit function has an intermediate section, the principal prefers the A_F at its right fringe. She then reaps the benefits of both increased conditional profit at lowest costs and an expanded optimal range. This is mirrored by the fact that the LHS truncated and untruncated expected profit functions are always increasing, the RHS profit function always decreasing in A_F.[3] When the base productivity r decreases, the project productivity at reduced costs becomes more valuable to the principal as the optimal range shrinks. In Figure 3.2.3 we see that

[3] The derivatives can be found in the Mathematical Appendix B.1.

the principal optimally shifts her A_F further to the right as to reduce the cost of training of potential hires when she cannot aim to hire the entire workforce. The same logic applies when Autonomy mismatch is more important for the workforce, as seen in Figure 3.2.4. The probability shrinks uniformly across the workforce, but the conditional profit of segments of the workforce is higher for more autonomous agents. The principal then wants to shift her A_F to the right to be able to attract them.

The larger the project productivity increase from training ϕ, the more interesting become agents with a marginally lower Autonomy level to the principal. As the profit function shifts up and the optimal range increases, the principal wants to set a lower A_F at given training costs (see 3.2.5). With increased training costs K_0 the expected profit function shifts down, potentially so strongly that low Autonomy agents generate losses (Figure 3.2.6). The conditional profit is higher for the high Autonomy segment of the workforce and the principal prefers an A_F high enough to attract the most autonomous agents.

Whenever the optimal range does not encompass the entire unit interval, the principal wants to give more leeway in her organizational structure, as embodied in a high A_F. This recruitment policy attracts the most autonomous agents to accept her wage offer; they are the most valuable when project related productivity gains and associated training costs are important. For parameter constellations allowing the principal to aim for the entire workforce, she wants to set an intermediate A_F to attract them. Only at extreme training costs prohibiting her to recruit anyone else would she consider $A_F = 1$. At extremely high productivity gains ϕ the optimal range becomes big and the expected profit function so flat that any A_F generates nearly the same high profits.

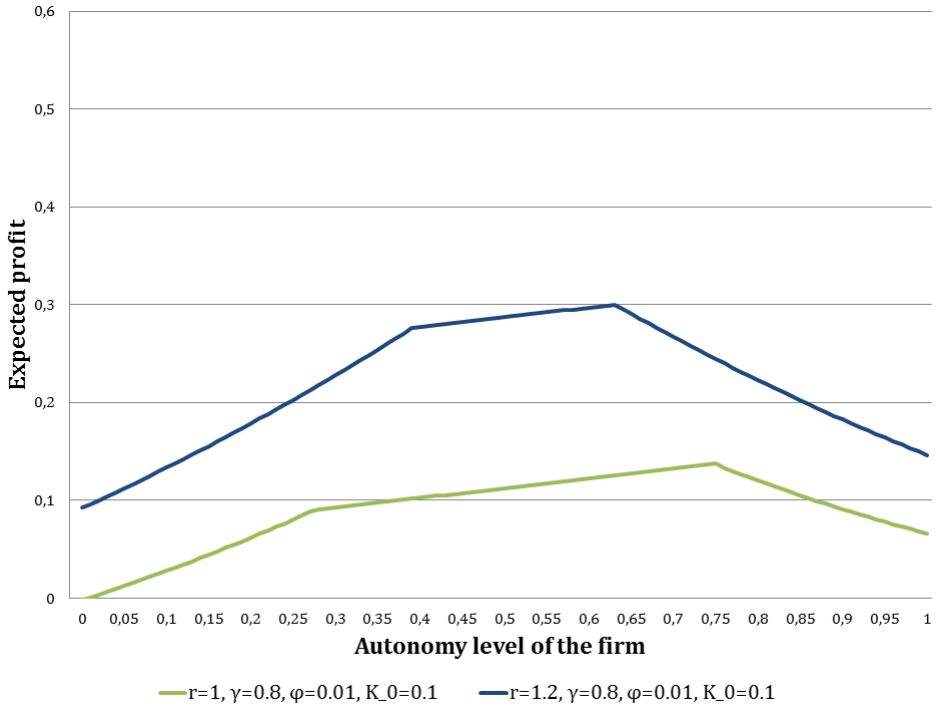


Figure 3.2.3: Expected profits for different levels of productivity r with productivity gains

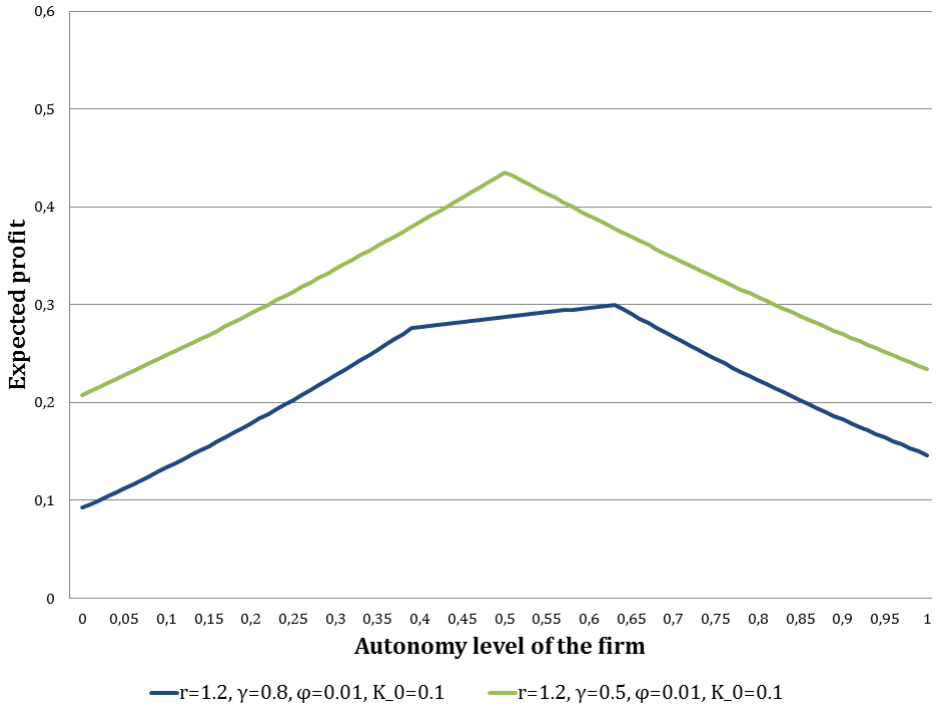


Figure 3.2.4: Expected profits for different mismatch costs γ with productivity gains

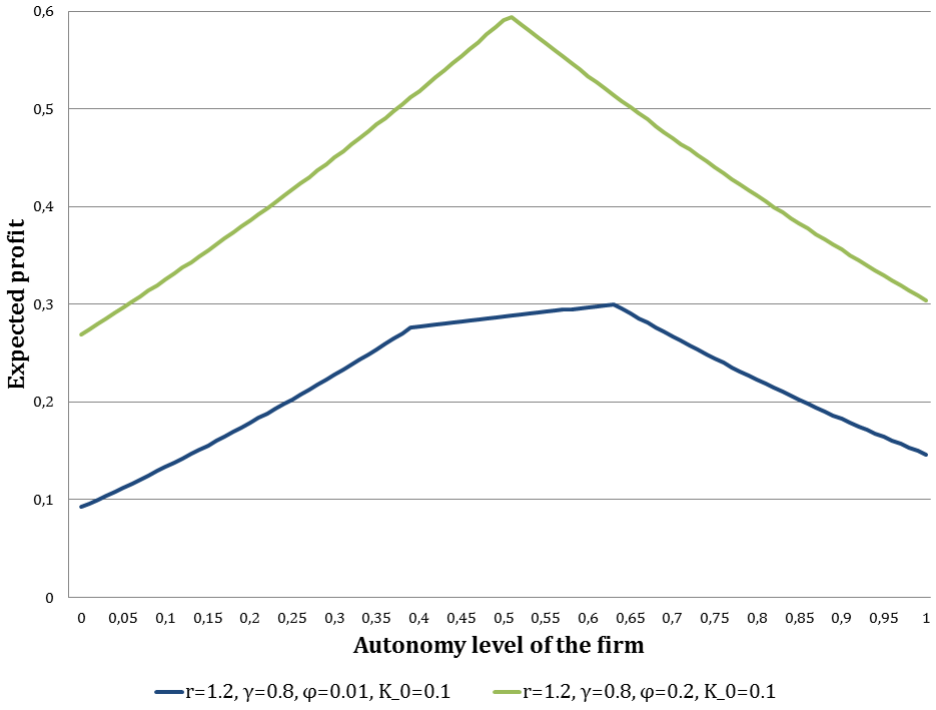


Figure 3.2.5: Expected profits for different project productivity parameters ϕ with productivity gains

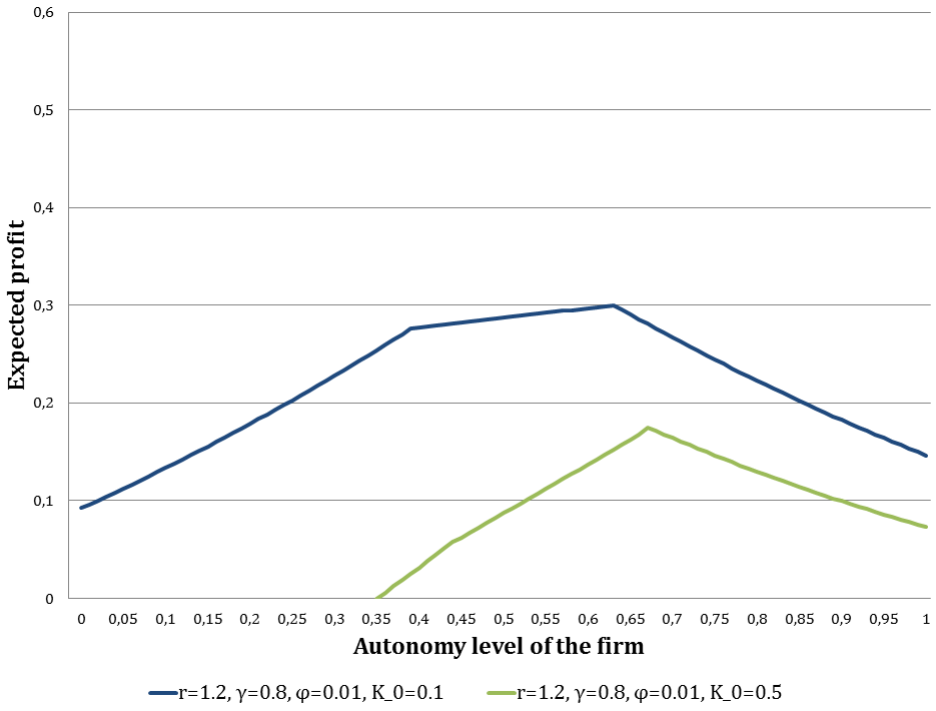


Figure 3.2.6: Expected profits for different project training costs K_0 with productivity gains

