When too many are not enough: Human resource slack and performance at the Dutch East India Company (1700–1795)

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Abstract

Slack is an elusive concept in organizational research, with studies documenting a variety of relationships between slack and firm performance. We advocate treating slack not as a resource, but as a practice – a sequence of events and responses over time. A longitudinal analysis of the Dutch East India Company (1700–1795) highlights the use of slack as a response to a resource constraint (the shortage of skilled labor). After documenting the negative performance effects of skill shortage, we identify a trade-off in the use of human resource slack (number of sailors above what is operationally required), in which slack enhanced operational reliability, but reduced efficiency. Derived from a historical context, this trade-off has contemporary relevance and is helpful in reconciling contradictory evidence on slack.

Keywords

contingent workers, human resources, management history, organizational slack, personnel selection

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"Slack" has proved one of the most elusive concepts in organizational research. There is agreement on what it represents – a pool of resources in excess of the minimum necessary to produce a given level of organizational output (Nohria and Gulati, 1996: 1246), but not on the consequences of its deployment (Daniel et al., 2004; Greenley and Oktemgil, 1998). Slack can be activated as a buffer from external shocks (Thompson, 1967), to improve adaptability to shifts in consumer demand (Pfeffer and Salancik, 2003) and to increase firm size or innovation (Cyert and March, 1963). However, it connotes operational inefficiency as resources remain underutilized in the form of unused productive capacity or unnecessary capital expenditure, thereby adding costs and hurting performance (Bourgeois, 1981; Singh, 1986).

Studies document a variety of relationships between slack and organizational performance that are positive, negative, linear and curvilinear in direction and form (e.g. Daniel et al., 2004). The findings attest that slack directly affects performance, but are too inconclusive for a clear statement about the nature of the relationship (Lecuona and Reitzig, 2014). To reconcile conflicting views, scholars have argued that the positive effect of slack on performance occurs within a range, beyond which the effect turns negative. Thus, Nohria and Gulati (1996) found an inverted U-shaped effect of slack on innovation, while Dreyer and Grønhaug (2004) observed that low levels of slack hinder the firm from reacting to a new opportunity, while high levels of slack lead to inefficiency. This implies the existence of an optimal level of slack – if slack drops below or rises above it, performance will suffer (Ferrier and Lee, 2002). While inherently appealing, this reasoning faces the challenge of establishing the optimal level of slack and proving that it matters in practical terms.

The existence of an optimal level of slack is questionable, however, considering that it is not uncommon for an organizational practice to result in simultaneous gain and loss (e.g. Cyert and March, 1963). In the definition of a "trade-off" something is lost, while something else is gained at the same time (Skinner, 1969). If scholars assume the existence of a trade-off between organizational goals in the use of slack (e.g. Goerner et al., 2009), its precise nature remains unclear (Daniel et al., 2004). What further complicates the analytical task is that the trade-off between the costs and benefits of slack is contextual and firm-specific (Lecuona and Reitzig, 2014).

Understanding the effects of slack on performance therefore requires a fine-grained analysis of the underlying mechanisms (Lecuona and Reitzig, 2014). To that end, we advocate analyzing how its costs and benefits accumulate at the organizational level. In this logic the focus is on slack as a practice – as a routine use of resources for carrying out organizational processes that has evolved under the influence of an organization's history or actions (Kostova and Roth, 2002). This perspective addresses the research priorities identified by Daniel et al. (2004) – the clarification of the nature of the relationship between slack and performance, and of the intervening organizational processes that explain that relationship, such as adaptability and risk-taking.

In our study, adaptability is not inferred from observed market outcomes, as customary in past research, but is documented as a response to a specific resource constraint – the shortage of skilled labor. Approaching slack not simply as a resource, but a sequence of events and responses over time, is made possible by the historical format of the analysis. We examine slack as a historical practice that existed long before the concept of slack

emerged in organizational research in the mid-20th century. The research context is the Dutch East India Company (Vereenigde Oostindische Compagnie or VOC) – the pioneer of large-scale intercontinental trade. As we demonstrate, the VOC was forced to systematically rely on human resource (HR) slack, as the rapid expansion of its fleet exhausted the local labor supply, forcing it to hire unskilled foreign sailors.

HR slack is receiving increasing scholarly attention as a distinct type of slack, but there lacks a unitary definition of the concept (Mishina et al., 2004; Voss et al., 2008). Some authors define it with respect to knowledge and efficiency gains (e.g. Goerzen and Beamish, 2007; Kor and Mahoney, 2000), while others use the classic definition of the level of excess employees in an organizational process over time (Bourgeois, 1981). Similar to studies that operationalize it as the number of full-time employees relative to sales (e.g. Mishina et al., 2004; Welbourne et al., 1999), we measure HR slack in the historical context of 18th century shipping as the number of surplus sailors relative to the number required by the capacity (tonnage) of the ship.

The analysis emphasizes the relevance of the past for the present by using observations from a long-extinct company to inform current organizational debates. Only a few organizational theorists have looked at organizations before the 19th century (Rowlinson et al., 2014) but causal regularities found in the distant past need not be limited in time (Kieser, 1994). How actors in the past have responded to threats can be meaningful for contemporary scholarship and practice (Üsdiken and Kieser, 2004). Highlighting the use of slack in adapting to a resource constraint, we document a direct trade-off, where slack enhanced reliability, but reduced operational efficiency. VOC directors faced the same need to balance competing pressures for efficiency and reliability as contemporary managers, and the same difficulty of identifying an optimal level of slack (see Ebben and Johnson, 2005). Derived from a historical context, the highlighted trade-off helps reconcile the contradictory attributions to slack as enhancing adaptability, but encouraging inefficiencies. In the long run, the use of slack alleviated the problem of skill shortage but did not help resolve the structural problems that brought about the VOC's demise.

Research context

One of the earliest waves of globalization saw the establishment of trade networks between Europe, Asia and the Americas in the 17th century. Given the technological constraints at the time, global trade was time-consuming and risky, requiring the coordination of thousands of employees at vast distances without the benefit of advanced tools of communication (Adams, 1996). Voyages to Asia typically lasted for six months or more, information travelled slowly, and sailors often boarded the ships not knowing what lay ahead. Enlisting as a sailor was never an attractive option, given the low pay, the physical dangers of the sea voyage, the long separation from home, insalubrity of life on board and high rate of mortality, mostly owing to tropical diseases (De Vries and Van der Woude, 1997). Overall, only one person returned for every three departing for Asia (Bruijn et al., 1987).

