Paper to be presented at the DRUID Academy 2013

on

DRUID Academy 2013
at Comwell Rebild Bakker, Rebild/Aalborg

Walking assets: the cost of losing an employee

Juan Martin Carriquiry
AAU
Business and Management
jmc@business.aau.dk

Abstract

Today, many companies claim that employees are their most valuable asset. And yet, there is surprisingly little known about how much it hurts companies when those assets walk out the door. Most research on employee turnover has focused on its causes rather than on its consequences. Such focus has yielded some fruitful literature for HR management, but the impact of this employee behavior on organizational finances remains underdeveloped. Moreover, turnover has not been given the relevance it should by practitioners either. This is reflected by the lack of measures to quantify its costs, and that no item in company balances and budgets attempts to account for it. The issue of how much resources should be utilized in preventing turnover over other goals is thus still open. Ultimately, the answer to this question will assist managers in their strategic allocation of scarce organizational resources. To address this question, I will draw on learning curves literature to contribute to the existing research on the costs of turnover for the firm.
Empirical evidence on the consequences of employee turnover is by and large based on very particular industries, concretely (a) health care and (b) lodging. These industries are very distinct for (a) is highly regulated, with a large public sector presence and complex revenue flows; and (b) is a highly seasonal industry with relatively low skilled personnel. It is this empirical gap that this paper addresses by providing data from a knowledge-intensive manufacturing firm, analyzed through turnover accounting models and learning curves literature. In particular, the focus will be on voluntary engineer turnover. Data was collected from company records and interviews with three key HR personnel and three engineer managers.
The company under consideration had 340 engineers at the end of the period (2010-2011), and an average voluntary turnover rate of 3.24%. The results indicate that employee turnover is indeed a costly phenomenon, in line with findings in the health care sector. On average, the cost of an employee voluntarily leaving was found to be $41.549, and the total costs of voluntary engineer turnover for the firm were $914.074 over the 2-year period under consideration. The results are conservative estimates, since the impact of turnover on production and sales could not be quantified. Training accounted for approximately 19% of the overall costs, while hiring was 6%. By far the largest single item was the productivity loss ?the monetary value of the gap in productivity between the former and the new employee? accounting for approx. 73% of the total costs.
For practitioners, the results suggest that most of the costs of losing an employee are intrinsic to the position. The

complexity of the tasks and the length of learning times appear to be the main determinants of the costs of voluntary turnover, and thus substantial reductions in such costs are unlikely at best. Hiring costs can be greatly reduced by the engagement of engineer managers in external networking for recruiting purposes. Yet, hiring costs are a relatively minor fraction of the total costs, and so even major reductions on this item are unlikely to have a major impact on the costs. The impact of voluntary turnover on the firm?s finances would be reduced by hiring former employees, or, naturally, by reducing turnover frequency. The results also suggest that the costs are large enough to have a significant impact on the firm, and that turnover of employees with complex tasks should be particularly avoided.
The main contribution to theory is the explicit incorporation of learning curve theory to accounting models of employee turnover, which is expected to advance human resources management literature. The evidence presented here provides support for the relevance of more investigation into the costs of turnover. Other case studies should be carried out to enhance the validity of the findings presented here and to bring our knowledge of this phenomenon a step further.

Jelcodes:M51,-

Walking assets: The cost of losing an employee

Juan Martin Carriquiry
Aalborg University

December 18, 2012

Abstract: A large part of the research on employee turnover has focused on its causes rather than on its consequences. While such focus has yielded some fruitful literature for HR management, the impact of this employee behaviour on organizational finances remains underdeveloped. The link between decisions at individual level and firm financial variables needs to be supported by empirical evidence. Previous studies on the consequences of employee turnover are by and large based on very particular industries, such as health care and lodging. The question of how much resources should be utilized in preventing turnover over other goals is still open. Ultimately, the answer to this question will assist managers in their strategic allocation of scarce organizational resources. In the following paper, I study the costs of voluntary employee turnover for the firm. In particular, evidence from a knowledge-intensive manufacturing firm is used to estimate the costs of engineer turnover. Data was collected from company records and interviews with HR personnel and managers. The findings indicate that employee turnover is indeed a costly phenomenon, in line with findings in the health care sector. By far the largest single cost for the firm is the productivity loss. This indicates that for positions which involve complex tasks and prolonged learning times, turnover is particularly costly. The implications for practice and research are outlined.

Keywords: Employee turnover, strategy, costs of turnover

Introduction

The tendency in many countries towards high employee mobility calls for the resurgence of the debate on the organizational consequences of voluntary employee turnover. The individual decision of employees to leave an organization may (or may not) have a significant impact on firm performance. Some scholars (Baron et al. (2001), Gjerlv-Juel and Guenther 2012) argue that turnover has a disruptive effect on organizational routines, and affects performance negatively. Others (Staw (1980), Dalton and Todor (1979), Dalton et al. (1982)), however, argue that the potential negative effects of employee turnover have been overstated, and that it can actually be beneficial for the firm to let employees go. Yet others (Abelson and Baysinger (1984), Glebbeek and Bax (2004)) argue that a firm could be harmed by either too high or too low turnover. Furthermore, while some authors (source) argue that high employee turnover is a concern for most managers, others (Hinkin and Tracey (2000)) argue that managers tend to underestimate the benefits of an stable workforce on productivity.