3.2.3 Inefficiencies at task level from granting Autonomy

The organizational structure guides the everyday tasks conducted at the firm. Frequent tasks are organized by procedure guidelines, deadlines and checklists which increases efficiency (e.g., Semel et al. (2010)). The principal ensures through her choice of organizational structure that dead ends and running idle are avoided. With a lax organizational structure, corresponding to a high Autonomy level A_F granted by the firm, agents may not use their time efficiently, or run into cumbersome dead ends when everyday tasks are not clearly specified and streamlined. We account for this loss in everyday task efficiency from a lax organizational structure by incorporating A_F into the agent's effort cost function. The higher A_F, meaning the more lax the organizational structure, the higher the agent's effort cost $c(e) = \frac{1}{2}e_1^2(1+A_F)$. The agent then maximizes

$$U(e|A_A, A_F) = w_0 + we - \frac{1}{2}e_1^2(1+A_F) - \gamma|A_A - A_F|$$

and optimally chooses

$$e^* = \frac{w}{(1+A_F)} \tag{3.6}$$

when the principal's contract offer (w, w_0) satisfies the adjusted Individual Rationality constraint such that

$$w_0 \geq U_0 + \gamma|A_A - A_F| - \frac{w^2}{2(1+A_F)}$$

The principal balances the trade-off between the probability to successfully recruit and the conditional profit upon recruitment upon decreased efficiency when granting Autonomy.[4]

$$\begin{aligned}\max_{w,w_0} E[\Pi] &= 2\left[\frac{w_0}{\gamma} + \frac{w^2}{2\gamma(1+A_F)}\right]\left[\frac{rw}{(1+A_F)} - \frac{w^2}{(1+A_F)} - w_0\right] \\ &= -\frac{w^4}{\gamma(1+A_F)} + \frac{w^3 r}{\gamma(1+A_F)^2} - \frac{3w^2 w_0}{\gamma(1+A_F)} + \frac{2rww_0}{\gamma(1+A_F)} - \frac{2w_0^2}{\gamma}\end{aligned}$$

and she optimally chooses

$$w^* = \frac{r}{(1+A_F)} \qquad\qquad w_0^* = \frac{-r^2}{4(1+A_F)}$$

[4] The result for the feasible range and the optimization is derived in the Mathematical Appendix B.2.

such that the expected profit on an untruncated optimal range is

$$E[\Pi] = \frac{r^4}{8\gamma(1+A_F)^2}$$

The bounds for the untruncated profit function where the optimal range is fully realized are

$$\begin{aligned} \underline{A}_A = A_F - \frac{r^2}{4\gamma(1+A_F)} \geq 0 \quad &\iff A_F \geq \sqrt{\frac{r^2+\gamma}{4\gamma}} - \frac{1}{2} \\ \bar{A}_A = A_F + \frac{r^2}{4\gamma(1+A_F)} \leq 1 \quad &\iff A_F \leq \sqrt{\frac{r^2+\gamma}{4\gamma}} - \frac{1}{2} \end{aligned} \tag{3.7}$$

LHS truncated profit function

When the principal has drawn a small A_F not satisfying Equation (3.7), she cannot realize the optimal range to her left and maximizes

$$\max_{w,w_0} E[\Pi] = \left[A_F + \frac{w_0}{\gamma} + \frac{w^2}{2\gamma(1+A_F)}\right]\left[\frac{r\,w}{(1+A_F)} - \frac{w^2}{(1+A_F)} - w_0\right]$$

which leads to the same optimal piece rate but a larger extracted flat payment of

$$w^* = \frac{r}{(1+A_F)} \qquad\qquad w_0^* = -\frac{A_F\gamma}{2} - \frac{r^2}{4(1+A_F)}$$

resulting in an expected profit of

$$E[\Pi] = \frac{A_F^2\gamma}{4} + \frac{r^2 A_F}{4(1+A_F)} + \frac{r^4}{16\gamma(1+A_F)^2}$$

RHS truncated profit function

Similarly, for a drawn A_F so large that it does not satisfy Equation (3.7) the principal maximizes

$$\max_{w,w_0} E[\Pi] = \left[(1-A_F) + \frac{w_0}{\gamma} + \frac{r^2}{2\gamma(1+A_F)}\right]\left[\frac{r\,w}{(1+A_F)} - \frac{w^2}{(1+A_F)} - w_0\right]$$

to obtain again a larger extracted flat payment and unchanged piece rate

$$w^* = \frac{r}{(1+A_F)} \qquad\qquad w_0^* = -\frac{(1-A_F)\gamma}{2} - \frac{r^2}{4(1+A_F)}$$

resulting in an expected profit of

$$E[\Pi] = \frac{(1-A_F)^2\gamma}{4} + \frac{r^2(1-A_F)}{4(1+A_F)} + \frac{r^4}{16\gamma(1+A_F)^2}$$

Implications of inefficiencies at task level and Autonomy mismatch

Incorporating inefficiencies at the task level in addition to the Autonomy mismatch changes the principal's recruitment strategy. In addition to the trade-off between probability for successful recruitment and conditional profit, she takes into account the negative consequences of a high A_F. Granting more Autonomy at the task level impacts the conditional profit negatively such that $A_F = 0$ seems favourable. However, setting A_F too low also limits her chances for a successful hire. The impact of organizational structure on everyday tasks amplifies the trade-off she faces.

How strict or lax organizational procedures are affects the agent's effort choice and the offered wage schedule directly. A more loose structure impedes efficiency such that the untruncated and the RHS truncated profit functions are always decreasing in A_F.[5] For the LHS truncated profit function the issue of granting Autonomy and its negative impact becomes more interesting.

We see in Figure 3.2.7 that an increase in the base productivity r shifts the expected profit function up. The conditional profit increases and so does the optimal range, such that the principal wants to accommodate it with a bigger A_F. When r increases further, the conditional profit increases further and the principal is better off with $A_F = 0$. At this point, setting a higher A_F as to attract more workers is outweighed by the inefficiencies from the marginal workers to the right. The probability to successfully recruit are limited at the end point of the unit interval, but the principal cuts out inefficiencies at the task level completely. Also in Figure 3.2.7, we can see the switch from an increasing A_F to accommodate a broader recruitable segment of the workforce to $A_F = 0$. This is mirrored by the fact that the LHS truncated profit

[5] The derivatives can be found in the Mathematical Appendix B.3.

function is increasing for a low r, becomes u-shaped as r becomes larger and is decreasing for a high r.[5]

Figure 3.2.8 shows the reverse effect of an decrease in mismatch cost parameter γ for a given base productivity level r. Lower mismatch costs make it easier to attract agents at the fringes, therefore expanding the optimal range and shifting the expected profit function up. The principal accommodates the bigger optimal range by optimally choosing a higher A_F. Once the mismatch costs are so low that it does not inhibit her chances for a successful recruit too much, she optimally prefers to switch to $A_F = 0$. She can avoid inefficiencies altogether when granting no Autonomy at the task level, when this mismatch is not too painful to agents.

Overall, the principal wants to grant as little Autonomy in tasks as possible. What constitutes 'possible' depends on productivity and the importance the workforce places on an Autonomy mismatch. When productivity is not too big to begin with, inefficiencies do not carry as much weight and the principal prefers increasing her probability for a successful hire. When mismatch matters a lot, she takes a loss in efficiencies in order to reach more potential employees. Discouraging inefficiencies is most important when productivity is high and mismatch costs negligible.

We derive the switching point between these two recruitment policies of granting no, or some Autonomy. Our discussion conveys two contenders for her optimal choice for granting Autonomy: zero Autonomy at $A_F = 0$ and the Autonomy level at the intersection between the untruncated and the LHS truncated profit function. For the latter, we set $E[\Pi_{LHS}] \stackrel{!}{=} E[\Pi_{untrunc}]$ and find

$$A_{Fintersect} = \sqrt{\frac{2(\sqrt{2}-1)r^2+\gamma}{4\gamma}} - \frac{1}{2}$$

as intersection point. However, Equation (3.7) states that the lower bound for the untruncated profit function is at $A_F = \sqrt{\frac{r^2+\gamma}{4\gamma}} - \frac{1}{2}$, which is always bigger than the analytic intersection. We also must conduct a case by case analysis based on whether the truncated profit function at the left hand side is always increasing (Case A), always decreasing (Case B), or u-shaped (Case C).