As a pioneer of intercontinental trade and the largest employer in the Dutch Republic, the VOC (1602–1795) needed a large workforce to maintain and expand its shipping network. Pursuing a strategy of rapid growth in the early 18th century (Gaastra, 2003), the
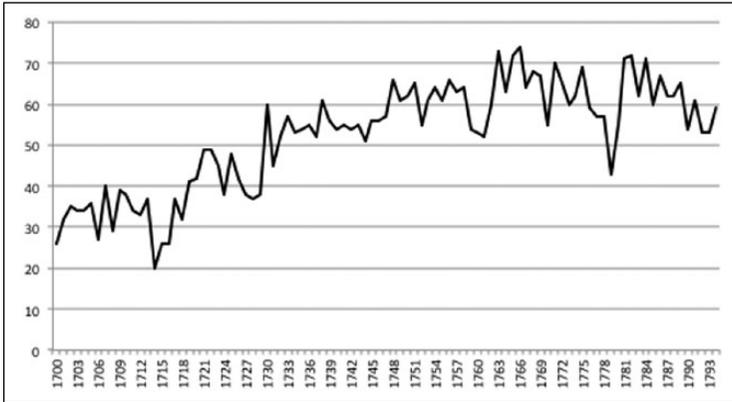
Figure 1. Proportion of foreigners on outbound voyages (1700–1795).
Source: VOC Seafarers ("VOC Opvarenden") Database.

Company raised the capital and recruited the labor force to build and equip new ships, practically doubling in size between 1680 and 1720 (De Vries and Van der Woude, 1997). However, the recruitment of the thousands of sailors and soldiers needed every year was complicated by the demographic decline in the Dutch Republic in the early 18th century, caused by the decline of the Dutch economy, poor living conditions and, to some extent, by recruitment by the VOC itself, as the massive recruitment of young men distorted the gender ratio of smaller communities (Bruijn, 1976). The reduced supply of local labor forced the VOC to increasingly hire foreigners, mostly Germans with little maritime experience (De Vries and Van der Woude, 1997: 451; Van Lottum et al., 2011). The 18th century witnessed steady growth in the share of foreigners – by 1700 the VOC recruited three-quarters of its staff from the Dutch provinces, but less than 40% by 1770. Figure 1 illustrates this dramatic change in the workforce composition of the VOC in the 18th century.

The main recruitment areas changed markedly – if in the 17th century most foreigners came from the coastal provinces of Prussia, Scandinavia and the Baltics (Bruijn, 1976), in the 18th century recruits came increasingly from the center of the European continent (Bruijn et al., 1987). The VOC's workforce became increasingly diverse in terms of nationality and skill level (Van Lottum et al., 2011). Company reports bemoaned hiring difficulties and the lack of skills of first-time sailors. For example, in 1767 the Middelburg city council accused the local volkhouders of supplying the VOC with "completely inexperienced and incompetent sailors despite claiming the opposite" (Van der Doe and Wiggers, 1987: 210). Notwithstanding repeated calls for better training of its employees (Lequin, 1982), the VOC generally treated them as possessions that were supposed to deliver a maximum amount of labor for a minimum wage (Klerk de Reus, 1894).

That the number of complaints surged in the 18th century (Van Gelder, 1997) has led some historians to designate skill shortage as a key factor for the decline of the VOC. According to Bruijn et al. (1987: 157), "it is likely that in terms of quality, the crews in the 18th century deteriorated: men let themselves be hired as sailors and soldiers with little or no experience at sailing or shipping, signing up from personal need, poverty and

unemployment." Similarly, Van Gelder (1997) and Van Lottum (2012) argue that the inexperience and poor physical condition of foreign sailors contributed to deteriorating labor productivity. However, there is still no systematic, quantitative evidence for the posited relationship between foreign labor, skill level and labor productivity.

It should be underlined that the sheer scale of recruitment of foreign labor was unprecedented at the time. For example, the VOC's main rival – the East India Company (EIC) – relied on experienced sailors from the British Isles[1] (Van Lottum, 2012). Experience at sea was of central importance as a factor of individual survival and organizational performance (Leuftink, 2008). Seasoned sailors were better prepared for the long, grueling voyages, were familiar with diseases and methods of their prevention, and the tasks that made up their daily routine. At the organizational level, experience was critical for the skillful navigation and maneuvering of ships (Ketting, 2002).

Hypotheses

The conditions of skill shortage confronted by the VOC in the 18th century can be observed nowadays too. It is not uncommon for firms to encounter constraints on the supply side, such as insufficient supply of qualified labor (e.g. Mitchell and Zatzick, 2015; Reitz et al., 2014). Studies document growing imbalances between job skills and requirements, and between workforce quality and pursued policies (Handel, 2003; Healy et al., 2015). Scholarship is increasingly attentive to issues of under-qualification, when hiring is conditioned by a market disequilibrium in which the quantity of workers demanded exceeds the available supply and when skills lack for the adequate execution of job duties (Kalleberg, 2008).

Evidence on the drivers and effects of skill shortage is ambiguous and fragmentary (Handel, 2003; Healy et al., 2015). This research area is dominated by macro-level economic studies of labor supply and demand (e.g. Haskel and Martin, 1993) and sociological studies of individual-level outcomes (for a review, see Kalleberg, 2008) that give short shrift to organizational processes. The lack of attention to management issues related to skill shortage has much to do with the difficulty of identifying skill shortage in the first place (Shah and Burke, 2005) and with the dominant perception of the mismatch between skills and job requirements as an employee, and not an employer, problem (Cappelli, 2015). It has been suggested that skill shortage hampers organizational performance (e.g. Richardson, 2009), but there is little systematic evidence for it.

