Incentives in Merchant Empires: Portuguese and Dutch Labor Compensation

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Abstract

The different organizational structure of the Portuguese and Dutch merchant empires affected their ability to monitor workers. I test the theoretical implications of these differences using micro data of overseas workers' compensation from the sixteenth to the eighteenth century. The two merchant empires used significantly different compensation structures: working for the king of Portugal corresponded to a higher bonus share of compensation on average than that of the Dutch East India Company. These results are consistent with theoretical implications and provide additional support to the historical evidence we have on the organizational structure of merchant empires.

KEYWORDS: Merchant Empires, Labor Compensation, Monitoring

1 Introduction

Since the beginning of the European overseas expansion in the fifteenth century, attracting individuals to risky ultramarine ventures was a major challenge for long-distance trade companies. Despite royal or merchant ownership, all companies faced the classic agency problem: how to motivate employees to work hard in distant locations where they could not only shirk, but also engage in activities that reduced the company's returns (e.g. smuggling). Standard labor theory tells us that when monitoring is costly, principals can induce workers' effort by linking compensation to performance, such as with the use of bonuses, but when monitoring is free, principals may retain a larger surplus of production by paying fixed wages.[1]

This paper presents historical evidence on the labor compensation of overseas workers in the Portuguese and Dutch merchant empires. On average, Portugal paid a larger portion of labor compensation in the form of bonus than the Dutch East India Company (*Verenigde Oost-Indische Compagnie*, henceforth VOC).[2] If the standard labor theory is right, the merchant controlled company in the Netherlands would have had a better information structure relative to the crown controlled enterprise in Portugal. These differences have stark theoretical implications.

I propose a standard Principal-Agent model to illustrate such implications. Better information on shirking workers led to contracts offering flat wages and low bonuses. A richer information structure was however more expensive. Such an investment might not have been optimal for every firm, in which case contracts would offer low wages and high bonuses. I analyze these implications using archival data on the labor compensation of Portuguese and Dutch workers overseas from the sixteenth to the eighteenth centuries. The results show marked differences between these two groups of workers, even after controlling for workers'

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[1]Bonuses are not the only way to deal with monitoring issues. Refer to the appendix for a discussion of the use of efficiency wages in the VOC.

[2]This evidence provides additional support to the theory explaining the emergence of different organizational structures of merchant empires presented in Rei (2010): differences in the distribution of endowments between the king and the merchants implied different structures in the organization of trading companies – Portugal's king remained the residual claimant of the enterprise, whereas in the Netherlands control was delegated to the merchants.

location, sector, and rank.

Even though there is no direct evidence on the quality of workers' monitoring in merchant empires, it can be proxied by the information structure present in each firm. Merchants pursuing long-distance trade in a king-controlled firm are less accountable than merchants working in a similar firm of their own. In the latter, monitoring is likely to be easier and the information structure better. Monitoring is therefore exogenous in the context of this paper, as it is determined by the choice of the firm's organizational form. The model explains the differences in the structure of labor compensation conditional on the (king or merchant) control structure; it does not explain the choice of monitoring levels. Compensation schemes are chosen optimally given the principal's monitoring ability: larger bonuses are offered when monitoring is hard, as opposed to larger wages when monitoring is easy.

Incentives to induce workers' effort, both in terms of bonuses and wages, have been the subject of a lengthy theoretical literature.[3] The use of bonus in non-linear compensation schemes has been analyzed in the context of performance standards (Murphy 2000). Wages on the other hand, have been subject of study in as different contexts as deferred compensation or efficiency wages (Shapiro and Stiglitz 1984 and Salop and Salop 1976).

The empirical work across the fields of organization and personnel economics is quite thin. Krueger (1991) finds differences in compensation schemes between company-owned and franchise-owned firms, which suggest that monitoring affects the compensation structure. Hejeebu (2005) does not focus on alternative organizational forms, but rather addresses the complementarity of private trade and labor compensation to deal with the moral hazard problem in the British East India Company, suggesting yet alternative ways to deal with monitoring difficulties. Finally, Carlos (1992) examines the contract structure by the Hudson's Bay Company and the Royal African Company in order to deal with the problems of moral hazard and adverse selection associated with long-distance trade.

In this paper I look not at bonuses or wages per se. Rather, I provide an explanation for

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[3]For an overview of the general literature see Lazear 1995, Gibbons 1996, and Prendergast 1999.

their relative size, which illuminates the historical evidence we have on the compensation of overseas workers in merchant empires.

2   Different, Yet Similar Merchant Empires

The sixteenth and seventeenth centuries saw the establishment of direct trade connections between Europe and the East.

All merchant empires hired workers in Europe to send them off to Asia in perilous vessels where the probability of dying, either from shipwreck or disease, was non-negligible.[4] In addition, the Eastern destinations of these workers were often stricken by military conflict either with local rulers, or with competing empires. The compensation package offered to these workers had to provide a premium that accounted for overseas location, workers' skill, and risk faced. Moreover, incentives had to be in place in order to hire trustworthy workers who would effectively run the empire on the spot, whereas the owner of the monopoly remained safely in Europe. These were challenges faced by all merchant empires which, however engaged similar long distance trades, organized businesses very differently.