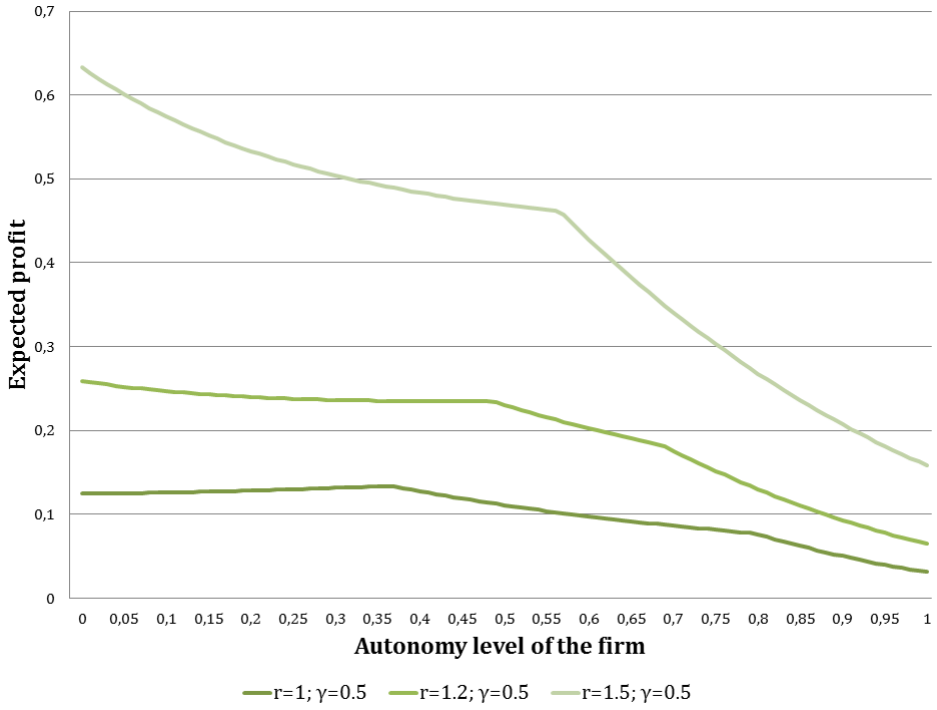


Figure 3.2.7: Expected profits for different levels of productivity r with task inefficiency

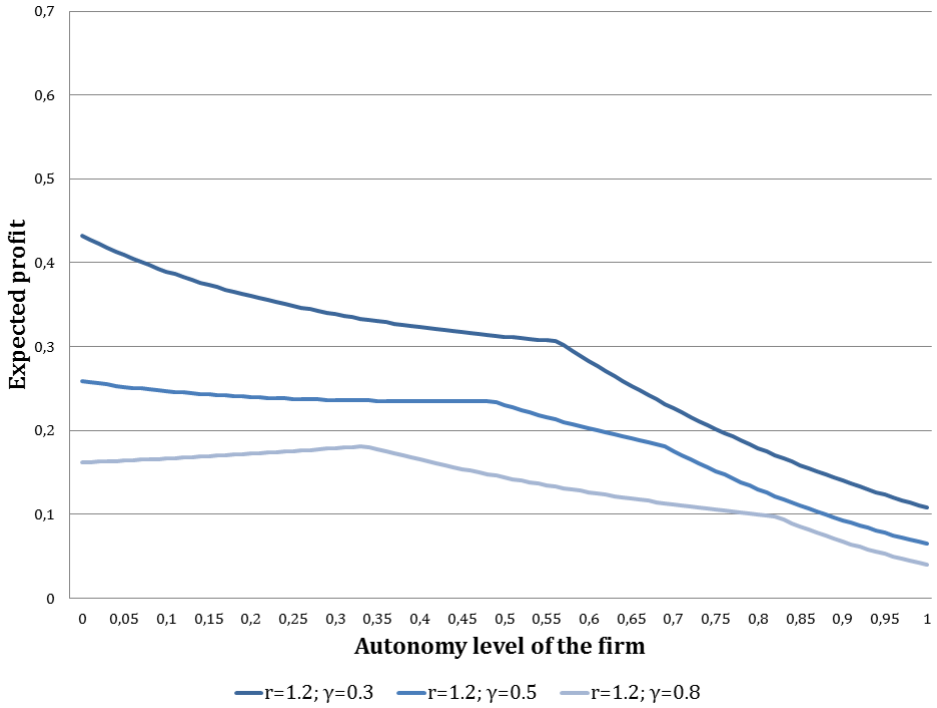


Figure 3.2.8: Expected profits for different mismatch costs γ with task inefficiency

Case A: LHS truncated profit function always increasing

For the truncated profit function for low A_F to be always increasing, it must be increasing at $A_F = 0$. This yields a condition on the parameter values for which Case A is applicable:

$$\frac{\partial E[\Pi_{LHS}]}{\partial A_F}\Big|_{A_F=0} = \frac{r^2}{4} - \frac{r^4}{8\gamma} > 0 \Longleftrightarrow 1 > \frac{r^2}{2\gamma}$$

For these parameter values the condition for the first order condition of the LHS truncated profit function to be positive $A_F > \sqrt{\frac{r^2}{2\gamma}} - 1$ also holds for any $A_F \in [0,1]$.
With the untruncated and RHS profit function decreasing, the transition point at the LHS bound is the maximum under these parameter values and yields a profit of $E[\Pi] = \frac{r^4}{8\gamma\left(\sqrt{\frac{r^2+\gamma}{4\gamma}} - \frac{1}{2}\right)^2}$.

Case B: LHS truncated profit function always decreasing

For the LHS truncated profit function to be always decreasing, it must be decreasing at $A_F = 0$. This yields a condition on the parameter values for which Case B is applicable:

$$\frac{\partial E[\Pi_{LHS}]}{\partial A_F}\Big|_{A_F=0} = \frac{r^2}{4} - \frac{r^4}{8\gamma} < 0 \Longleftrightarrow 1 < \frac{r^2}{2\gamma}$$

At this parameter constellation, the left hand side bound is right to the right hand side bound in Equations (3.7), the untruncated profit function with a fully realized optimal range is not viable. The transition point between the truncated profit function occurs at $A_F = \sqrt{\frac{r^2}{2\gamma}} - 1$. It is interesting to note that the transition point between the truncated is shifted to the right profit function in comparison to the Autonomy mismatch only case. With a reduction in productivity due to granted Autonomy, the optimal range is wider at low A_F, and if fully realized at an $A_F > 0.5$. Nonetheless, the Principal maximizes her expected profits to be $E[\Pi] = \frac{r^4}{16\gamma}$ when choosing $A_F = 0$.

Case C: LHS profit function is u-shaped

For the LHS truncated profit function to be u-shaped, it must be decreasing at $A_F = 0$, thus fulfilling the same parameter restrictions as in Case B: $1 < \frac{r^2}{2\gamma}$. The minimum of the u-shape

occurs at $\tilde{A}_F = \sqrt{\frac{r^2}{2\gamma}} - 1$ such that for all $A_F > \tilde{A}_F$ the left hand side truncated profit function is increasing. The two candidates for a maximal expected profit are thus at $A_F = 0$ and at the left hand side bound in Equation (3.7). Comparing the two profit functions yields

$$E[\Pi_{LHS}]\big|_{A_F=0} \gtrless E[\Pi_{untrunc}]\big|_{LHSbound} \Longleftrightarrow \frac{r^2}{2\gamma} \gtrless 2(2-\sqrt{2}). \tag{3.8}$$

We therefore conclude that depending on the interplay of productivity r and mismatch γ, the principal either chooses to grant no Autonomy on the task level at all, or an Autonomy level at $A_F = \sqrt{\frac{r^2+\gamma}{4\gamma}} - \frac{1}{2}$ that increases in productivity and mismatch cost. Table 3.2.1 collects the results.

Case	parameter restriction	Principal chooses
Case A LHS profit function increasing	$\frac{r^2}{2\gamma} < 1$	$A_F = \sqrt{\frac{r^2+\gamma}{4\gamma}} - \frac{1}{2}$
Case C1 LHS profit function u-shaped	$1 < \frac{r^2}{2\gamma} < 2(2-\sqrt{2})$	$A_F = \sqrt{\frac{r^2+\gamma}{4\gamma}} - \frac{1}{2}$
Case C2 LHS profit function u-shaped	$2(2-\sqrt{2}) < \frac{r^2}{2\gamma}$	$A_F = 0$
Case B LHS profit function decreasing	$1 < \frac{r^2}{2\gamma}$	$A_F = 0$

Table 3.2.1: Optimal A_F choice when granting Autonomy reduces efficiency

3.2.4 Project productivity gains and task inefficiencies - requiring and granting Autonomy

The sections afore demonstrate that increased project productivity from hiring autonomous workers persuades the principal to choose a more lax organizational structure, and that increased inefficiencies on the task level move her towards choosing a more, if not completely, confining organizational structure. We now combine these two effects - task inefficiencies from granting Autonomy and project productivity from Autonomy oriented agents - in one setup.

The agent optimally chooses, as in Equation (3.6),

$$e^* = \frac{w}{(1+A_F)}$$

The principal expects the agent's Autonomy level when the full optimal range is realized to be $E[A_A] = A_F$. She therefore balances the trade-off between probability to recruit and conditional profit upon recruitment by maximizing

$$\max_{w,w_0} E[\Pi] = 2\left[\frac{w_0}{\gamma} + \frac{w^2}{2\gamma(1+A_F)}\right]\left[\frac{r(1+\phi)w}{(1+A_F)} - \frac{w^2}{(1+A_F)} - w_0\right] - K_0(1-A_F)$$

She chooses

$$w^* = \frac{r(1+\phi)}{(1+A_F)} \qquad\qquad w_0^* = -\frac{r^2(1+\phi)^2}{4(1+A_F)}$$

and achieves an expected profit of

$$E[\Pi] = \frac{r^4(1+\phi)^4}{8\gamma(1+A_F)^2} - K_0(1-A_F).$$

LHS truncated profit function

At low A_F, the principal cannot realize the full optimal range and expects to attract an agent with Autonomy level $E[A_A]_{LHS} = \frac{1}{2}\bar{A}_A$, where

$$\bar{A}_A = A_F + \frac{w_0}{\gamma} + \frac{w^2}{2\gamma(1+A_F)}.$$

She maximizes

$$\max_{w,w_0} E[\Pi] = \left[A_F + \frac{w_0}{\gamma} + \frac{w^2}{2\gamma(1+A_F)}\right]\left[\frac{r(1+\phi)\,w}{(1+A_F)} - \frac{w^2}{(1+A_F)} - w_0\right] - K_0\left[1 - \frac{A_F}{2} - \frac{w_0}{2\gamma} - \frac{w^2}{4\gamma(1+A_F)}\right]$$

which leads to an optimal piece rate and extracted flat payment of

$$w^* = \frac{r(1+\phi)}{(1+A_F)} \qquad\qquad w_0^* = -\frac{A_F}{2} - \frac{r^2(1+\phi)^2}{4(1+A_F)} + \frac{K_0}{4}$$

and results in an expected profit of

$$E[\Pi] = \gamma\left[\frac{A_F}{2} + \frac{r^2(1+\phi)^2}{4\gamma(1+A_F)} + \frac{K_0}{4\gamma}\right]^2 - K_0.$$