One way in which such evidence can be obtained is by analyzing organizational performance over a longer period of time, featuring variation in the level of labor market constraint. We expect that the VOC's performance in the 18th century was negatively affected by the skill shortage it faced, making it more difficult to attract skilled sailors and balance between skill levels. The expected effect is both direct (unqualified labor performing inadequately or inefficiently the assigned tasks) and indirect (the cost of measures to compensate for poor skills). We posit the lack of skills as an important obstacle to achieving high performance at the organizational level:

Hypothesis 1: Skill shortage influenced negatively VOC's operational and financial performance.

It is generally considered that skill shortage can be resolved with training, longer work hours, wage increases or outsourcing. However, on-the-job training is typically "stickier" than assumed, while market competition and the associated financial and time constraints render many of these solutions unfeasible (Healy et al., 2015). Faced with strong market pressure, managers tend to resort to stopgap measures, such as hiring non-standard employees (Payne, 2009, 2012) and expanding the labor pool to include groups with skills inferior to job requirements (Shoobridge, 2006). Construction is the proverbial example of an industry with chronic shortage of skilled labor and a high proportion of unskilled, foreign-born employees (MacKenzie et al., 2000). These conditions are reproduced on a broader scale with globalization, confronting multinational corporations with the need to address skill shortages in local labor markets (Kahn, 2004; Shoobridge, 2006).

There are also substantive reasons to expect the use of HR slack in response to the adverse effects of skill shortage. It is well-documented that slack allows organizations to adapt to complex landscapes (Levinthal, 1997) and adverse events (Vogus and Sutcliffe, 2007), and protect critical processes from environmental threats. As Mishina et al. (2004) argue, HR slack is best deployed when a firm embraces growth strategies, permitting it to employ more workers than is strictly necessary to attend to routine operations. In our research context (18th century shipping), the resource that could be most easily mobilized was additional crewmembers. Maritime historians have noted the tendency to use more sailors than is operationally necessary as a buffer against adverse events and uncertainty (e.g. Bruijn et al., 1987). Accordingly, our expectation is that HR slack mitigates the negative consequences of skill shortage for performance:

> *Hypothesis 2:* The negative effect of skills shortage on operational and financial performance at the VOC was mitigated through the use of human resource slack.

Understanding the effects of HR slack on performance requires considering both the costs and benefits of holding excess employees (Lecuona and Reitzig, 2014). We posit a trade-off, where slack has a positive effect on reliability but a negative effect on efficiency. Skill shortage is expected to hurt reliability, as a result of the inadequate fulfillment of job duties and poor competencies. However, organizations can use slack resources as a response to "uneven" performance, helping them to stabilize operations (Cyert and March, 1963). A similar proposition is drawn from engineering science. Von Neumann (1956) proposed redundancy as a design solution to the problem of reliability in complex systems. Redundancy is central to all modern reliability calculations (Beck, 1992) and to organizational decisions on key technologies and protocols. It typically invokes negative connotations as something superfluous, but in many domains it is equated with safety (Landau, 1969). Redundancy is a particularly important tool for organizations faced with unpredictability and uncertainty (Rochlin et al., 1987), enabling them to decrease the operational influence of human error (French et al., 2011).

Applying this logic to skill shortage leads to the suggestion that the use of HR slack enhances reliability by allowing better control of operational performance. There are also psychological reasons for this expectation. In conditions of skill shortage, managers harbor doubts on the ability of unqualified workers to adapt to and succeed in the workplace (e.g. Ramsay et al., 2008). This makes it more likely for them to supervise more closely

and adopt relatively simple production methods or technologies to match employees' skills (Rosenbaum and Binder, 1997). We expect that the use of HR slack allowed the VOC to improve operational reliability, reflected in reduced probability of loss of ships in intercontinental trading:

> *Hypothesis 3a:* The use of human resource slack enhanced VOC's operational reliability.

Considering the heavy consequences of a shipping accident, prevention of accidents tends to prevail over considerations of efficiency (Lawson, 2001). HR slack implies maintaining a workforce size above what is needed for routine operations, so that a portion of it remains underused or idle and negatively affects performance (Lecuona and Reitzig, 2014). Redundancy is thus expected to add operational costs, related to maintaining the surplus workforce. As a result of the extra weight and food, the ships are likely to be heavier and slower in reaching their destination (see Mannix and Cowley, 1962), thus reducing the efficiency and timeliness of operations. At the same time, the use of HR slack may lead to risk aversion, so that the organization becomes increasingly committed to exploitation and to refining existing routines, and less willing to explore alternative practices that may improve efficiency (Voss et al., 2008). In sum, we expect that the use of HR slack led to the loss of operational efficiency, reflected in reduced speed of intercontinental voyages:

> *Hypothesis 3b:* The use of human resource slack decreased the VOC's operational efficiency.

Data and measures

Our main source of data is the *VOC Opvarenden* ("VOC Seafarers" – VOCO) database, containing records for more than 750,000 people who ever boarded a VOC ship, with information on the voyage, the ship, the rank and the birthplace of each person. Another source is the Dutch-Asiatic Shipping Database (Bruijn et al., 1987), from which we constructed variables on the annual number of voyages, tonnage per ship, the number of crewmembers on board and the mortality rate.[2] Secondary historical sources, such as De Korte (1984), Lequin (1982) and the Netherlands Economic Historical Archive (NEHA), offered measures of profitability, working capital, the amount of exchange bills, wage per sailor, wage levels in the Dutch Republic and shipping costs.[3] The last two represent indices with the base year of 1600. To reduce skewness, profitability, bills of exchange and working capital were logged. Basic statistics for all variables are presented in Table 1. The operationalization of the key variables in the analysis is described below.

Performance

Our main dependent variable, organizational performance, is decomposed into operational and financial performance. Operational performance is broken down into reliability and efficiency. Reliability is captured by the number of lost ships per year. Ships were

Table 1. Descriptive statistics for the variables used in the analysis of VOC annual financial and operational performance (1700–1795).