Despite the significance of the phenomenon for organizations in general, evidence of the performance consequences of turnover has so far been limited to health care (Waldman et al. (2004), Jones (2004), Buchbinder et al. (1999)) and lodging (Hinkin and Tracey (2000), Tracey and Hinkin (2008)) industries. Earlier studies have instead focused on low skilled, or relatively automatised positions (source). But can the findings in those industries be extended to other settings? After all, health care is a heavily regulated sector with a large public participation and an unusual relation between revenue and expenditure (Waldman et al. (2004)). Lodging is usually seasonal and charaterised by high turnover rates, and low firm-specific knowledge requirements.

The lack of evidence on the consequences of turnover by qualified employees in knowledge intensive industries limits our knowledge of the underlying phenomenon. Is the turnover by these groups more or less costly than in health care or lodging? Insights from learning theories (Mazur and Hastie (1978)) suggest that it might be particularly relevant to advance evidence in fields where learning periods are prolonged, since this may have have a critical impact on the overall

consequences of turnover. At individual level, learning seems to be largely a cumulative process.

The study of the costs of employee turnover for the organization should contribute to the efficient allocation of resources. An ever-present question for managers, particularly in the field of HR decision-making (Mobley and Fisk (1982), Abelson and Baysinger (1984), Glebbeek and Bax (2004)) is how much resources should be directed to tackling non-optimal levels of turnover.

Previous attempts to account for the costs of turnover have resulted in widely diverging estimations. Waldman et al. (2004), in one of the most comprehensive and detailed studies, estimate that the cost of replacing a nurse to be between \$27.927 and \$37.437,[1] and a physician between \$183.488 and \$220.250. Buchbinder et al. (1999) estimated the cost of primary care physicians to be between \$318.701 to \$356.805 depending on the speciality. Jones (2005) estimates the cost of turnover by registered nurses to be between \$73.831 and \$79.776. Hinkin and Tracey (2000) find that for two different hotels, the costs of turnover ranged from \$7.419 for a front-office associate to \$3.376 for a line cook in the same hotel, and from to \$9.989 for an administrative assistant, sales and catering personnel to \$1.737 for room-service waitstaff in the other. Also, the turnover costs for a front-desk associate could range from \$7.419 in one city to \$16.801 in another.

The theoretical accounting model is based on Tziner and Birati (1996), who extend a previous model by Cascio (1991). In this paper, there is an explicit effort to account for the learning process of new employees and the impact on organizational finances.

This paper explores the evidence on the costs of engineer turnover for a knowledge-intensive manufacturing firm in northern Europe. Data on selection, performance, networking, coaching and training, among others, was obtained from interviews with engineer managers. General data on the sample, such as age and tenure, and compensation, selection, further training activities and other costs were obtained from the HR department. To sort the lack of precise records on the evolution of employee productivity, I propose a model to account for the costs of reduced productivity due to turnover. The coefficients in this model are estimated for this study from interviews with engineer managers.

[1] All figures have been brought to 2011 terms.

The findings indicate that the departure of an engineer costed the company approx. $41,549. These results are in line with studies in the health care sector, and in contrast to those in less knowledge-intensive industries. The contribution for literature is that, by incorporating learning processes into the assessment of employee turnover, we can obtain a much richer picture on the actual consequences for the firm. These findings further validate the approach by Waldman et al. (2004) of incorporating learning curves at individual level to calculate turnover costs, and show that this method could be used in other industries as well. Practitioners should incorporate this method for calculating the actual financial loss for the firm of employee turnover, and include in they financial statements and balances.

Turnover costs

Whether voluntary turnover is or not a type of employee behaviour detrimental for the firm remains a point of contention in the literature. One stream of thought, particularly organizational ecologist (Baron et al. (2001)), sees turnover as a negative event. In their view, the continuity of organizational routines is essential for increasing productivity and survival. Employee turnover breaks organizational routines, and consequently threaten to undermine the firm's performance. Baron et al. (2001) provide some evidence for this in the context of a sample of high-growth firms, and find that turnover affects negatively future performance.

Another stream of literature (Dalton and Todor (1979), Staw (1980), Dalton et al. (1981)) argues that the costs of turnover have been overemphasised in academics. They argue that turnover only marginally reduces productivity, since employees are relatively easy to replace. Moreover, a survey on managers in the banking industry actually found that most employees that left the company voluntarily would not have been rehired by their managers. This suggests that managers not always perceive keeping the employees as beneficial, and might even find beneficial that some of them leave. Turnover offers the possibility of letting under-performers go, and possibly attracting better employees to replace them. The main limitation of this line of research is that it has focused on employees in positions that are either seasonal, or fairly mechanical. At any rate, learning periods are relatively low and replacements easy to find.