RHS truncated profit function

At high A_F, the principal is limited to realize the full optimal range and expects an Autonomy level of $E[A_A]_{RHS} = \frac{1}{2} + \frac{1}{2}\underline{A}_A$ where

$$\underline{A}_A = A_F - \frac{w_0}{\gamma} - \frac{w^2}{2\gamma(1+A_F)}$$

The principal maximizes

$$\max_{w,w_0} E[\Pi] = \left[(1-A_F) + \frac{w_0}{\gamma} + \frac{w^2}{2\gamma(1+A_F)}\right]\left[\frac{r(1+\phi)\,w}{(1+A_F)} - \frac{w^2}{(1+A_F)} - w_0\right] - \frac{K_0}{2}\left[(1-A_F) + \frac{w_0}{\gamma} + \frac{w^2}{2\gamma(1+A_F)}\right]$$

by optimally choosing a wage schedule of

$$w^* = \frac{r(1+\phi)}{(1+A_F)} \qquad\qquad w_0^* = -\frac{(1-A_F)}{2} - \frac{r^2(1+\phi)^2}{4(1+A_F)} - \frac{K_0}{4}$$

resulting in an expected profit of

$$E[\Pi] = \gamma\left[\frac{1-A_F}{2} + \frac{r^2(1+\phi)^2}{4\gamma(1+A_F)} - \frac{K_0}{4\gamma}\right]^2.$$

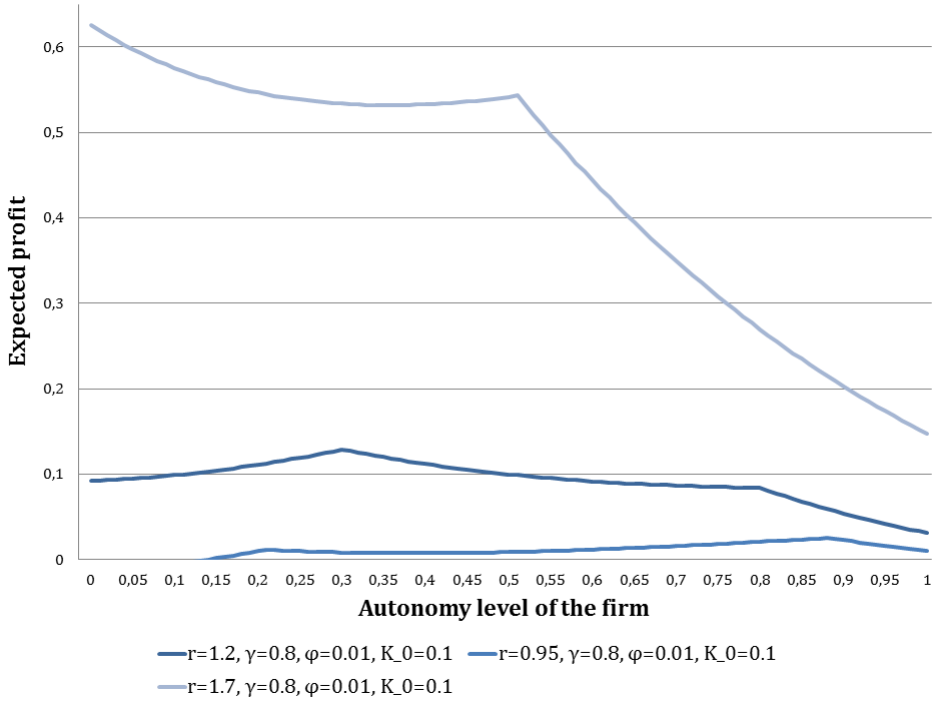


Figure 3.2.9: Expected profits for different levels of productivity r with productivity gains and task inefficiencies

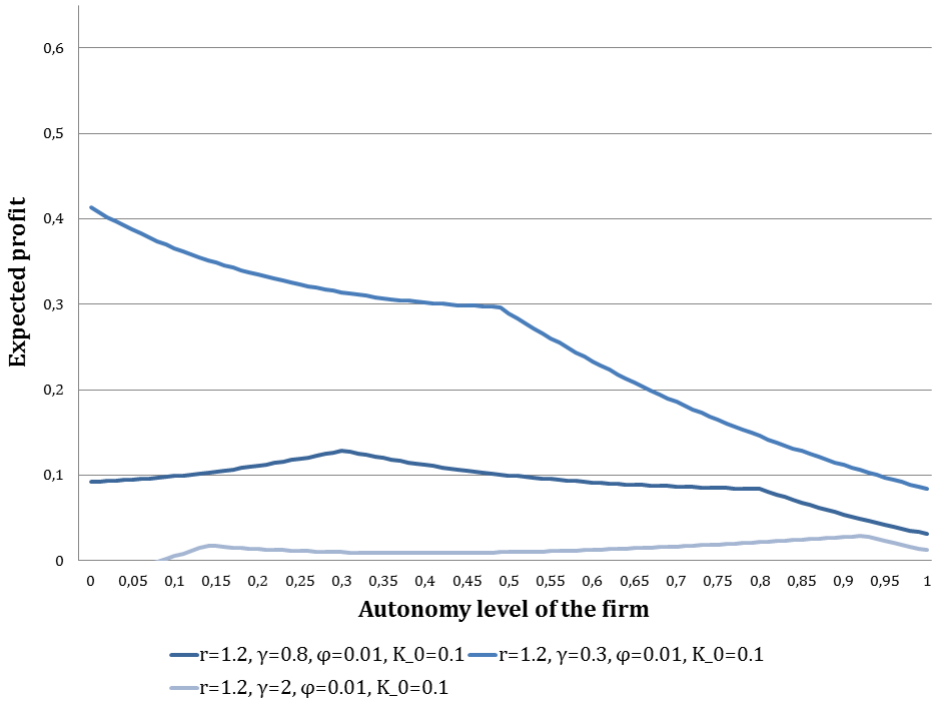


Figure 3.2.10: Expected profits for different mismatch costs γ with productivity gains and task inefficiencies

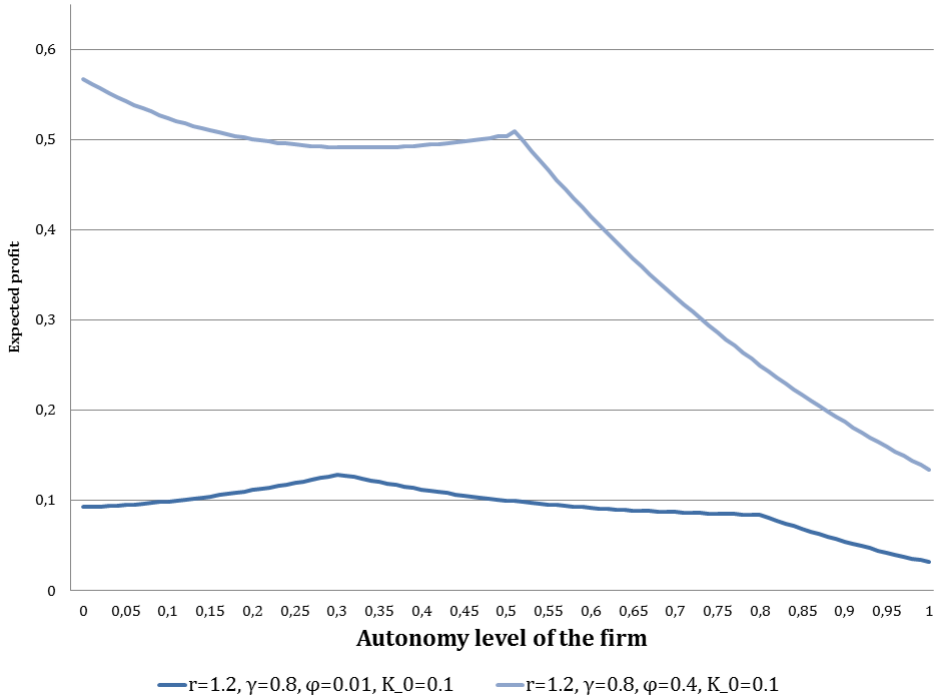


Figure 3.2.11: Expected profits for different project productivity parameters ϕ with productivity gains and task inefficiencies

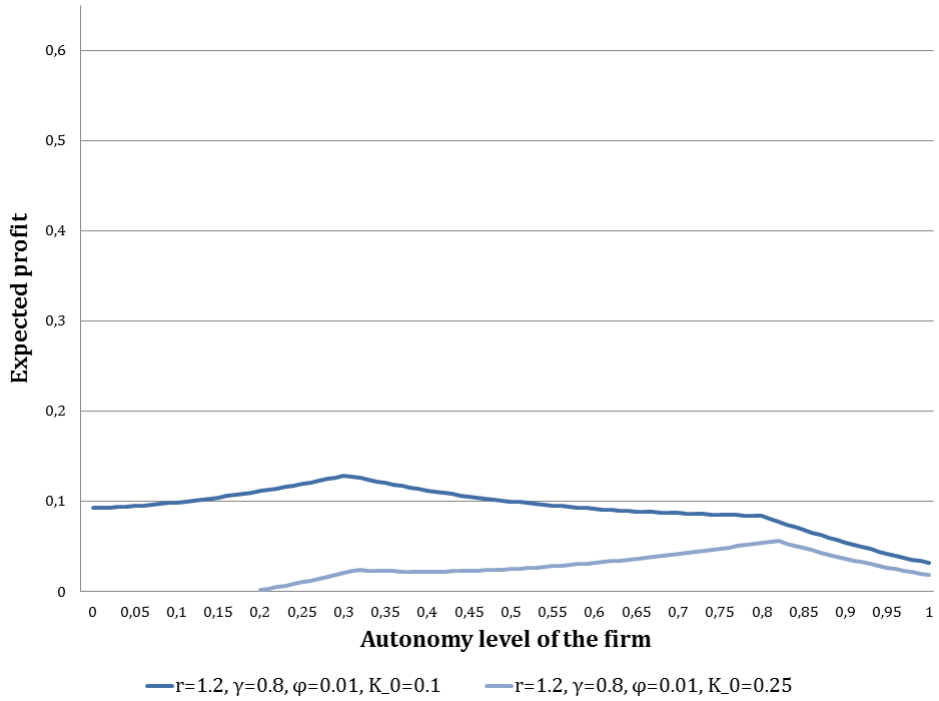


Figure 3.2.12: Expected profits for different project training costs K_0 with productivity gains and task inefficiencies

Implications of inefficiencies at task level, productivity gains at project level, and Autonomy mismatch

The separate effects of productivity gains at reduced costs from hiring high Autonomy agents and the task inefficiencies from a firm granting Autonomy now come together for a compelling picture of how strict a firm wants to set her organizational structure.