Variable	OBs	Unit	Construct	Mean	SD	Min	Max
# Lost ships	94	Ships	Operational reliability	1.077	1.647	0	8
Voyage length	95	Days	Operational efficiency	217.464	24.520	73.346	314.37
VOC Profitability	95	Guilders	Financial performance	16.084	.723	11.561	16.805
Bills of exchange	96	Guilders	Private trade	14.272	.878	11.649	15.630
% Soldiers on board	95	Pct. point	Protection	.296	.061	.044	.442
General wages	96	Guilders	Aggregate price of labor	143.356	1.494	140	147
Shipping costs	96	Guilders	Investment in mounting fleets	135.505	10.560	114	176
# Outbound voyages	95	Voyages	Operational scale	31.211	8.211	0	51
# Inbound voyages	95	Voyages	Operational scale	24.688	6.221	3	40
Working capital	95	Guilders	VOC purchasing power	17.426	.202	16.941	17.824
VOC wage/person	90	Guilders	Willingness to pay for labor	150.016	21.932	79.739	217.632
Mortality rate	95	Pct. point	Loss of life on board	.065	.051	0	.244
% Foreigners	95	Pct. point	Skill shortage	.524	.131	.2	.74
# People per ship	95	Persons	HR slack	221.156	45.340	79.773	315.913
Tonnage per ship	95	Tons	Economic activity	834.837	122.530	568.833	1030.4
# Places of origin	95	Places	Cohesion on board	70.895	10.018	34	88
% Sailors from coastal region	95	Pct. point	Sailor experience	.709	.090	.452	.888

VOC = Vereenigde Oostindische Compagnie; OBs = observations; SD = standard deviation; Pct. Point = Percentage Point.

the most complex machines in the 18th century – the construction costs were considerable (Gaastra and Bruijn, 1993), as was the value of the cargo, including goods and currency (Bruijn et al., 1987).[4] Given the heavy costs, a key concern of the VOC directors was avoiding the loss of ships, which was typically owing to sea storms or underwater reefs, and on rarer occasions, to pirates and enemy ships (Gaastra and Bruijn, 1993).

Our proxy for operational efficiency is voyage length, measured as the average duration (in days) of voyages per year. Speed was critical to success in intercontinental trade – faster voyages allowed to better meet market demand and to limit the loss of perishable goods (Bruijn et al., 1987). From the second half of the 17th century the VOC became more vulnerable to competition by the EIC (Adams, 1996; Gaastra, 2003). Increased competition led to the saturation of European markets and to falling prices, putting a premium on the freshness of spices, directly related to the speed of voyages. Profitability depended largely on the efficiency of shipping operations, itself dependent on economies of scale and productivity of labor. However, labor productivity remained low owing to inexperience and poor pay (De Vries and Van der Woude, 1997). Exposed to competitive markets where turnover and speed were of paramount importance, the VOC reprimanded delays of its ships, offering bonuses to merchants, skippers and steersmen, whose vessels made fast passages.[5]

The VOC never developed an integrated accounting system, keeping separate accounts for its Dutch and Asian operations. Profitability is therefore operationalized as the Company's "trade balance" in the Dutch Republic, which corresponds to the difference between what auctions in Europe brought in each year and the costs of equipment (De Korte, 1984).

Skill shortage

Skill shortage is our main independent variable. We do not have a reliable direct measure of the skill level or maritime experience of VOC sailors. Owing to alternative spellings of names and the lack of unique identifiers in the database, the records do not allow presently for reliable reconstruction of the number of times a sailor enlisted with the VOC. As a proxy, we use a contextual indicator for the skill level aboard the ships – the proportion of foreign (non-Dutch) sailors. There is general agreement among historians that Dutch sailors in the 17th and 18th centuries were more experienced and better skilled than foreign recruits and that the VOC resorted to foreign labor only if it was unable to hire locally (e.g. Bruijn et al., 1987; Van Lottum, 2012). Undoubtedly, aboard the ships there were Dutch sailors with little experience too. The VOC recruited from orphanages and churches (Janssen, 1968; Van Voorst van Beest, 1955), but long-term contracts and the prospect of stable employment encouraged these institutions to provide a workforce that was relatively well prepared for service at sea (Van Gelder, 1997). In contrast, the foreigners recruited by middlemen were often ill prepared for a voyage to Asia.

As already discussed, the influx of inexperienced foreign sailors increased in the 18th century. For this period, the proportion of foreigners on board can be used as a proxy for the degree to which hiring was constrained by skill shortage. We constructed an alternative proxy for maritime experience based on birthplace in a coastal region. Those born in coastal regions were more likely to have obtained experience at sea or, at the very least,

of having acquired practical knowledge of seamanship from relatives or friends. We coded the cities from provinces bordering water as "coastal." As a validity check, we compared this variable to the number of foreign sailors. Similar tendencies emerge, pointing to a steep rise in the number of foreign and non-coastal sailors from the early 18th century, when recruitment shifted from coastal to inland regions (Bruijn et al., 1987). The high correlation between the proportion of foreigners and that of sailors from non-coastal regions (.9) corroborates the observation that foreign recruits were largely inexperienced. The appropriateness of the measure is bolstered by the low level of re-enlistment of sailors with the VOC after returning from Asia (Bruijn et al., 1987). As the high correlation prevents the simultaneous use of these measures in the analyses because of multicollinearity concerns, we used the proportion of foreigners as our main measure of skill shortage and re-ran the analyses with the birthplace measure.

Human resource slack

In our model HR slack serves as a key moderator of the relationship between skill short-age and organizational performance. The use of HR slack is reflected in practices of "overmanning" the ships and is empirically captured through the interaction effect between the proportion of foreigners and the crew size, controlling for the tonnage of the ship.[6] Overmanning the ships occurred when the crew size exceeded what was required by the cargo.[7] If, as hypothesized, the VOC reacted to skill shortage by overmanning ships, we would expect to observe more crewmembers on the ships when the proportion of foreigners was higher.

Method and analytical procedure

We used time series regression to test our hypotheses, correcting the standard errors through the Newey-West (Newey and West, 1987) procedure. The error structure is assumed to be heteroskedastic and autocorrelated up to some lag. We used a lag of three, but lags of two and four were also tested. When the dependent variable was a count (i.e. number of lost ships), the coefficients were estimated in a negative binomial regression. Considering the delay in communication between Europe and Asia, we regressed profit-ability on predictors lagged by one. We did not lag the predictors of average voyage length and lost ships, as we had no priors to rule out simultaneity. The coefficients were estimated with the quasi maximum-likelihood estimator, providing reliable estimates under potential misspecifications (White, 1982).