The last stream of literature (Abelson and Baysinger (1984), Glebbeek and Bax (2004)) argues that the true question should not be whether turnover is good or bad for a company, but rather what level of turnover should be the optimal. Keeping employees in the company implies a set of costs in terms of retention strategies, and turnover implies a set of costs. From this cost-benefit analysis, the "optimal" rate of turnover should be that point where the marginal costs of turnover equal the marginal costs of retention.

In general terms, literature has been vague about how to analyse the effect of employee learning processes on the firm. Both Cascio (1991) and Tziner and Birati (1996) recognize in their model

that the productivity of new employees employees is initially lower than their predecessors, but their method for calculating this gap rather rough. This paper will contribute by incorporating a learning curve approach, similar to the one used in the analysis of turnover in health care by Waldman et al. (2004)[2]. In this way, learning is modelled as a continuous and non-linear rather than a discrete process.

Following Abelson and Baysinger (1984), this paper argues that a zero turnover rate should not be the aim of any company. In their view, it should be the goal of management to attain an "optimal" turnover rate, defined as that point where the net costs of turnover are equal to zero. At that point, the costs of retention practices would equal the costs of employee turnover, and thus further attempts to retain employee would be non-optimal and economically inefficient (Abelson and Baysinger (1984)).

Furthermore, even if turnover was very costly for an organization, this does not mean that it is always a negative event. Poor performers might leave and leave room for better-performing replacements (Dalton et al. (1981). Others might have knowledge and competences that become obsolete, and letting them go might help the firm adapt and innovate. Yet others might leave due to unresolved conflicts, improving workplace conditions. These and other considerations might mean that employee turnover, in general, is not necessarily detrimental for an organization. Nevertheless, it is important that such potentially beneficial effects are weighted against the financial costs of employee turnover. This paper, thus, will focus on the financial impact of turnover on the firm.

Empirically, there have also been a number of attempts to measure the costs of employee turnover. Buchbinder et al. (1999), Jones (2004) and Waldman et al. (2004) have provided estimates of the costs in the healthcare industry. Buchbinder et al. (1999) have focused on the turnover of primary physician, while Jones (2004) has focused on nurses and Waldman et al. (2004) have considered both.

Hinkin and Tracey (2000), Tracey and Hinkin (2008) provide two of the only accounts of turnover costs in a sector other than healthcare; the lodging business. They too conclude that the financial

[2]For a review of the literature on learning curves, see Anzanello and Fogliatto (2011)

impact of turnover is substantial, and they advance a set of characteristics of the position that influence how costly turnover will be for the firm.

The generalizability of the evidence presented until now, however, has been limited by the extent to which it is based on low skilled employees or very particular industries. The studies on the lodging industry provide insightful accounts of measurable and intangible costs, but focus exclusively on positions that are low knowledge-intensive. On the other hand, the studies from the health care sector do analyse some high knowledge-intensive positions. Yet still, this is a very special sector, characterised by high entry barriers, a large presence of the public sector, and heavy regulations on practices and processes. Most importantly, the relation between cash flows and service quality in this sector is highly intricate. These characteristics of the health care sector attenuates the validity of the evidence in other context.

On the theoretical side, this paper provides a more detailed account of the costs of turnover for the firm than Cascio (1991) and Tziner and Birati (1996). Particularly, a model of reduced productivity, based on learning curves' literature, allows for a better estimation of the output loss due to employee turnover.

One of the main limitations of early work on the effects of employee turnover stems from its focus on low-skilled workers, at relative repetitive or manual tasks, and with short learning curves. It might makes sense that seasonal workers are not hired all year round just to prevent the costs of turnover in agriculture or tourism. In those instances, the costs of retaining employees for long periods might far outweigh the costs. But the case of highly specialised workers presents a much more complex analysis, which unfortunately has either not been considered relevant or its study has resulted impractical for researchers. According to Hinkin and Tracey (2000), the level of complexity of the tasks will affect substantially the costs of turnover. There is a gap in the research of highly skilled employee turnover, and thus a strong need for the analysis of costs of turnover for highly skill workers in knowledge intensive industries to improve our understanding of the consequences of turnover for firms.

Measuring the costs

The model that will be presented here is based on Tziner and Birati (1996), whose model is based on Cascio (1991). Tziner and Birati (1996) separate the costs of turnover into direct and indirect costs. The former include the hiring costs, the training costs, the time spent by others socializing the newcomer, and the difference in wages between the newcomer and the former employee. The indirect costs include the costs of temporarily replacing the former employee, and the financial value of the productivity gap between the departing employee and the newcomer. To capture the higher tendency of new hires to end employment relations than more tenured employees, the sum of the direct and indirect costs is finally multiplied by a coefficient μ [0;1], called the *turnover rate multiplier*.[3]

I therefore take this model by Tziner and Birati (1996) as the basis for constructing a more detailed account on the financial costs of turnover. The main contributions of this new model are: a) it makes more explicit all the possible costs incurred in the turnover process, and so enhances its applicability; and b) it advances an applicable partial-productivity model to calculate the productivity loss due to employee turnover. The productivity model reflects insights from learning curves theory, in this case applied at an individual level.

The complete account of the costs of employee turnover includes a) the costs of departure of an employee, b) the costs of hiring and c) training the new employee, and d) the costs of reduced productivity due to the lower productivity of the new hire.