We start with a parameter constellation displayed in all Figures 3.2.9 through 3.2.12 where the project productivity parameter scales base productivity only by 1%, training costs K_0 are not prohibitive (in graphs at 0.1) and mismatch matters to the agents (at $\gamma = 0.8$). The optimal range is smaller than the unit interval, such that the principal wants to set A_F in the untruncated range. At these parameter values, the effect of task inefficiencies outweigh productivity gains on the project level, such that the principal optimally sets her A_F at the lowest point of the untruncated range. Compared to this constellation, we find two other patterns.

First, the principal wants to employ a lax organizational structure with a large A_F at the highest point of the untruncated range when (i) the base productivity is so low that even small project productivity increases matter a lot, and autonomous agents are less costly at achieving it (Figure 3.2.9); (ii) mismatch cost are so high that the probability to successfully recruit, and achieving a higher conditional profit from autonomous agents overtakes the probability in the principal's assessment (Figure 3.2.10); or (iii) the training costs to achieve a project productivity gain are so big that the reduced cost from hiring autonomous agents becomes most important (Figure 3.2.12). In the last case, training costs can become prohibitively high that the principal may even grant full Autonomy at $A_F = 1$.

Second, the principal wants to employ a restrictive organizational structure at $A_F = 0$ when (i) the base productivity is already high such that project productivity gains do not matter as much as task efficiency (Figure 3.2.9); (ii) mismatch costs matter little to the workforce such that confining probability for a successful recruit outweighs the benefits of avoiding task inefficiencies with focusing on Control oriented agents (Figure 3.2.10); or (iii) the project productivity gains are high for everyone, such that avoiding task inefficiency costs are more important than reduced project management costs (Figure 3.2.11).

We see that the principal must carefully choose her organizational structure A_F when she takes into account that it influences which agents in the workforce she can attract. The rel-

ative importance of task and project requirements on her expected profit change her optimal recruitment strategy and with it her optimal choice of the rigidity in the organizational structure. Our analysis presumes that the principal may be able to adapt the organizational structure in a recruitment situation, observing the current parameter dimensions. However, it is plausible to assume that once operational procedures have been put in place, they 'stick'. Adapting them may be costly, or at worst, impossible. Comparing the graphs in Figures 3.2.9 through 3.2.12 suggests that granting at least some leeway, $A_F > 0$, yields positive expected profits for most parameter constellations, even, as sections 3.2.1 and 3.2.3 suggest, when initiative in projects does not matter for the company at all.

3.3 Discussion and Conclusion

In this paper, we demonstrate how a principal uses organizational structure to appeal to potential employees in the recruitment process. Agents with an Autonomy orientation thrive in project work where their initiative and tendency to easily absorb information is beneficial; agents with a Control orientation excel at clearly structured tasks. Many work environments demand their employees to do both project and task related work, requiring them to take initiative and think out of the box as well as tick off checklists and comply to deadlines. We show that the principal prefers a rather lax (strict) structure on operational procedures when project management (task efficiency) is more important for the company's overall success in both generating profit and attracting agents that fit the requirements.

The relative combination of three components balances the trade-off between success in recruitment and conditional profit from a hire: the rigidity of the structure in the organization, the degree of Autonomy orientation of the agent, and the wage schedule. The piece rate reflects an undistorted effort choice in each version of our model. Decisive for the principal's profit is however the flat payment she extracts. The more aligned the organizational structure with the agent's Autonomy orientation, the more the principal can extract. This echoes the argument from the economic literature on mission that a better fit between principal and agent reduces the need for high-powered incentives (Besley and Ghatak, 2005; Cassar, 2018). Our novel contribution is that potential employees with enthusiasm and initiative for the 'mission' project may still avoid fitting companies that rely on rigid operational procedures for every-

day tasks complementing the project. Our approach adds to understanding why people in jobs that require initiative on the project level, e.g. programmers, are often self-employed, or why companies aiming to attract these workers present themselves to have non-confining organizational structure, e.g. Google's 20% free time rule. It also explains why companies make an effort to separate project and task related work, as for example in consultancies where the work week is typically divided in four days on the project with the customer and one day at the office doing documentation. The division between project and task facilitates presenting the company as less procedure focused, thereby attracting more project-driven employees.

We contribute to and continue the discussion about complementarities in Human Resource Management (HRM) practices with a view to behavioural economics (e.g. Englmaier and Schüßler (2016)) pointing towards incentives schemes attracting workers with different personalities. Our results indicate that concerns about task efficiency and active project management are strategic complements in the recruitment process. HRM may not be able to hire employees with favourable characteristics for each separate work requirement without acknowledging that the requirements can be contradictory. Individuals with high ability and extracurricular credentials seek challenging jobs, but while they are more desirable to hire, their characteristics also make them harder to recruit (Trank et al., 2002). If HRM searches for an 'all-in-one worker suitable for every purpose', it may indeed put potential recruits of all shades off to apply as they anticipate a mismatch. Need satisfaction of Autonomy contributes to job satisfaction (Gagné and Deci, 2005), and workers dissatisfied with their jobs are more likely to opt into self-employment (Noorderhaven et al., 2004). If HRM allows that form follows function, the organizational structure attracts the workers the company wants, and for the jobs they want them for. Kolaska (2014) shows that companies who afford their workers more discretion report higher labour productivity and pay higher wages when they screen for personality. This is attributed to screening worker's reciprocity. Our approach offers the supplemental explanation that Autonomy oriented worker's initiative is not suffocated by a controlling organizational structure, and that workers screen for companies that grant Autonomy as much as companies screen for Autonomy oriented workers. Screening for an Autonomy or Control orientation may be as beneficial as screening for talent, creativity or risk aversion for specific jobs.

The concept of Autonomy - a feeling of volition and freedom - is related to the concept authority. Authority is understood as power over others (Herz et al., 2011). The two concepts are closest at the opposite of Autonomy, Control. A controlled person reacts to incentives where the locus of causality is external, such as rewards and fear of punishment (Gagné and Deci, 2005), that are executed by other individuals in power. Autonomy however is associated with an internal locus of causality: people feel volition in doing something. But this does not extend to having authority over others. Indeed, Leach et al. (2017) find that high influence over others does not coincide with personal Autonomy. The starting point of the authority literature is the seminal paper of Aghion and Tirole (1997). They mainly investigate the interaction between decision rights and the consequential asymmetrical ability to gather private information, such that the principal tends to withhold decision rights and the agent's initiative is dampened. An experimental study shows that a principal only delegates decision rights when the agent's ex ante effort choice exceeds a minimum requirement (Bartling et al., 2014). Granting decision rights here is a reward for effort choice, in contrast to our take of effort being a result from granting Autonomy. This subtle distinction is important: in the former, agents react to a reward (Control), in the latter, agents choose their effort freely (Autonomy). The same authors show that the controlling party over-provides and the subordinate party under-provides effort in a game of project choice under asymmetric information (Fehr et al., 2013). The distinction between project initiation and project implementation is further scrutinized in Sloof and von Siemens (2015): workers are granted decision rights on choosing a project when the project hurts them and they have the ability to reduce effort in the implementation stage. This argument is thus based on workers having leeway at the implementation stage to choose their effort, and suggests that when workers have real choice at the implementation stage, they should have real choice at the initiation stage. Our assumption of agents heterogenous in their personal Autonomy level furthers this argument: workers should be granted similar high (low) Autonomy on both the project and task level, because it attracts those agents to the job where autonomous (controlled) work is relatively more important. Fehr et al. (2013) conclude that "a lack of authority only seems to demotivate a minority of people [which] suggests that putting the right people into positions that lack authority is important". Our results augments this statement by adding that the company chooses with its organizational structure whether it puts the right people into the right (high or low) Autonomy positions.

While the focus of this paper is on recruitment, it also speaks to the economic literature on incentives in general. E.g., monitoring can lead to a reduction of an agent's effort (Falk and Kosfeld, 2006), but this does not necessarily undermine its effectiveness altogether (Ziegelmeyer et al., 2012). Potential explanations have included the undermining of an interpersonal relationship between principal and agent (Dickinson and Villeval, 2008) and the evolution of trust as a social norm when abstaining from monitoring (Sliwka, 2007). We contribute to the discussion by allowing Control and Autonomy to have both positive and negative consequences. While leaning towards one or the other depends on which work aspects predominate the job description, our results suggests that for many instances the principal prefers an organizational design in the intermediate range. An interesting question for further research is the principal's Autonomy choice when composing teams, e.g., whether she combines or separates project and task work for teams. Given our insights from this project, we would expect considerations similar to our model when project and task work is combined in a team, and team specific degrees of Autonomy granted when separated.

Our results also contribute to the discussion on effective leadership in both economics and social psychology because it provides a bridging between the two. The economic view, at large, focuses on transactional leadership, where the principal's responsibility is to determine contracts and recruitment, for example. In contrast, other disciplines highlight i.a. the transformational ability of a leader to inspire motivation and a common mission (Zehnder et al., 2017). As jobs and work environments grow more complex and require both structure and leeway, the principal's ability to understand which organizational structure and which leadership style is relatively more conducive to attract those workers most suited for the position becomes critical. Consider the example of working from home, which appears to grant Autonomy. Technology makes working from home possible, but it also enables the principal to monitor the agent more closely (Gagné and Bhave, 2011). She must carefully design the job, how to use the technology at hand, and whom to hire. The principal's personal Autonomy orientation may indeed greatly impact her ability to support her workers' Autonomy, an issue related to innovation as discussed in Chapter 2 of this dissertation, workers' well-being (Gagné and Bhave, 2011), and consequentially, performance. Indeed, one avenue for further research in economics is how the principal's role of providing rewards and control may have to adapt in complex organizations that rely on granting Autonomy.