   We use nested models to test our hypotheses. We expect a baseline negative effect of the proportion of foreigners on operational and financial performance (H1). We subse-quently add the measures for the number of people per ship, tonnage and the interaction effect between proportion of foreigners and the number of people per ship. We expect that after controlling for the tonnage of the ships (and the labor required), the negative effect of the proportion of foreigners on performance will be mitigated by an overall positive effect of HR slack (H2). The hypothesized operational trade-off should be reflected in a negative effect of the interaction term on the probability of ship loss (H3a) and a positive effect on the duration of the voyage (H3b).

Our analytical strategy was influenced by several methodological choices. First, the analysis is focused on the 18th century. This is the period of internationalization of hiring at the VOC and the occurrence of skill shortage (Dillo, 1992). Second, the analysis takes place at the organizational (and not ship) level, for both substantive and empirical reasons. Slack is an organizational concept and scholarship on slack is typically at the level of the organization (see Daniel et al., 2004). Appropriate for analyses of trade networks and private trade (e.g. Erikson and Bearman, 2006), the level of individual voyage is less so to hiring practices, which were based on the needs of the entire fleet, and not just of specific voyages (Bruijn, 1976; Gaastra and Bruijn, 1993). The staffing policy was determined by VOC directors and conveyed to ship captains, who had only a limited say on the composition of the crews (Bruijn et al., 1987; Dillo, 1992; Ketting, 2002; Van Gelder, 1997). That hiring was coordinated across the fleet and decisions on remuneration were taken by VOC directors, advises against the analytical focus on the individual voyage. Another reason is the insufficiency of data on financial performance, only available at the aggregate, organizational level (see De Korte, 1984). For these reasons and for compatibility with past studies we ran the analyses at the organizational level.

Third, we considered only "outbound" voyages (from Europe to Asia, the final destination was usually Batavia) to ensure that staffing decisions were made in the Dutch Republic and that they were contingent on Dutch labor supply, which is important in modeling the response to skill shortage. Inbound voyages were excluded for a number of reasons. The labor supply in Asia was different from that in Europe in several respects. One is the availability of local Asian sailors with experience at sea (Bruijn, 1976). Another is that fewer sailors were needed on the inbound voyages (Gaastra and Bruijn, 1993). Most importantly, Dutch and foreign sailors on the inbound voyages were more experienced, as a result of surviving the outbound voyage and serving in Asia (Leuftink, 2008), thus reducing the utility of nationality as a proxy for skill level. It should also be mentioned that Asian VOC data are inferior in quality than Dutch data, featuring sources of heterogeneity that we are unable to control for in the analysis.

Fourth, we determined nationality on the basis of place of birth and present-day borders. Considering the vastness of the VOCO database, we drew a random sample of 100 people per year. This method is routinely employed in historical research (e.g. Bruijn and Lucassen, 1980). We preferred the manual coding of a sample to the automatic coding of the entire database[8] because many city names are outdated or alternatively spelled. We "fuzzy coded"[9] the entire database, yielding an alternative annual percentage of non-Dutch sailors. The high correlation (.95) between the two measures is reassuring. The upside of sampling is greater reliability of the measures, but the downside is the inability to do ship-level analyses. As a validity check, we obtained through fuzzy coding ship-specific proportions of non-Dutch sailors, allowing us to compute an annual standard deviation of the proportion of foreigners.

Finally, we assumed that organizational outcomes were determined by the composition of the entire crew. The large majority of those on the ships were sailors of different grade. The differences in terms of status or remuneration were, however, minimal (Bruijn et al., 1987). We controlled for the difference between soldiers and sailors by adding a measure of the percentage of soldiers on board. The officers were relatively few and invariably of Dutch origin, serving an important function as an instrument of control by

the Dutch principal over a workforce that became increasingly diverse in its ethnic composition (Bruijn and Van Eyck van Heslinga, 1980).

Results

Table 2 presents the coefficient estimates of the analysis of the first measure of operational performance – the number of lost ships per year. Among the control variables in Model 1, the notable findings are that VOC profitability reduced the probability of losing ships and that high mortality was conducive to accidents of this type. In Model 2, the proxy for skill shortage reveals a strong, positive effect ($z = 4.17, p < .001$), lending support to Hypothesis 1 – having more unskilled sailors undermined operational reliability, increasing significantly the probability of losing a ship. Unsurprisingly, having a larger crew enhanced safety, likely owing to the more efficient division of labor or as compensation for the high mortality rate. To check if the effect is owing simply to the size of the ship, we added tonnage in the next model, as a proxy for ship size (Bruijn et al., 1987). However, tonnage changed little in the effect of crew size. In the last model, we examined whether skill shortage and crew size are related in the hypothesized manner, adding their interaction term. The negative, significant coefficient ($z = 2.17, p < .05$) lends support to Hypotheses 2 and 3a. It implies that VOC directors were aware of the risks that unskilled foreign sailors presented, overmanning the ships to improve operational reliability. But the compensation was only partial – HR slack enhanced safety, but did not offset the negative effect of skill shortage.

Table 3 presents the results of the analysis of our second performance measure – the average duration of voyages to Asia. The strong positive effect of the mortality rate in Model 1 is noteworthy – mortality slowed down ships by reducing available labor and by requiring an interim stop. Adding the key measures in Model 2 reveals a pattern similar to that in Table 2 – a greater proportion of unskilled labor is associated with longer voyages, as more experienced crews reached their destinations faster. A larger crew is more effective, but introducing tonnage in Model 3 suppresses this effect, suggesting that it is attributable to ship size. The interaction term in Model 4 attests to an indirect effect of crew size – the combination of skill shortage and a larger crew prolongs the voyage. This finding supports Hypothesis 3b, pointing to the existence of a trade-off – overmanning the ships improved safety, but reduced efficiency, as more food had to be stocked and as heavier ships were slower (Mannix and Cowley, 1962).