Departure costs. The departure costs include administrative costs, exit interviews by the employee manager and a member of the Human Resources department, the reorganization of workload by the manager, and IT costs. The reorganization of workload by managers when an employee leaves might also be a time-consuming process. If there is a temporary replacement for the departing employee, this might represent an extra cost for company. If instead the workload is spread through the rest of the employees, this might be at overtime rates and decreased productivity.

[3]For evidence on the high hazard of new jobs ending in the first year, see for example Farber (1999).

Hiring costs. The hiring costs could be grouped into costs of selecting the new employee, and costs of initiating the employee in the firm. The costs of selection include advertising the position, application screening and reviewing, background and reference check, selection interviews by HR staff and managers, administrative costs, travelling costs for candidates and personnel, and pre-employment tests. When an employee needs to be hired by an external agency, the agency fee and advertisement costs should also be accounted. Also, if managers spend time looking for candidates themselves, this should be included in the costs. In the latter case, many of the costs -such as application screening and interviews- can be greatly reduced or eliminated, potentially representing substantial savings in the selection process. The costs of initiation, on the other hand, include relocation packages and benefits for new employees, IT and other access services, administrative and payroll inclusion costs and medical examination. The introductory activities to the company itself and the department should also be accounted as initiation costs.

Training costs. The training costs for new employees include the cost of training material, the wage of the course instructor, the time spent on company activities for the introduction of newcomers into the organization, and if relevant the time an employee is on payroll before starting to perform the task. The training costs should also account for the time spent socializing the newcomer into the company and introducing him to the social networks of the firm. Some firms have this process more formalized than others, but it nevertheless may require substantial time.

Costs of reduced productivity. The productivity gap in our current model has been defined as the value of output loss due to the lower productivity of new hires until they reach the same productivity as the former employees. But how do we know how long it might take a new hire to achieve a certain level of productivity? In other words, how can we know the shape of his learning curve? If the data allows, we could of course calculate the curve that minimizes the square errors. Alternatively, we can estimate it by modelling a productivity curve for new employees. The latter should simulate the learning process of new employees whenever precise data is not available.

It is usually the case that new hires have a lower initial productivity than former employees. This is a well known phenomenon in learning curve theory: the more you do, the better will become at the task (Waldman and Yourstone (2011)). A similar learning curve pattern has been found across industries and occupations, from manufacturing (Argote 1990, Write 1936) to health care (Waldman et al. (2004)), and both at organizational and individual levels. On an individual level, it takes some time until the new hire has all the knowledge she needs to master the tasks and networks at the firm to be as productive as her predecessor. A large part of the knowledge needed to perform a set of tasks might be firm-specific, and thus new hires need to undergo learning processes that are particularly relevant in early stages. This is especially the case if they have no previous work experience, or if their previous knowledge is not easily transferable to the new position –because it was highly firm-specific.

Learning, however, is specific to the type of activity (Waldman and Yourstone (2011)). The shape of the learning curve will be marked by the nature of the job: it is not the same for a nuclear physicist than for a line worker in a manufacturing plant. There is, naturally, infinitely many equations that might be used to represent the data. To model the learning curve, here I will use a variation of the widely popular hyperbola model (Hackett (1983)), and similar in form to accumulative learning models (Mazur and Hastie (1978)). That learning is a smooth, monotonic process where learning gradually decreases is not undisputed: in fact, learning curves with very diverse shapes have been documented (Mazur and Hastie (1978)). The model presented here assumes that the processes underlying learning happen at a constant rate. Output here is a function of time (x), the learning ability (α), and previous experience (Exp):

$$y_i = 1 - \frac{1}{\alpha x_i + Exp} \tag{1}$$

The output loss then becomes

$$y_i = \frac{1}{\alpha x_i + Exp} \tag{2}$$

and

$$Y_i = W_i * \int_i^{i+1} F(x)dx \tag{3}$$

becomes the value of the the productivity loss (Y_i) at the ongoing salary (W_i) for a given period. We can extend the model to allow for different wages in different periods:

$$Y(i,N) = W_i * \int_i^{i+1} F(x)dx + W_{i+1} * \int_{i+1}^{i+2} F(x)dx + ... + W_{N-1} * \int_{N-1}^{N} F(x)dx \tag{4}$$

$$Y(i,N) = \sum_{i=0}^{i=N} W_i * \int_i^{N} F(x)dx \tag{5}$$

Data

Turnover figures were compiled from company records provided by the HR department, including data on compensation, selection, initiation and training costs. Further training costs and the costs of reduced productivity were estimated from interviews with managers. Data regarding the performance of the employees that left the company was not available. Managers were, nonetheless, asked what was the performance level of the engineers that turned over in the last year with respect to those who stayed, to gather evidence that would indicate a disproportionate turnover of lower or higher performers. Moreover, managers were asked to rate the performance of employees at different points in time to estimate the coefficients for the simulation of learning curves.