Appendix A

Autonomy Support and Innovation: Mathematical Appendix

A.1 Low future benefits

Pattern I: Conditions

For Pattern I with investments in each period, $s^*_{a,1} > 0$ and $s^*_{a,2} > 0$, given by Equations (2.6) and (2.7), must hold. For this to be the case, neither can $\frac{v_P}{\alpha}$ be too low (which holds by assumption $\frac{v_P}{\alpha} > 2$), nor can $\bar{s}$ be too high, as is stated by condition in Equation (2.11), or too low, as is stated in Equation (2.12). Also, the optimal $s^*_{a,1}$ in Equation (2.6) cannot be too high, otherwise the principal will not find it optimal to invest in period $t = 2$ as well. For $s^*_{a,1}$ (Equation (2.7)) not to exceed the threshold level in period $t = 2$, the following condition must hold:

$$\left(\frac{v_P}{2\alpha(1-\beta\delta)}\right)^{\frac{2}{3}} - \delta\bar{s} < \frac{1}{\delta}\left(\frac{v_P}{2\alpha}\right)^{\frac{2}{3}} - \delta\bar{s} \tag{A.1}$$

where the RHS is derived by the inequality of $s^*_{a,2} > 0$. Simplification leads to

$$\frac{1}{\delta} - \sqrt{\delta} > \beta$$

which is the necessary condition for Pattern I with investments in each period to exist.

The threshold condition in Equation (2.11) follows directly from $s^*_{a,1} > 0$ in Equation (2.7). The threshold condition in Equation (2.12) follows directly from plugging the optimal investment levels $s^*_{a,1} > 0$ and $s^*_{a,2} > 0$ into the principal's time-interdependent profit function (Equation (2.3)) and solving for the $\bar{s}$ guaranteeing the principal non zero profits for her investments.

Pattern II: Conditions

An investment in only the second period requires $s^*_{a,1} = 0$. Following Equation (2.7), this implies $\frac{1}{\delta}\left(\frac{v_P}{\alpha}\frac{1}{2(1-\beta\delta)}\right)^{\frac{2}{3}} \geq \bar{s}^i$. Further, it requires $s^*_{a,2} > 0$, implying that the condition in Equation (2.13) must hold.
Hence, Pattern II only exists if $\bar{s} \in \left[\frac{1}{\delta}\left(\frac{v_P}{\alpha}\frac{1}{2(1-\beta\delta)}\right)^{\frac{2}{3}}, \frac{1}{\delta^2}\left(\frac{1}{2}\right)^{\frac{2}{3}}\left(\frac{v_P}{\alpha}\right)^{\frac{2}{3}}\right)$. This set in only non-empty if

$$\frac{1}{\delta}\left(\frac{v_P}{\alpha}\frac{1}{2(1-\beta\delta)}\right)^{\frac{2}{3}} < \frac{1}{\delta^2}\left(\frac{1}{2}\right)^{\frac{2}{3}}\left(\frac{v_P}{\alpha}\right)^{\frac{2}{3}}$$

Simplifying this inequality leads to the same condition as above:

$$\frac{1}{\delta} - \sqrt{\delta} > \beta$$

Pattern III: Conditions

If $\bar{s} > \frac{1}{\delta^2}\left(\frac{1}{2}\right)^{\frac{2}{3}}\left(\frac{v_P}{\alpha}\right)^{\frac{2}{3}}$, Equation (2.6) states that $s^*_{a,2} = 0$ is optimal for the principal. Further, since $\frac{1}{\delta} - \sqrt{\delta} > \beta$, this fulfills the condition in Equation (2.14) and $\bar{s}$ lies above the threshold level ensuring $s^*_{a,1} = 0$. Hence, under this condition the principal will not invest in any period.

A.2 High future benefits

Pattern IV: Conditions

When future benefits are high for the principal, she wants to invest a positive amount in $t = 1$. With $\frac{1}{\delta} - \sqrt{\delta} \leq \beta$, $s_{a,1}$ is such that it exceeds Equation (A.1) and there are no investments are

made in $t = 2$. With $s^*_{a,2} = 0$ the optimization problem of the principal in $t = 1$ becomes

$$max_{s_{a,1}} \frac{(\delta \bar{s} + s_{a,1})^{\frac{1}{2}} - 1}{(\delta \bar{s} + s_{a,1})^{\frac{1}{2}}} v_P - \alpha s_{a,1} + \beta \left[v_P - \frac{v_P}{(\delta^2 \bar{s} + \delta s_{a,1})^{\frac{1}{2}}} \right] \tag{A.2}$$

The resulting optimal level of $s_{a,1}$ is then:

$$s^*_{a,1} = \left[\frac{v_P}{2\alpha} \left(1 + \frac{\beta}{\sqrt{\delta}} \right) \right]^{\frac{2}{3}} - \delta \bar{s} \tag{A.3}$$

We check our result by plugging $s^*_{a,1}$ into the threshold level in period $t = 2$

$$s^*_{a,1} \geq \frac{1}{\delta} \left(\frac{v_P}{2\alpha} \right)^{\frac{2}{3}} - \delta \bar{s}$$

which simplifies to $\delta + \sqrt{\delta}\beta \geq 1$ or $\beta \geq \frac{1}{\sqrt{\delta}} - \sqrt{\delta}$, respectively. This holds as $\frac{1}{\delta} - \sqrt{\delta} \leq \beta$ holds and $\frac{1}{\delta} \geq \frac{1}{\sqrt{\delta}}$ is true for $\delta \in (0, 1)$.

The condition in Equation (2.15) follows directly from equation (A.3). The condition in Equation (2.16) follows directly from plugging the optimal investment levels $s^*_{a,1} > 0$ and $s^*_{a,2} = 0$ into the principals time-interdependent profit function (Equation (2.3)) and solving for the $\bar{s}$ guaranteeing the principal nonzero profits for her investment. These conditions therefore describe Pattern IV.

A.3 Model version with complements

Model setup

We show that except for the u-shaped Pattern II and the no investment Pattern V, the investment patterns in the main section emerge also under the assumption of complementarity. We introduce complementarity by assuming that the agent's initial level and the investments by the principal multiply, implying that the principal only invests if the agent arrives with at least a minimal positive $\bar{s}$. The total value of Autonomy Support $\bar{s}_1$ and $\bar{s}_2$ available to the agent in periods $t = 1,2$ becomes

$$\bar{s}_1 = \bar{s} \cdot s_{a,1}$$
$$\bar{s}_2 = \bar{s} \cdot \delta s_{a,1} + \bar{s} \cdot s_{a,2}$$

For the sake of simplicity, we assume that only Autonomy support provided by the principal is discounted. The agent's utility as a function of his innovative activity i for periods $t = 1,2$ are

$$\begin{aligned} U_A(i,1) &= v_A \frac{i}{1+i} - \frac{i}{\bar{s} \cdot s_{a,1}} & &= v_A \frac{i}{1+i} - \frac{i}{\bar{s}_1} \\ U_A(i,2) &= v_A \frac{i}{1+i} - \frac{i}{\bar{s} \cdot (\delta s_{a,1} + s_{a,2})} & &= v_A \frac{i}{1+i} - \frac{i}{\bar{s}_2} \end{aligned}$$

The principal's profit functions for periods $t = 1,2$ are

$$\Pi_P(s_{a,1},1) = v_P \frac{i}{1+i} - \alpha s_{a,1} + \beta \Pi_P(s_{a,2},2)$$
$$\Pi_P(s_{a,2},2) = v_P \frac{i}{1+i} - \alpha s_{a,2}$$

We solve the model by Backward Induction.

Solving the model

Period 2

The agent chooses the optimal level of i to maximize his utility $U_A(i,2)$, resulting in

$$i_2^* = (\bar{s}(\delta s_{a,1} + s_{a,2}))^{\frac{1}{2}} - 1$$
$$i_2^* \geq 0$$

Innovative activity in period $t = 2$, i_2^*, is only greater than zero if $s_{a,2} \geq 1 - \frac{1}{\bar{s}} - \delta s_{a,1}$.
If $\frac{1}{\bar{s}} + \delta s_{a,1}$ is large enough, the principal does not have to provide additional Autonomy Support in the second period to induce innovative effort by the agent. If investments in the first period have vanished such that $\delta s_{a,1} = 0$, then $s_{a,2}$ must be high enough to instill innovation in the second period.

The principal maximizes $\Pi_P(s_{a,2}, 2)$, which with the agent's choice becomes

$$max_{s_{a,2}} \frac{\bar{s}(\delta s_{a,1} + s_{a,2}))^{\frac{1}{2}} - 1}{(\bar{s}(\delta s_{a,1} + s_{a,2}))^{\frac{1}{2}}} v_P - \alpha s_{a,2}$$

in order to derive her optimal investment in the second period by taking the agent's innovation effort into account, which results in

$$s_{a,2}^* = \left(\frac{1}{\bar{s}}\right)^{\frac{1}{3}} \left(\frac{v_P}{2\alpha}\right)^{\frac{2}{3}} - \delta s_{a,1} \geq 0 \tag{A.4}$$

Similar to the main section, the optimal value of $s_{a,2}^*$ decreases in α and increases in v_P. The principal only invests in Autonomy Support in the second period if her investment in the first does not exceed the threshold $\frac{1}{\delta}\left(\frac{1}{\bar{s}}\right)^{\frac{1}{3}} \frac{v_P}{2\alpha}^{\frac{2}{3}}$ making additional investments unnecessary.