For additional insights into this trade-off, we turn to the analysis of profitability (Table 4). The coefficients for the control variables (Model 1) confirm that profitability was largely a function of the shipping costs and the working capital (De Vries and Van der Woude, 1997). The shipping costs were negatively related to profitability, while the availability of working capital enabled the VOC to invest in its trading network and increase the scale of operations. Model 2 presents the coefficient estimates of the main predictors. As expected (Hypothesis 1), skill shortage influences negatively profitability. Labor market constraints had a strong financial impact. Crew size reveals an initially positive effect that disappears when tonnage is added. Models 3 and 4 highlight the importance of ship size in trade – bigger ships have scale advantages that improved profit margins. Controlling for tonnage, the interaction term in Model 4 reveals a strong, positive effect on profitability, without suppressing the negative main effect. In agreement

Table 2. Negative binomial regression of the number of lost VOC ships per year on outbound voyages. $N = 90$.

	Number of lost ships			
	Model 1	Model 2	Model 3	Model 4
Bills of exchange	.0575	.1596**	.1067*	.1547*
	(.1427)	(.0599)	(.0531)	(.0666)
% Soldiers on board	1.0880	1.7648	2.0923	1.0726
	(1.4727)	(1.3092)	(1.3021)	(1.2377)
General wages	−.0654	−.1636**	−.1037*	−.1769**
	(.0891)	(.0573)	(.0528)	(.0611)
Shipping costs	.0073	.00753	.0012	.0065
	(.0162)	(.0147)	(.0127)	(.0157)
# Outbound voyages	.0158	.0205**	.0197*	.0177*
	(.0102)	(.0074)	(.0098)	(.0081)
# Inbound voyages	.0157	.0187	.0070	.0170
	(.0147)	(.0116)	(.0092)	(.0124)
Working capital	.2657	.0357	.2281	−.0877
	(.5684)	(.2830)	(.3329)	(.3337)
VOC wage/person	−.0015	.0014	.0031	.0032
	(.0061)	(.0041)	(.0037)	(.0043)
Mortality rate	2.8251**	1.5478	2.434*	1.1674
	(1.0198)	(1.1116)	(.9494)	(1.4750)
VOC profitability	−.1808*	−.0486	−.1155**	−.0398
	(.0852)	(.0398)	(.0405)	(.0435)
% Foreigners		3.9841***	3.0253***	3.3638***
		(.8526)	(.7270)	(.8490)
# People per ship		−.0084***	−.0068**	−.0025
		(.0015)	(.0024)	(.0028)
Tonnage per ship			.0001	−.0008
			(.0009)	(.0008)
% Foreigners/people per ship				−.0375*
				(.0172)
Constant	3.9385	17.2766^	8.0022	21.2590*
	(9.8738)	(9.9777)	(8.4629)	(10.3663)
BIC	−270.30	−207.95	−271.96	−201.14

VOC = Vereenigde Oostindische Compagnie; BIC = Bayesian Information; ^$p < .1$ *$p < .05$ **$p < .01$ ***$p < .001$.

with Hypothesis 2, skill shortage negatively affected performance, but the use of HR slack (i.e. overmanning) mitigated the damage.

Validity

In additional analyses (available upon request) we tested the validity of the percentage of foreigners as a proxy for skill shortage. Against the control variables from Tables 3–4,

Table 3. Newey-West Regression of VOC outbound voyage duration (days). N = 90.

	Outbound voyage duration			
	Model 1	Model 2	Model 3	Model 4
Bills of exchange	−5.7885*	−.8356	.4616	.8196
	(2.9317)	(3.2192)	(3.4097)	(3.4460)
% Soldiers on board	31.7613	72.0891**	62.2006*	82.4632**
	(31.8002)	(26.9956)	(26.3128)	(26.8260)
General wages	5.6201*	5.0651*	5.1445*	5.6261**
	(2.3889)	(2.0815)	(2.1846)	(2.1401)
Shipping costs	−1.2701*	−1.0868*	−.7766	−.7534
	(.6001)	(.5177)	(.5164)	(.4638)
# Outbound voyages	−.1427	−.0500	−.1392	−.0820
	(.2335)	(.2261)	(.2207)	(.2137)
# Inbound voyages	−1.1978*	−1.3460*	−1.3340*	−1.3201*
	(.5897)	(.5716)	(.5558)	(.5471)
Working capital	−21.105	−15.2688	−17.5909	−17.0655^
	(13.2694)	(9.4423)	(10.0183)	(9.8319)
VOC wage/person	.1340	.1504	.1609	.1154
	(.1596)	(.1297)	(.1310)	(.1089)
Mortality rate	152.3214***	166.0455***	155.4577***	172.2488***
	(43.1818)	(31.6401)	(33.8875)	(36.1068)
VOC profitability	−2.6065	1.7097	2.2364	1.1994
	(3.5528)	(2.4903)	(2.5704)	(2.7186)
% Foreigners		37.7308*	43.6072*	52.0852**
		(18.1899)	(18.7928)	(19.5649)
# People per ship		−.2567***	−.1229	−.1888^
		(.0466)	(.0968)	(.1036)
Tonnage per ship			−.0692	−.0624
			(.0489)	(.0495)
% Foreigners/ people per ship				.7873*
				(.3755)
Constant	68.9196	−95.4121	−104.8365	−175.5439
	(387.3493)	(343.5082)	(360.8759)	(337.7601)
AIC	9.16	9.09	9.09	9.09

VOC = Vereenigde Oostindische Compagnie; AIC = Akaike Information Criterion; ^$p < .1$ *$p < .05$ **$p < .01$ ***$p < .001$.

our alternative measure of maritime experience (born in a coastal region) is a significant predictor of all dependent variables ($p < .05$). Sobel's (1982) mediation test and Preacher and Hayes' (2008) bootstrapping method confirm that maritime experience mediates the relationship between the percentage of foreigners and the number of lost ships. Indirect tests provide additional evidence. The analysis of a common measure of productivity – tonnage per sailor, attests that productivity was significantly lower at ships with more foreigners. We also compared the average length of outbound and inbound voyages – sailors on inbound voyages were more experienced, as they had survived the first leg

Table 4. Newey-West Regression of VOC profitability in Europe (guilders). *N* = 90.