The sample. The sample is composed by all engineers that have left the company during the period 2010-2011. Of a total population of 340 engineers in the area, 37 have left their positions in the those two years. Of these employees, 24 left the company voluntarily, 12 finished their temporary contract and 1 was laid off. Temporary contracts usually correspond to employees who have been hired for particular projects, including interns and thesis collaborations. Table 1 shows the descriptive statistics of this cohort.

Table 1: Descriptive statistics I 2010-2011

Variable name	Total	Rate (%)	Average age (Years)	Average Tenure (Years)
All engineers	340	-	41,532	10,554*
Total turnover	37	10,882	36,135	2,184
Voluntary turnover	24	7,059	38,500	2,861
Involuntary turnover	13	3,824	31,769	0,934

* Beginning of period (2010)

After further analysis of company records, 3 observation were excluded from the initial sample. One observation was disregarded from the involuntary turnover list because the individual, aged 69, retired from work. The other 2 observations that were excluded from the sample were individuals that are registered to have left the company the same day they joined. It is understood that

these individuals never actually joined the company. After these refinements, the final descriptive statistics of the sample are reflected on Table 2.

Table 2: Descriptive statistics II 2010-2011

Variable	Total	Rate (%)	AVG age (Years)	AVG Tenure (Years)	σ Age	σ Tenure
All engineers	340	-	41,532	10,554*	9,143	7,730*
Total turnover	34	10,000	35,559	2,353	10,284	1,005
Voluntary turnover	22	6,471	39,318	3,121	10,265	1,601
Involuntary turnover	12	3,529	28,667	0,944	6,005	1,023

* Beginning of period (2010)

We can see from table 2 that the average tenure for voluntary turnover is just over 3 years, compared to over 10 years for the remaining employees. It should be noted that only 2 out of the 22 engineers who voluntarily left had been in the company for less than 1 year.

The variables. The first set of variables regards the *departure costs*. Here figures were gathered from company records and salary estimations from payroll officials and HR personnel. Exit interviews by managers are not required by the company, and are left to the discretion of managers. Exit interviews with HR officials lasted 1 hour on average. IT and administrative costs are spread throughout the organization, and estimations are based on enquiries by HR personnel. Administrative and IT costs were estimated by the HR department, after their cross-departmental inquiry. Nearly all the positions left by employees leaving the firm in the last years have been subsequently re-filled.

The second category of variables regards the *hiring costs*. Data on these variables was provided by managers and HR personnel. The recruitment process starts with the managers discussing with superiors the need for hiring a new employee. Once they reach an agreement, the manager needs to write down the specifications of what is the technical and personal profile of the candidate they are looking for, and he is usually assisted by a technician. Then the advertisement is made either by the HR department or an external HR firm, and then the it is published. A meeting between the manager requesting the new employee and HR personnel usually takes place at this

stage too. In the screening process, both the manager in question, HR personnel and usually a technician are involved. Afterwards, a small number of candidates, usually 3-4, are called in for an interview, and sometimes a second round of interviews is necessary. The person from HR that was present in the interviews then meets with the manager to exchange feedback and discuss the outcome of the interviews and reach an agreement. Then candidates are informed of the results of the selection process, and the contract with the selected candidate is negotiated. Some specialists needed to be hired through and external HR agency, although this was not the most common event (around 5% of the cases). These cases imply an agency fee, and an additional cost if the agency needs to advertise the position outside the country. The HR department kept a precise estimation of the average time spent by their personnel in application screening and reviewing, background checking, interviews with candidates and meetings with managers. They were only able to provide an estimation of the whole process, and so these variables will be captured in a variable called *HR Selection Costs*. All managers presented slightly different estimations of the time they believe to spend for filling a position. They were explicitly asked how much time they spend on each of the variables identified in the model, and they provided varying degrees of detail in this respect. Administrative costs, including notifying unsuccessful candidates and drafting the contract for the selected candidate were also provided by the HR on an aggregated level.

The third group of variables regards the *training costs*. Here the figures were obtained from interviews with managers and HR personnel. The HR department provides a 1-day introduction to the company every 3 months for new employees, including both white and blue collar workers. This is generally a group 80-100 people in total. In this day, both members of the HR and representatives from the management are present. The second introduction event held by the HR department is a 2,5 hour monthly introduction to new white collar employees, which are typically around 25. In addition, new employees typically follow official courses ranging from basic knowledge of pumps to highly technical courses.

The rest of the training refers to "on-the-job" training, and deserves perhaps to be treated separately. When a new employee comes into the firm, he is assigned a mentor (or group of mentors)

to coach him during the first (typically 3) months of his career at the firm. The amount of time and attention that the coach needs to invest in the newcomer can vary enormously depending mainly on 2 factors: on the one hand, the level of experience of the newcomer and its relatedness to his new role; on the other hand, the degree of specialization of the position and standardization level of the tasks. In this way, a new software engineer with 15 years of experience in similar application software will need relatively few attention and will be largely autonomous from an early stage. In contrast, if the newcomer is a recent university graduate with no major experience in the industry or applications at hand, she might require substantial time (often spread over a group) for coaching and guidance.