Since 1498, Portugal's merchant empire in the East was established as a crown monopoly with the king as the ultimate residual claimant of profits. In the East, the Portuguese empire was rooted in three basic pillars: the all-sea-route to India, diplomatic agreements with local rulers from the eastern coast of Africa to the Spice Islands, and the establishment of fortresses in strategic geographical locations along the way and in the East Indies (Boxer 1969). The ultimate goal was to control all the spice trade in the Indian Ocean by exacting taxes on all ships, thereby blocking the Levant trade and becoming the unique middleman between Europe and Asia in an extremely profitable business.[5] In the East, the Portuguese empire was headquartered in Goa where a viceroy centralized the all governance from Mozambique

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[4]For example, in Vasco Da Gama's 1498 voyage to India about two-thirds of the original crew succumbed to scurvy (Sanceau 1967).

[5]The net profit rate on pepper imported to Lisbon was between 89 to 152 percent in 1558 (Phillips 1990). Although pepper was the staple traded spice, others (cinnamon, cloves, nutmeg and ginger) could achieve even higher profit rates.

to Macau, in the name of the king of Portugal (Diffie and Winius 1977).

The Dutch had a similar trade policy in the East to the Portuguese since the foundation of the VOC in 1602: they exerted territorial control through agreements with local sovereigns establishing trade exclusivity, and also destroyed spice surpluses to enable price control (Morris 1904, Hamilton 1948, Ames 2008).

In other aspects however, the Netherlands's empire had a very different approach to that of Portugal. The VOC was a chartered monopoly, belonging to a group of private merchants. The residual claimants of the enterprise were the *Heeren XVII*, a board of seventeen delegates located in the Netherlands and selected from the managing shareholders of the original six chambers. The Dutch government had no direct involvement in Eastern trade other than the natural return on customs duties and the payments at every renewal of the company's charter. In the East, the VOC was centralized in Batavia, the seat of the governor-general who responded directly to the *Heeren XVII* (De Vries and van der Woude 1997). The governor-general effectively administered the company's activities in Asia – with outposts from the Cape of Good Hope to Taiwan – and was advised by the Council of the Indies (*Raad van Indië*, RVI), which was also created to prevent possible despotic tendencies.

Other than organizational design, there were also other noteworthy differences across empires, such as the concern with religion. Beyond their trade interests, the Portuguese were also fervent converters of souls. The Dutch did not share the latter objective, possibly because they had no king controlling the enterprise, in which case religion was a consequence of organizational control rather than a causal difference.[6] This matter goes beyond the scope of this paper, but even if religion were a pertinent difference across merchant empires, its relation with the compensation structure is unclear.

Most relevant is perhaps the emergence of the Portuguese and Dutch companies more

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[6]The case of England is perhaps more striking. Similar to the VOC, the English East India Company was controlled by the merchants and never exhibited any religious interest. We know, however, that the English crown founded its own religion in the sixteenth century, and prosecuted those who were still followers of Rome. It would therefore not be surprising to see the same interest in religion in the English empire had the English monarch been in charge of Eastern trade. This fascinating topic, is not addressed in this paper.

than one hundred years apart: 1498 and 1602, respectively. In the mean time the Dutch could have invented better monitoring techniques, or learned from Portugal's mistakes, which could have affected the type of compensation package offered.

Though this *learning hypothesis* is hard to dismiss, it is equally hard to imagine such a radical innovation in pre-industrial times of slow inter-continental communication. The first successful European voyage to the East lasted a little over tow years: Da Gama sailed off of Lisbon on July 8, 1497 and returned on July 10, 1499 (Sanceau 1967:217-8). By the Dutch golden age in the seventeenth century, the length of the round-trip was practically the same: the VOC's ships would depart the Netherlands in the spring of each year, arrived in Batavia nine months later, and sailed back between November and March, arriving Amsterdam by the end of the following year (De Vries and van der Woude 1997:389). The intact duration of the long commercial cycle dictated by the distance and the monsoons, suggests the irrelevance of technological innovations in the sailing ship over the time period in which both the Portuguese and the Dutch faced similar difficulties in communication and coordination of operations between Europe and Asia. The high degree of autonomy of the Portuguese viceroy and the Dutch governor-general, as well as of other higher officials in Asia, was unavoidable, which made efficient monitoring a matter of the utmost importance.

Despite the differences across empires, Portugal and the Netherlands faced equal challenges with respect to the recruiting and choice of compensation structure of European workers in which the type of organization could have had relevant implications. Oliver Williamson, taught us that organizational control at the top manifests throughout the firm, either in its design, in its policies, in its inner workings, and ultimately in its long-run performance (Williamson 1975). The next section offers an illustrative model to explain the link between organizational control and the personnel economics of merchant empires.