| | VOC Dutch profitability | | | |
	Model 1	Model 2	Model 3	Model 4
Bills of exchange	.0057	−.1594*	−.2111*	−.1947*
	(.0570)	(.0689)	(.0898)	(.0848)
% Soldiers on board	1.3827	.3705	.7786	1.5049
	(1.2803)	(1.1542)	(1.1409)	(1.1656)
General wages	−.1116*	−.0369	−.0385	−.0183
	(.0465)	(.0460)	(.0454)	(.0486)
Shipping costs	−.0180*	−.0190*	−.0314**	−.0299**
	(.0082)	(.0082)	(.0095)	(.0097)
# Outbound voyages	.0024	−.0003	.0036	.0059
	(.0077)	(.0082)	(.0086)	(.0081)
# Inbound voyages	.0095	.0123	.0113	.0110
	(.0180)	(.0134)	(.0141)	(.0135)
Working capital	1.6378**	1.1107**	1.1848***	1.1658***
	(.5058)	(.3324)	(.3155)	(.3106)
VOC wage/person	.0087^	.0062*	.0057*	.0038
	(.0047)	(.0026)	(.0026)	(.0026)
Mortality rate	−2.0165	−2.2826	−1.8534	−1.2652
	(2.8034)	(2.0292)	(2.1475)	(2.1474)
% Foreigners		−2.3513**	−2.5690***	−2.2205**
		(.6953)	(.6589)	(.6515)
# People per ship		.0102***	.0046	.0021
		(.0024)	(.0030)	(.0032)
Tonnage per ship			.0028*	.0031*
			(.0013)	(.0013)
% Foreigners/people per ship				.0283**
				(.0101)
Constant	3.9098	4.5555	4.7029	1.7449
	(7.0199)	(6.2724)	(6.0712)	(6.2941)
AIC	1.90	1.63	1.58	1.54

VOC = Vereenigde Oostindische Compagnie; AIC = Akaike Information Criterion; ^*p* < .1 *p < .05 **p < .01 ***p < .001.

(Leuftink, 2008). For the 18th century, the inbound voyages were shorter than outbound voyages by 22 days on average, but in the period when foreigners dominated, the difference grew to 30 days, implying that foreigners learned more on the job than more seasoned Dutch sailors. Related analyses show that experience mattered less for voyage length than for avoiding loss of ships, confirming that inexperience was more detrimental in extreme conditions, involving non-routine tasks.

We also considered alternative explanations for our findings (available upon request). First, we checked whether the effects of the proportion of foreigners were owing to social cohesion rather than poor skills and inexperience at sea. Analyses with the number of unique birthplaces in the sample as a proxy for social cohesion on board (as those from

the same villages typically stuck together (Dash, 2002)) proved this not to be the case. Social cohesion played only a limited role in operations, as tasks were well defined and discipline was ruthlessly enforced (Van Gelder, 2003). Second, we checked the possibility that our measure of foreign labor masked differences in crew composition across ships. The annual standard deviation of the proportion of foreigners was added to all models, but it was not significant and did not affect the significance level of key predictors, providing some evidence that the presence of unskilled foreigners affected organizational performance widely.

Discussion

This analysis of the use of HR slack in adapting to the shortage of skilled labor in the 18th century Dutch Republic illustrates the benefits of applying historical methods to organizational analysis. Our main substantive contribution is analyzing slack not just as a resource, but as a practice – a sequence of events and responses over time, with associated costs and benefits that determine the effectiveness of slack as an instrument of adaptation. Confronted with skill shortage, the VOC resorted to unskilled foreign labor. Our expectation of negative performance effects of skill shortage (Hypothesis 1) was confirmed: skill shortage contributes to inferior operational and financial performance. The proportion of unskilled sailors was associated with higher probability of ship loss and delays. While generally expected that skill shortage hurts organizational performance (e.g. Burke and Ng, 2006), evidence for it is limited (Richardson, 2009). A notable contribution of our analysis is in providing robust evidence for the negative effects of skill shortage in terms of efficiency and productivity.

How do organizations address the adverse effects of skill shortage? Drawing on past research, we proposed the use of slack resources as a key response. Hypothesis 2 predicted that the detrimental effects of skill shortage are mitigated through the use of HR slack. The analysis attests that the VOC's reliance on extra crewmembers to complement the main workforce led to an overall improvement in financial performance. We also found evidence for enhanced operational reliability, lending support to Hypothesis 3a. These findings imply that the VOC's directors were aware of the problems posed by the shortage of skills (Van Gelder, 1997) and responded by overmanning the ships when foreign sailors prevailed in the ranks. This finding lies in agreement with historical research, which has linked the inexperience of shipping crews to their size.[10] Our study provides the first systematic evidence for the link between skill shortage and HR slack.

Most importantly, the analysis furthers our understanding of the trade-off underlying the use of HR slack. The VOC's efforts to mitigate the negative effects of skill shortage were only partly successful – adding sailors enhanced safety, but simultaneously increased the duration of voyages, attesting to a trade-off between speed and safety. Our findings corroborate observations of the "dual" nature of slack (e.g. Wefald et al., 2010) and of misalignment between effectiveness and efficiency in the use of slack (e.g. Chen and Huang, 2010). Scholarship suggests that firms can balance between effectiveness and efficiency in reaching an optimum level of slack (e.g. George, 2005; Nohria and Gulati, 1996), but our analysis advises caution in this regard. The use of HR slack at the VOC did not lead to achieving optimal performance – it was an adaptive, stopgap measure that

functioned well under the existing constraints. It marked a point of "temporary equilibrium," brought about by the interaction of economic forces and organizational counterforces (Sgourev and Van Lent, 2015).