Finally, the *costs of reduced productivity* were estimated from the interviews with managers. Based on those figures, I constructed a model to estimate the loss in output due to the reduced productivity of the new employee with respect to the former employee. Here again, there is an substantial divergence between different groups of employees. Recent graduates usually start at a close to zero productivity level, and in general take up to 6 months to master the tasks at hand. Newcomers with vast experience in related applications and coming from a similar industry usually takes much shorter. There was no track of the delays in operations due to employee turnover, and managers were unable to make any estimation on that, although they recognised that turnover does cause delays. Policies concerning temporary replacements varies from manager to manager. All the them acknowledged that often the other members of the project spread the workload among themselves, even if it implied working (unpaid) overtime. One of the managers was explicit about the non-temporary replacement policy in his department due to the sensitivity of the knowledge involved, and another reported that only in those tasks that do not involve sensitive information this was possible. In case an specialist would be missing, the manager in software development would prioritise and assign someone else to the tasks; this is not possible in the other two departments, where the project would have to be delayed until they find a replacement or an external consultant would have to be hired. In what concerns potential mistakes, all managers reported that newcomers do not make significant or costly mistakes, since they are gradually given more challenging tasks

according to the skills shown. One manager, in fact, reported that newcomers, although they do work slower, make actually less mistakes in basic tasks, due to the greater attention and focus the put to them.

Results

The final estimation of the total costs of voluntary employee turnover are summarized on table 3.

Table 3: Total costs (2011 US$)

Item	Cost per employee	Total cost
Departure	652	14,345
Hiring	2,546	56,003
Training	8,097	178,134
Loss productivity	30,254	665,592
Total costs	41,549	914,074

Departure Costs. The departure costs in this case represent a relatively small share of the total costs. In total, including administrative costs, exit interviews by the relevant manager and HR personnel, and the reorganization of workload, the average departure cost was $699 per employee.

Hiring costs. The costs of selecting and initiating new hires into the firm were approximately $2.728. This estimation accounted for the propensity of manager to find appropriate candidates through their external social networks. This practice reduces the selection costs substantially for managers and the HR department alike. Finally, these estimates also account for the probability of outsourcing the selection process of some specialists engineers, which increases the costs dramatically. If the candidate has to be hired through an external agency, as it is in approximately 5% of the cases, that would increase the costs by $16.310 on average.

In this case, the costs that varied according to department regarded the hiring costs, determined by the time spent by managers in the hiring process and their tendency to use external networks to find candidates. Since the selection process appears to be the same for filling any position (see above), the variation in time can be attributed to the managerial preferences.

Managers reported that one of the most important activities for newcomers was to develop an internal network of contacts. To this end, new employees were expected to spend significant time within the first month in meetings with the people within their area of work –that is, people that

they need to know for their work. These meetings are set up so as to increase the "know-who" of individuals within the company, allowing for a more efficient internal flow of information.

In total, the HR department estimates that they themselves spend approximately 14 hours in selection the process. Concerning the initiation of newcomers, one full day of the HR representative and 3-4 hours of directors' time are invested in this event. Additionally, newcomers participate in a 2,5 hour introduction to the company exclusively for white-collar employees. This event has a cots of around $269 per employee.

Training costs. Employees spent typically 2 weeks of full-time official training within the first 3 to 6 months. A factor that differs according to the level of experience is the amount of coaching that a new employee requires. A new experienced employee will hardly need much coaching, while an inexperienced newcomer may need 20-25% of a person's time (often spread over a group) for coaching and guidance. This coaching gradually fades out, and after the first quarter it has in most cases disappeared. Erring on the side of caution, I will estimate from the interviews that an inexperienced employee requires 20% of the time of a more experienced coach for the first quarter, on average, and an experienced new hire needs only 5% of the time of her coach. This gives an average of $4.139 for an inexperienced new hire, against $1.035 for an experienced one.

Costs of reduced productivity. The other factor that varies significantly with experience and speciality is the loss productivity costs. The initial productivity level of a recent graduate with no significant previous experience was reported to be close to zero. The productivity of an employee with some relevant experience (in this case, more than 3 years) is initially much higher. The more similar to the organization the previous company was, and the more similar the tasks and tools to those used in their new position, the higher the initial productivity of experienced workers. Managers estimated that recent graduates effectively start with a productivity close to *zero*. In the loss productivity model, based on the data from managers, the new hire productivity after two quarters will be approximately 67%, and after 4 quarters 80%. For employees with relevant

experience, I have estimated a value of $c = 2$ for new engineer in non software-related areas, $c = 3$ for software development (see section on productivity loss). This means an initial productivity of 67% and 75% respectively. The distinction is based on the understanding that software development is highly codified and the tools used in different companies are relatively similar, and thus knowledge is more general and less firm-specific. The final monetary loss should of course take into account the difference in salaries for experienced and inexperienced new hires.

Thus, in total, the cumulative productivity loss of a new inexperienced employee in product development or R&T will be approximately $23,366 in the first year, compared to $20,090 an experienced new employee. In software development, the figure for an experienced new employee is close to $16,435 within the first year. After two years, the productivity loss $35,995, $30,808, and $26,049 approx.