Period 1

Optimizing $U_A(i,1)$ leads to the agent's optimal choice of innovative activity in period $t=1$:

$$i_1^* = (\bar{s} \cdot s_{a,1})^{\frac{1}{2}} - 1 \geq 0$$

The principal takes i_1^* as well as the discounted future consequences of her choice of $s_{a,1}$ into account. She maximizes $\Pi_P(s_{a,1},1)$ which has become

$$max_{s_{a,1}} \frac{(\bar{s} \cdot s_{a,1})^{\frac{1}{2}} - 1}{(\bar{s} \cdot s_{a,1})^{\frac{1}{2}}} v_P - \alpha s_{a,1} + \beta \bar{\Pi}_2 + \alpha\beta\delta s_{a,1}$$

with $\bar{\Pi}_2 = v_P - \frac{v_P}{\bar{s}^{\frac{1}{3}}\left(\frac{v_P}{2\alpha}\right)^{\frac{1}{3}}} - \alpha\frac{1}{\bar{s}^{\frac{1}{3}}}\left(\frac{v_P}{2\alpha}\right)^{\frac{1}{3}}$ as a constant, and optimally chooses

$$s_{a,1}^* = \left(\frac{v_P}{2\alpha(1-\beta\delta)}\right)^{\frac{2}{3}} \frac{1}{\bar{s}}^{\frac{1}{3}} \geq 0 \tag{A.5}$$

where $(\alpha - \beta\delta\alpha) > 0$, because $\delta, \beta < 1$.

Results: Autonomy Support investment patterns

As in the main section, the investment patterns that emerge depend on the benefit-cost ratio $\frac{v_P}{\alpha}$, the agent's depreciation rate of Autonomy Support δ and the principal's discount factor β, and can be distinguished by the relationship between β and δ.

Low future benefit investment patterns under $\beta < \frac{1}{\delta} - \sqrt{\delta}$

When either or both β and δ are low, the principal has lower incentives to invest which results in lower investments.

Pattern A: Investment in each period

When the principal wants to lower investments, she may have to invest in each period. For this, $s^*_{a,1}$ must be smaller than the threshold level $\frac{1}{\delta}\left(\frac{1}{\bar{s}}\right)^{\frac{1}{3}}\frac{v_P}{2\alpha}^{\frac{2}{3}}$ such that $s^*_{a,2} > 0$ is optimal. It follows that

$$\begin{aligned} s^*_{a,2} &= \left(\frac{1}{\bar{s}}\right)^{\frac{1}{3}}\left(\frac{v_P}{2\alpha}\right)^{\frac{2}{3}} - \delta\left(\frac{v_P}{2\alpha(1-\beta\delta)}\right)^{\frac{2}{3}}\frac{1}{\bar{s}}^{\frac{1}{3}} \\ &= \left(\frac{1}{\bar{s}}\right)^{\frac{1}{3}}\left(\frac{v_P}{2\alpha}\right)^{\frac{2}{3}}\left[1-\delta\frac{1}{(1-\beta\delta)}^{\frac{2}{3}}\right] > 0 \end{aligned}$$

Since $\bar{s}$ and $\left(\frac{v_P}{2\alpha}\right)$ are strictly positive, this expression holds for as long as $\beta < \frac{1}{\delta} - \sqrt{\delta}$ which is the same necessary condition as in the main section with substitutability. However, there is no explicit upper threshold $\bar{s}$ that renders $s^*_{a,1}$ to zero. Therefore, there is no u-shaped pattern with complementarity.

Inserting $s^*_{a,1}$ and $s^*_{a,2}$ (from Equations (A.5) and (A.4)) into the profit function we derive the principal's payoff

$$\Pi^*_1 = v_P - \frac{v_P}{\frac{v_p}{(2\alpha(1-\beta\delta)}^{\frac{2}{3}}} - \alpha\left(\frac{v_P}{2\alpha(1-\beta\delta)}\right)^{\frac{2}{3}}\frac{1}{\bar{s}}^{\frac{1}{3}} + \beta\delta\alpha\left(\frac{v_P}{2\alpha(1-\beta\delta)}\right)^{\frac{2}{3}}\frac{1}{\bar{s}}^{\frac{1}{3}} + \beta\left[v_P - 3\alpha\left(\frac{1}{\bar{s}}\right)^{\frac{1}{3}}\left(\frac{v_P}{2\alpha}\right)^{\frac{2}{3}}\right]$$

which we use to derive the sufficient condition that guarantees positive profits for the principal

$$\bar{s} \geq \frac{9}{4}\frac{\alpha}{v_P}\left[\frac{(1-\beta\delta)^{\frac{2}{3}}+\beta}{(1+\beta)}\right]^3$$

The higher $\frac{v_P}{\alpha}$, the lower $\bar{s}$ can be without setting $s^*_{a,1} = 0$. The threshold depends negatively on δ and β, as long as $\delta, \beta \in (0,1)$, which by assumption, they are. Hence, if $\bar{s}$ is not too low the principal invests a positive amount in both periods in the low future benefit investment pattern.

Pattern B: No investment

In Pattern A, we derive that the principal does not invest in period $t = 1$, $s^*_{a,1} = 0$, when

$$\bar{s} < \frac{9}{4}\frac{\alpha}{v_P}\left[\frac{(1-\beta\delta)^{\frac{2}{3}}+\beta}{(1+\beta)}\right]^3$$

Taking this into account in Equation (A.4), the optimal investment in period $t = 2$ must satisfy $s^*_{a,2} = \left(\frac{1}{\bar{s}}\right)^{\frac{1}{3}}\left(\frac{v_P}{2\alpha}\right)^{\frac{2}{3}}$ leading to the condition for a positive investment $s^*_{a,2} > 0$

$$\bar{s} \geq \frac{9}{4}\frac{\alpha}{v_P}$$

We know that $\bar{s} < \frac{9}{4}\frac{\alpha}{v_P}\left[\frac{(1-\beta\delta)^{\frac{2}{3}}+\beta}{(1+\beta)}\right]^3$, therefore we know that $\bar{s} < \frac{9}{4}\frac{\alpha}{v_P}$ must hold as well, because $\left[\frac{(1-\beta\delta)^{\frac{2}{3}}+\beta}{(1+\beta)}\right]^3 \in [0.125, 1]$ for $\delta, \beta \in [0, 1]$.
It follows that for $\bar{s} < \frac{9}{4}\frac{\alpha}{v_P}\left[\frac{(1-\beta\delta)^{\frac{2}{3}}+\beta}{(1+\beta)}\right]^3$ the principal does not invest in either period, such that $s^*_{a,1} = s^*_{a,2} = 0$.

High future benefit investment patterns under $\beta \geq \frac{1}{\delta} - \sqrt{\delta}$

Pattern C: Investment only in first period

With high future benefits when both β and δ are high, the principal wants higher investments in the first period. For $\beta \geq \frac{1}{\delta} - \sqrt{\delta}$,

$$s^*_{a,2} = \left(\frac{1}{\bar{s}}\right)^{\frac{1}{3}}\left(\frac{v_P}{2\alpha}\right)^{\frac{2}{3}}\left[1 - \delta\frac{1}{(1-\beta\delta)}^{\frac{2}{3}}\right] \leq 0$$

such that the principal never wants to invest in period $t = 2$ and chooses $s^*_{a,2} = 0$. Her maximization problem in period $t = 1$ becomes

$$max_{s_{a,1}} \frac{(\bar{s}\cdot s_{a,1})^{\frac{1}{2}} - 1}{(\bar{s}\cdot s_{a,1})^{\frac{1}{2}}} v_P - \alpha s_{a,1} + \beta\left[v_P - \frac{v_P}{(\delta\bar{s}\cdot s_{a,1})^{\frac{1}{2}}}\right]$$

resulting in the optimal investment in the first period of

$$s^*_{a,1} = \left(\frac{1}{\bar{s}}\right)^{\frac{1}{3}} \left(\frac{v_P}{2\alpha}\right)^{\frac{2}{3}} \left[1 + \frac{\beta}{\sqrt{\delta}}\right]^{\frac{2}{3}} \tag{A.6}$$

This also exceeds the threshold $\frac{1}{\delta}\left(\frac{1}{\bar{s}}\right)^{\frac{1}{3}} \frac{v_P}{2\alpha}^{\frac{2}{3}}$, guaranteeing that $s^*_{a,2}$ in Pattern C is zero.

Comparison to the model version in the main section

For the low future benefits case, the principal either invests in both periods when the agent arrives with a sufficiently high initial amount of Autonomy Support, or invests in neither period if the agent does not. The u-shaped Pattern II in the main section does not emerge. Once the agent's Autonomy Support stock is too low, the principal has no incentive to top it up under complementarity.

For high future benefits, the principal always invests, but only in the second period. The no investment Pattern V in the main section does not emerge due to high future benefits. Because of the complementarity, her incentive to invest a lot 'in advance' pays off stronger in the later period.

Although the complementarity version features a different core assumption, the main results hold. First, the principal's investments are lower the higher the existing level of Autonomy Support, as $\frac{\partial s^*_{a,2}}{\partial s^*_{a,1}} < 0$ and $\frac{\partial s^*_{a,2}}{\partial \bar{s}} < 0$ for $\delta > 0$. In a way, there is a certain degree of substitutability even under the assumption of complementarity. Second, whether the principal invests in each or only one period depends on the β-δ relationship. As in the main section, this relationship is displayed by $\beta \lessgtr \frac{1}{\delta} + \sqrt{\delta}$ reflecting the future benefits of investments.