In agreement with findings from meta-analyses (e.g. Daniel et al., 2004), we observe an overall positive slack–performance relationship. However, a fine-grained analysis of the constitutive parts of the relationship reveals a more complex picture. That the benefits exceeded the costs had much to do with the fact that the loss of ships had such a huge economic downside that the extra costs related to "overmanning" the ships were largely justified. Yet, these costs had a negative long-term impact. They reinforced operational problems that plagued the VOC, eroding its competitive position vis-a-vis its English rival, who relied on skilled sailors. The inexperience of sailors and the low level of re-enlistment limited peer learning, constituting an important reason why the VOC did not translate the increasing trading volume into efficiency gains (De Vries and Van der Woude, 1997). Ships grew larger in the 18th century (Bruijn et al., 1987), giving rise to stocking efficiencies (North, 1968), but we found a constant tonnage-per-sailor ratio for the 18th century, indicating a lack of efficiency gains. This is partly related to the habitual use of HR slack, which alleviated, but did not *resolve* problems related to efficiency and productivity that led to long-term decline. The VOC adapted only partly to a dynamic economic context that required greater investment in training and hiring (Lequin, 1982).

The historical perspective allows for better connecting the past and present in organizational research. The analysis demonstrates that a widely used current concept has deep historical roots, as the practice of using slack predates by centuries the emergence of the concept itself. An important use of history in organizational research is to provide past parallels, showing how practices, issues and challenges faced by organizations today are historically embedded (Üsdiken and Kieser, 2004). It is only recently that scholars started to inquire into whether and when it makes sense to employ more workers than needed to attend to routine operations (Lecuona and Reitzig, 2014; Mishina et al., 2004; Voss et al., 2008), but the question appears to be much older than recognized. As the Dutch were at the forefront of economic development in the early 18th century (see De Vries and Van der Woude, 1997), the VOC was the first company to hire on such a grand scale, unprecedented at the time. The use of HR slack to offset the adverse effects of unskilled labor was a natural solution at a time when formal training was inadequate and was considered unnecessary (Gaastra and Bruijn, 1993; Lequin, 1982), while cheap, unskilled labor was widely available. This is likely the main reason why we find a more positive effect on performance than current studies of HR slack (e.g. Lecuona and Reitzig, 2014). Another reason is the nature of the work, which was exclusively manual on 18th century ships, with tasks lending themselves readily to subdivision, standardization and substitution. Naturally, the degree of relevance to tasks that are not as easily standardized is expected to be lower.

The featured practice is embedded in the 18th century and is most meaningful in that context. However, some of its aspects have contemporary resonance, such as the tendency of firms to use HR slack in periods of growth (Mishina et al., 2004), the emphasis on refinement of routines at the expense of finding new solutions (Voss et al., 2008) or the adoption of simple production methods to match employees' skills (Rosenbaum and Binder, 1997). Moreover, persistent productivity issues and fatalities at construction sites related to unskilled labor serve as a reminder of its relevance (MacKenzie et al., 2000).

The use of HR slack is a suboptimal policy, but is a preferred solution to the shortage of skilled labor when training is not feasible (see Payne, 2009, 2012).

The fundamental conviction behind the value of HR slack in corporations is that retaining corporate staff may pay off in the long term, even if short-term considerations would suggest laying people off (Lecuona and Reitzig, 2014). Our context presents the inverse logic, where the value of HR slack declines over time, proving more beneficial to the company in the short, than the long term. It is recommended for future research to examine other practices of slack use, historical or contemporary, and other moderators than those featured, to deepen our understanding of the underlying trade-off. This work underlines the value of a research perspective on slack as practice, and the need to examine in greater detail how organizations balance between pressures toward reliability and efficiency. Our data suggest that overmanning the ships was not a sudden discovery, but a gradual process of trial and error that built up over time. There is little evidence for a preset plan, but for a routine that evolved from practical experience and from the intuitive understanding of the complexity of global shipping.

Organizational scholars are not used to looking back centuries, but past causal regularities and experiences can be meaningfully woven into current organizational debates (Kieser, 1994; Rowlinson et al., 2014). More than 200 years after its demise, the VOC remains a source of insights into processes of adaptation and change that are relevant to scholarship and practice (Adams, 1996). Similar to contemporary managers, VOC directors sought to reconcile competing pressures toward efficiency and reliability, and struggled to properly balance operating efficiently and retaining surplus resources, necessary to address unexpected threats and opportunities (e.g. Greenley and Oktemgil, 1998). Confronted with unpredictability in shipping on a grand scale, the VOC was a "high-reliability organization" centuries before the term was coined, resorting to slack in responding to situations that occur without warning (Lawson, 2001). It was the first company to internationalize its workforce and address the difficulties of operating in multiple locations, but not the last one to have found these difficulties more persistent than expected. In some respects, management practice has not changed much since the 18th century.

Notes

1   Note that "impressment" (forced re-enlistment of sailors) − the technique favored by the British − was illegal in the Dutch Republic. The Dutch had to solicit labor on the open market (see Van Lottum et al., 2011).

2   We do not discuss mortality in detail in the article, as our analytical focus is on other issues. However, it should be underlined that the high mortality rate on VOC ships is an important reason for the featured practice of "overmanning." The VOC needed to have available on its ships "extra" sailors who may be underutilized through task dilution or stay idle for a part of the voyage until called upon to replace a deceased sailor. Hence, it is appropriate to speak of human resource "slack," as sailors were literally used as substitutes for those who had died.

3   All monetary variables are in guilders.

4   The construction costs, money chests and trade goods aboard one ship that sank in 1629, the *Batavia*, can be estimated at about 400,000 guilders or the equivalent of about US$ 35m today (Dash, 2002: 194).

5   In the 17th century, 600 guilders were offered for a voyage of only six months, 300 for one of seven and 150 for one of less than nine months (Dash, 2002: 85).

6   The interaction term was calculated by multiplying the percentage of foreigners by the number of people per ship.

7   The greater the cargo of the ship, the more crewmembers needed − the high correlation between the two (.85) confirms that the Dutch manned the ships in proportion to the cargo.

8   We used three tools: (1) Google's "autocomplete" function, (2) the 1881 edition of the *Andrees Allgemeiner Handatlas*, a German atlas containing old geographical names, and (3) the *Kartenmeister* (www.kartenmeister.com), an online database of Prussian city names and their Polish, Czech or Hungarian equivalents.

9   The "fuzzy coding" software compared city names to a reference list of city names, choosing the best match.

10 For example, Bruijn et al. (1987: 157) posit that "this inexperience probably explains in part the VOC's need for more manpower on the ships than before: to man a ship more inexperienced sailors were needed than used to be the case with experienced ones."

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