The results shown in Table 3 also include the calculation of the higher probability that an employee leaves within the first year of joining the company (μ in the model),[4] which in this case is approximately 0,091.

As we can see, there are some slight variations across specialities. The main difference we can appreciate is the smaller productivity loss of experienced by software engineers with respect to others. This difference stands from the standardization of tools and knowledge in the field, which allows employees to develop a higher share of general human capital –as opposed to firm-specific– than other engineers. This suggests two things: firstly, that some of the costs of turnover are intrinsic to the position, regardless of management practices. This is an important result, for it means that a part of the costs of turnover are independent of managerial decisions or the employees capabilities: they simply depend on the nature of the knowledge required for the job. Secondly, this also suggests that if the firm could benefit from a pool of workers with a higher level of knowledge that could be readily applied to the firm, the costs of productivity loss could be significantly reduced. The company, however, is limited in the extent that there are few other companies in the area that would provide highly skilled workers with knowledge applicable to the

[4]Remember the final model: $TC = (D + H + T + CoRP)(1 + \mu)$

firm.

Total costs for the firm of voluntary employee turnover: 2010-2011. The results until now are general estimations on the average costs of engineer turnover for the firm. But we still need to address the question of how much it costed the organization that a number of engineers voluntarily left the firm in 2010 and 2011.

Since precise data on department of those leaving, I adopted an average of the three departments known in the items that they differed. Managers estimated that approximately 25% of the newcomers are recent graduates, while 75% are experienced. Thus, the value of c in the loss productivity model will be a weighted average of the three departments and the two levels of experience. This gives an average value of $c = 1,75$. Similarly, this proportion was used to estimate the average coaching costs.

The total costs of engineer turnover for this period are reflected on Table 3. The total cost of voluntary employee turnover for the firm in this period was thus approximately \$914,074. [5] We can appreciate, thus, that even at this low rate, turnover can draw significant resources away from productive uses. The average cost of engineer turnover was roughly \$41,549, so each time an engineer leaves the organization, that is the cost of replacing her. One should keep in mind, however, that some of the costs are spread over several years. For example, if an employee stayed 24 months (8 quarters) before turning over, a new employee will accumulate higher productivity losses until she reaches the same point in the productivity curve than the former employee (8 quarters). Thus, the productivity loss costs will expand over the whole 8 quarters, being stronger in the first period, and gradually fading out (but still accumulating). The selection costs, *inter alia*, are bear all in the period immediately previous to the hiring of the new employee, and as such are mostly reflected in the same financial year (the longer the selection takes, the less likely this is of holding). It is possible to extend the model to estimate the present value of the costs, but this will only marginally improve the calculation.

[5] 2011 Dollar figures are provided here to allow for comparison with other studies.

Summary The results of the quantitative analysis show that, on average, the cost of an engineer turning over is approximately $41,549. By far the largest component was the cost of reduced productivity, accounting for over 70% of the total costs. The analysis also shows that, once wage differences are taken into consideration, the value of the productivity loss after 4-5 years is very similar if the new hire is inexperienced or experienced –although the latter will have higher initial productivity. As expected, the engineers turning over were, on average, slightly younger than the overall engineer population, and had been in the company for a significantly shorter period than those remaining.

Discussion

In this paper, I find that the costs of voluntary employee turnover for the company can indeed be substantial. The analysis yielded some interesting results. First and foremost, the learning process in the highly qualified positions considered account for a major share of the costs of turnover. This is highly relevant, since it highlights the financial implications of learning of new employees for the firm.

This research identifies that the costs of employee turnover for the firm will depend on several factors. First, the selection practices of the company, which might be influenced both by cultural norms and by industry standards. Even when the hiring procedure is the same for all engineers, managers can still reduce the costs of selection if they use extensive external networking to find suitable candidates. This suggests that managers with extensive networks -and willingness to use them- might bring additional value in coping with employee turnover.

Second, the characteristics of the new employee, particularly if this one has previous related experience. If the newcomer has related experience, then this one will have a higher initial productivity when joining the firm. Given the wage structure of the company in our analysis, however, lower previous experience was compensated with a proportionally lower salary over the learning period. Thus, it appears that experience was not a significant factor affecting the overall costs of employee turnover in this case. There is no reason to believe that this will be also be the case for other companies, however.

Third, the technologies and knowledge required for the position; the more firm-specific these are, the higher will be the costs of turnover. Similarly, even if the technology or knowledge was general in nature, additional complementary knowledge might be required for the position that new employees might not have. In general, the easier it is to transfer knowledge from previous experience, the lower the productivity losses due to turnover. This means that for some positions where knowledge can be relatively easily carried into new workplaces, costs of turnover will be lower.

The results are somewhat surprising. They show that the costs of learning of new employees represents the largest loss in the turnover process. This also suggests that some of the differences with previous findings might be related to the characteristics of the tasks at hand. Earlier studies (Hinkin and Tracey (2000), Tracey and Hinkin (2008), source) focused on positions with shorter learning periods. Compared to previous results on health care, however, the estimations presented here are relatively modest. This might of course be in part expected since those cases were done on the public sector. Selection processes in that sector are more regulated, and thus costly (Waldman et al. (2004), Jones (2004), Buchbinder et al. (1999)). The results are likely to be a conservative estimate of the costs, given that the effects on production could not be quantified. Moreover, the reflect the average cost for a general engineer. Turnover by specialist engineers might be more costly, since these are in shorter supply and are thus more difficult and expensive to hire.