Appendix B

Autonomy and Recruitment: Mathematical Appendix

B.1 Derivatives of the profit functions in the case of productivity gains at the project level through agent's Autonomy

1. Derivative of LHS truncated profit function

$$\frac{\partial E[\Pi_{LHS}]}{\partial A_F} = \gamma \left[\frac{A_F}{2} + \frac{r^2(1+\phi)^2}{4\gamma} + \frac{K_0}{4\gamma} \right] > 0$$

2. Derivative of untruncated profit function

$$\frac{\partial E[\Pi]}{\partial A_F} = K_0 > 0$$

3. Derivative of RHS truncated profit function

$$\frac{\partial E[\Pi_{LHS}]}{\partial A_F} = -\gamma \left[\frac{A_F}{2} + \frac{r^2(1+\phi)^2}{4\gamma} + \frac{K_0}{4\gamma} \right] < 0$$

B.2 Inefficiencies at task level from granting Autonomy

Feasible range

The principal maximizes

$$\Pi = (r - w)e^* - w_0 = \frac{r\,w}{(1 + A_F)} - \frac{w^2}{2(1 + A_F)} - \gamma|A_A - A_F| - U_0$$

which leads to

$$w^* = r$$

and

$$w_0^* = \gamma|A_A - A_F| - \frac{w^{*2}}{2(1 + A_F)} + U_0 = \gamma|A_A - A_F| - \frac{r^2}{2(1 + A_F)} + U_0$$

The principal considers the Individual Rationality constraint in Equation (3.3) under the absolute value mismatch function to determine which range of agents she can attract (assuming $U_0 = 0$):

$$w_0^* = \gamma|A_1 - A_F| - \frac{r^2}{2(1 + A_F)} \stackrel{!}{=} 0 \Longleftrightarrow A_1 = A_F \pm \frac{r^2}{2\gamma(1 + A_F)}$$

Therefore, the bounds of the range in which agents can be feasibly attracted are $\bar{A}_A^* = A_F + \frac{r^2}{2\gamma(1+A_F)}$ and $\underline{A}_A^* = A_F - \frac{r^2}{2\gamma(1+A_F)}$. This corresponds to following feasible range:

$$\textit{feasible range} = 2 * \frac{r^2}{2\gamma(1 + A_F)}$$

Given that the principal cannot observe the specific A_A and renegotiate, she the same conditional profit and pays the same wage to all agents who accept the contract.

$$\begin{aligned} E[\Pi|\textit{feasible range}] &= \left[2 * \frac{r^2}{2\gamma(1 + A_F)}\right]\left[(r - w^*) - w_0^*\right] \\ &= \left[\frac{r^2}{\gamma(1 + A_F)}\right][(0) - 0] = 0 \end{aligned}$$

Therefore, the principal makes zero profits under the feasible range, but inefficiencies at the task level due to granting Autonomy has the additional effect that the feasible range becomes smaller with increasing A_F.

Deriving the optimal wage schedule

The principal optimizes her profits by accounting for the fact that the flat payment influences the range of agents she can attract and that this in turn influences the profit she can extract from successfully attracted agents. When granting Autonomy entails inefficiencies at the task level, the principal maximizes

$$\begin{aligned}\max_{w,w_0} E[\Pi] &= 2\left[\frac{w_0}{\gamma}+\frac{w^2}{2\gamma(1+A_F)}\right]\left[\frac{rw}{(1+A_F)}-\frac{w^2}{(1+A_F)}-w_0\right] \\ &= -\frac{w^4}{\gamma(1+A_F)}+\frac{w^3 r}{\gamma(1+A_F)^2}-\frac{3w^2 w_0}{\gamma(1+A_F)}+\frac{2rww_0}{\gamma(1+A_F)}-\frac{2w_0^2}{\gamma}\end{aligned}$$

The derivative with respect to w_0 is

$$\frac{\partial}{\partial w_0} = -\frac{3w^2}{\gamma(1+A_F)}+\frac{2rw}{\gamma(1+A_F)}-\frac{4w_0}{\gamma}=0$$

and we obtain

$$w_0^*(w)=\frac{2rw-3w^2}{4(1+A_F)}.$$

The derivative with respect to w is

$$\frac{\partial}{\partial w} = -\frac{4w^3}{\gamma(1+A_F)}+\frac{3w^2 r}{\gamma(1+A_F)^2}-\frac{6ww_0}{\gamma(1+A_F)}+\frac{2rw_0}{\gamma(1+A_F)}=0$$

which we plug into $w_0^*(w)$

$$-\frac{4w^3}{\gamma(1+A_F)^2}+\frac{3rw^2}{\gamma(1+A_F)^2}-\frac{12rw^2-19w^3}{4\gamma(1+A_F)^2}+\frac{4r^2w-6rw^2}{4\gamma(1+A_F)^2}=0$$

simplify and multiply by $2\gamma(1+A_F)^2$

$$w^3-3rw^2+r^2w=0$$

divide by $w\neq 0$

$$w^2-3rw+1.5^2r^2=1.5^2r^2-2r^2=0.25r^2$$

such as to obtain

$$w = 1.5r \pm 0.5r$$

We therefore have two potential solutions: $w_1 = 2r$ with resulting $w_{0,1} = \frac{-r^2}{(1+A_F)}$, and $w_2 = r$ with resulting $w_{0,2} = \frac{-r^2}{4(1+A_F)}$. We check the principal's expected profits for each potential solution:

$$E[\Pi|w_1, w_{0,1}] = 2 * [\frac{-2r^2}{\gamma(1+A_F)} + \frac{4r^2}{2\gamma(1+A_F)}][\frac{2r^2}{(1+A_F)} - \frac{4r^2}{(1+A_F)} + \frac{2r^2}{(1+A_F)}] = 0$$

$$\begin{aligned} E[\Pi|w_2, w_{0,2}] &= 2 * [\frac{-r^2}{4\gamma(1+A_F)} + \frac{2r^2}{4\gamma(1+A_F)}][\frac{r^2}{(1+A_F)} - \frac{r^2}{(1+A_F)} + \frac{r^2}{(1+A_F)}] \\ &= \frac{r^4}{8\gamma(1+A_F)^2} \end{aligned}$$

and find that the profit maximizing choice of the principal is $w^* = r$ and $w_0^* = \frac{-r^2}{4(1+A_F)}$.
For the Individual Rationality constraint in Equation (3.3), this means that

$$w_0 \geq \gamma|A_1 - A_F| - \frac{r^2}{2(1+A_F)} \stackrel{!}{=} \frac{-r^2}{4(1+A_F)} = w_0^*$$

such that it binds at a higher value. The principal attracts agents in a smaller range around A_F. Indeed, the bounds for the optimal range are $\bar{A}_A^* = A_F + \frac{r^2}{4\gamma(1+A_F)}$ and $\underline{A}_A^* = A_F - \frac{r^2}{4\gamma(1+A_F)}$, and the optimal range

$$\textit{optimal range} = 2 * \frac{r^2}{4\gamma(1+A_F)}$$

only half as wide as the feasible range:

$$\begin{aligned} &\textit{feasible range} > \textit{optimal range?} \\ \iff 2\frac{r^2}{2\gamma(1+A_F)} &> 2\frac{r^2}{4\gamma(1+A_F)} \iff \frac{1}{2} > \frac{1}{4} \end{aligned}$$

B.3 Derivatives of the profit functions in the case of inefficiencies at the task level from granting Autonomy

1. Derivative of RHS truncated profit function

$$\frac{\partial E[\Pi_{RHS}]}{\partial A_F} = -(1-A_F)\gamma - \frac{r^2}{2(1+A_F)^2} - \frac{r^4}{8\gamma(1+A_F)^3} < 0$$

2. Derivative of the untruncated profit function

$$\frac{\partial E[\Pi]}{\partial A_F} = \frac{-r^4}{4\gamma(1+A_F)^3} < 0$$

3. Derivative of the LHS truncated profit function

$$\frac{\partial E[\Pi_{LHS}]}{\partial A_F} = \frac{A_F\gamma}{2} + \frac{r^2}{4(1+A_F)^2} - \frac{r^4}{8\gamma(1+A_F)^3}$$

   This results in a quartic equation.

4. When is the LHS truncated profit function increasing?

$$\frac{\partial E[\Pi_{LHS}]}{\partial A_F}\Big|_{A_F=0} = \frac{r^2}{4} - \frac{r^4}{8\gamma} \geq 0 \Longleftrightarrow 2\gamma \geq r^2$$

$$\frac{\partial E[\Pi_{LHS}]}{\partial A_F} \geq 0 \Longleftrightarrow 4\gamma^2 A_F(1+A_F)^3 + 2\gamma(1+A_F)r^2 - r^4 \geq 0$$

   According to Wolfram Alpha

   - $r = 0, 0 \geq A_F \geq 1, \gamma > 0$
   - $r > 0, A_F = 0, \gamma > \frac{r^2}{2}$
   - $r > 0, A_F = 0, \gamma < 0$
   - $r > 0, 0 \geq A_F \geq 1, \gamma > \frac{r^2}{2(1+A_F)^2}$
   - $r > 0, 0 \geq A_F \geq 1, \frac{r^2}{2A_F(1+A_F)} < \gamma < 0$

5. Second derivative LHS truncated profit function

$$\frac{\partial^2 E[\Pi_{LHS}]}{\partial A_F^2} = \frac{\gamma}{2} - \frac{r^2}{2(1+A_F)^3} + \frac{3r^4}{8\gamma(1+A_F)^4}$$

6. Curvature at $A_F = 0$

$$\frac{\partial^2 E[\Pi_{LHS}]}{\partial A_F^2}\Big|_{A_F=0} = \frac{\gamma}{2} - \frac{r^2}{2} + \frac{3r^4}{8\gamma} = \frac{(2\gamma - r^2)^2 + 2\gamma}{8\gamma} > 0$$

Therefore, the untruncated and the RHS truncated profit function are always decreasing. The LHS truncated profit function is increasing for $\gamma > \frac{r^2}{2(1+A_F)^2} \leftrightarrow A_F > \sqrt{\frac{r^2}{2\gamma}} - 1$.

Inefficiencies at task level case: Potential Saddle point at $w = r$?

Taking the non-optimized LHS profit function and taking the first and second order derivatives

$$\frac{\partial E[\Pi_{LHS}]}{\partial w} = \frac{A_F r}{(1+A_F)} + \frac{w_0 r}{\gamma(1+A_F)} + \frac{3rw^2}{2\gamma(1+A_F)^2} - \frac{2A_F w}{(1+A_F)} - \frac{2w_0 w}{\gamma(1+A_F)} - \frac{4w^3}{2\gamma(1+A_F)^2} - \frac{2ww_0}{2\gamma(1+A_F)}$$

$$\frac{\partial^2 E[\Pi_{LHS}]}{\partial w^2} = \frac{3w(r-2w)}{\gamma(1+A_F)^2} - \frac{2A_F}{(1+A_F)} - \frac{3w_0}{\gamma(1+A_F)}$$

We scrutinize the point $w = r$ and $w_0^* = -\frac{(1-A_F)\gamma}{2} - \frac{r^2}{4(1+A_F)}$:

$$\frac{\partial^2 E[\Pi_{LHS}]}{\partial w^2}\Big| w^*, w_0^* = -\frac{A_F}{2(1+A_F)} < 0$$

therefore, there is no saddle point at $w^* = r$ and w_0^*.

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