A limitation of the approach used in this paper is that the learning process had to be simulated due to the lack of precise empirical evidence on employee productivity evolution. Future studies should attempt to provide further capture such evolution from empirical data to validate the cumulative learning model used to in this paper.

It has been argued by some authors that there is an optimal rate of turnover for the firm. In this view, the optimal would be achieve when the marginal cost of retaining an employee equals the marginal cost of letting her go. In this case, this was calculated to be approximately $41,549 for each engineer that turned over in the years 2010-2011. This implies that allocating up to this to retain an employee would be *cost efficient*, if the turnover is avoidable.

That said, this paper can say little on the desirability -or even on the ability of firms- to retain employees. There might naturally be other considerations that lead a firm not to retain a certain employee. Where this article contributes in the calculation of how much it will costs the company to replace the employee, rather than in whether or not the employee should be let go in the first place. Practitioners should first and foremost find the results presented here as further evidence on the potential benefits of a stable workforce. There is a price to pay for loosing an employee. But, from a purely economic point of view, a company may not decide to retain an employee at

any price -only at a price lower than the cost of replacing her.

This provide the only documented article of turnover in knowledge intensive manufacturing. Since this paper is based on one case study, the results cannot be said to be generally applicable. This concern for external validity could be ameliorated by extending the research to at least one other case study of a another firm with similar characteristics.

The evidence presented here, nevertheless, calls for a stronger debate on the merits of employee mobility from an economic perspective. Particularly in knowledge intensive industries, the costs of loosing employees can be daunting for firms. Those who have thought that the negative effects of turnover has been overstressed may do well to revise their view in the light of new evidence.

References

Abelson, M. and B. Baysinger (1984). Optimal and dysfunctional turnover: Toward an organizational level model. *Academy of Management Review 9*(2), 331–341.

Anzanello, M. and F. Fogliatto (2011). Learning curve models and applications: Literature review and research directions. *International Journal of Industrial Ergonomics 41*(5), 573–583.

Baron, J., M. Hannan, and M. Burton (2001). Labor pains: Change in organizational models and employee turnover in young, high-tech firms. *American Journal of Sociology 106*(4), 960–1012.

Buchbinder, S., M. Wilson, C. Melick, N. Powe, et al. (1999). Estimates of costs of primary care physician turnover. *The American Journal of Managed Care 5*(11), 1431.

Cascio, W. (1991). *Costing human resources*. PWS-Kent Boston, MA.

Dalton, D., D. Krackhardt, and L. Porter (1981). Functional turnover: An empirical assessment. *Journal of Applied Psychology 66*(6), 716.

Dalton, D. and W. Todor (1979). Turnover turned over: An expanded and positive perspective. *Academy of Management Review 4*(2), 225–235.

Dalton, D., W. Todor, and D. Krackhardt (1982). Turnover overstated: The functional taxonomy. *Academy of management Review 7*(1), 117–123.

Farber, H. (1999). Mobility and stability: The dynamics of job change in labor markets. *Handbook of labor economics 3*, 2439–2483.

Glebbeek, A. and E. Bax (2004). Is high employee turnover really harmful? an empirical test using company records. *The Academy of Management Journal 47*(2), 277–286.

Hackett, E. (1983). Application of a set of learning curve models to repetitive tasks. *Radio and Electronic Engineer 53*(1), 25–32.

Hinkin, T. and J. Tracey (2000). The cost of turnover. *Cornell hotel and restaurant administration quarterly 41*(3), 14–21.

Jones, C. (2004). The costs of nurse turnover: part 1: an economic perspective. *Journal of Nursing Administration 34*(12), 562.

Jones, C. (2005). The costs of nurse turnover, part 2: application of the nursing turnover cost calculation methodology. *Journal of Nursing Administration 35*(1), 41.

Mazur, J. and R. Hastie (1978). Learning as accumulation: A reexamination of the learning curve. *Psychological Bulletin 85*(6), 1256.

Mobley, W. and M. Fisk (1982). *Employee turnover: Causes, consequences, and control*. Addison-Wesley Reading, MA.

Staw, B. (1980). The consequences of turnover. *Journal of Occupational Behaviour 1*(4), 253–273.

Tracey, J. and T. Hinkin (2008). Contextual factors and cost profiles associated with employee turnover. *Cornell Hospitality Quarterly 49*(1), 12–27.

Tziner, A. and A. Birati (1996). Assessing employee turnover costs: A revised approach. *Human Resource Management Review 6*(2), 113–122.

Waldman, J., F. Kelly, S. Arora, and H. Smith (2004). The shocking cost of turnover in health care. *Health Care Management Review 29*(1), 2.

Waldman, J. and S. Yourstone (2011). 3 learning and thinking systems. *Learning Curves: Theory, Models, and Applications 21*, 37.