3 A Model of Labor Compensation

There are two parties: a Principal, the manager of the venture, who works in a company either controlled by the king or the merchants. Among other tasks, the principal is in charge of designing labor contracts that induce workers' effort, and is risk neutral in income; and an Agent, the worker hired in Europe to work in Asia, who is risk averse in income, and has preferences $u(w) - a$ with $u' > 0$, $u'' < 0$.[7]

The agent can either shirk or work $a = \{0, 1\}$. Either action is unobservable by the principal (located in Europe), who delegates monitoring in exchange for a signal indicating if the worker is diligent (σ_1) or not (σ_0).[8] Better monitoring costs more.

The principal prefers an agent who works ($a = 1$), whereas the agent prefers to shirk ($a = 0$). The distribution of signal values depends on the agent's effort choice: if $a = 1$ ($a = 0$), σ_1 (σ_0) arrives with probability p ($q < p$) and σ_0 (σ_1) with probability $1 - p$ ($1 - q$). The precision of the signal, and the cost of monitoring, is given by $\Delta = p - q$; the larger the Δ, the more informative (and costly) the signal, and the easier it is to monitor workers. The principal ties the agent's payoff to the observed signal: w_1 if σ_1 is observed, and w_0 if σ_0 is observed.

Conditional on the information structure Δ, the principal minimizes the expected labor compensation cost subject to the incentive and participation constraints of the agent:

$$\underset{w_1, w_0}{Min}\ E[w | a = 1, \Delta]$$

$$s.t.\ pu(w_1) + (1-p)u(w_0) - 1 \geq qu(w_1) + (1-q)u(w_0)$$

$$pu(w_1) + (1-p)u(w_0) - 1 \geq \underline{u}$$

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[7]I do not consider locally hired workers for several reasons: very likely these workers would be hired for low skilled and/or temporary occupations (e.g. loading ships), easier to monitor; workers hired in Asia to work in Asia would be monitored (and paid) locally and would have less of a moral hazard problem. Such workers are not observed in the data.

[8]In the standard principal-agent model profit is a possible measure of performance to which the Principal may tie the Agent's payoff. In this paper I separate profitability from the information structure, hence the signal notation. The results do not depend on this specification.

The (binding) incentive constraint can be rewritten as

$$u(w_1) = \frac{1}{\Delta} + u(w_0)$$

which indicates that the less informative the signal, the larger the payoff dispersion. In the two-state model the contract is determined entirely by the two constraints, both of which bind. The result is:

$$u(w_0) = \underline{u} + 1 - \frac{p}{\Delta} \text{ and } u(w_1) = \underline{u} + 1 + \frac{1-p}{\Delta}.$$

Poor monitoring (low Δ) increases the gap between payoffs associated with of good (w_1) and bad signals (w_0). If we interpret w_0 as the wage, and $w_1 - w_0$ as the bonus, then the bonus share of total compensation is

$$\frac{w_1 - w_0}{w_1} = 1 - \frac{v(\underline{u} + 1 - \frac{p}{\Delta})}{v(\underline{u} + 1 + \frac{1-p}{\Delta})}, \text{ where } v(.) = u^{-1}(.).$$

Since $v(.)$ is increasing, the bonus share falls in Δ.

The predictions of the model are straightforward: better information leads to less reliance on bonuses. Lower bonus shares imply lower expected compensation. Thus, while high values of Δ minimize compensation costs, they are also more onerous since better information is more expensive. In the less efficient organization, the principal earns a lower return from every investment, including monitoring, and therefore there is less of it, this in turn will lead to the design of a labor contract with greater use of bonuses relative to wages, an implication that can be assessed in the data.

4 Data and Descriptive Statistics

The Portuguese data were extracted from an original manuscript written ca. 1582 (Luz 1960). Portugal's loss of independence to Spain in 1580 brings the former Portuguese empire in the East under the control of the Spanish king, to whom this manuscript was addressed. The document – whose author remains anonymous, though Luz speculates him to be a former high secretary of state – seems to have had the purpose of providing information about the conditions of the newly acquired eastern empire. In this sense, the data cannot be taken as representative of year 1582 alone, but rather as a summary of almost one hundred years of Portuguese operations in the East. With the exception of the island of Ternate, by 1582 the Portuguese strongholds in the East remained intact since the 1520s the decade of the last conquests in Asia.

The document is divided in seventeen chapters each providing a detailed description of a Portuguese stronghold in the Indian Ocean from Mozambique in East Africa, to Ternate in the Southeastern Archipelago (now Indonesia), and also Macao in China.[9]

A typical chapter starts with the description of the location (town or fortress), its geographic characteristics (peninsula, island, mountains or plains), its local rulers (usually vassals of the Portuguese crown), and sometimes the type of buildings as well as the characteristics of local inhabitants or the type of products traded (or produced) in each location. The author then goes in detail over the list of all job positions in that same location and respective compensation provided by the king of Portugal.[10] All seventeen chapters together give us the complete set of job positions (e.g. captains, factors, scribes, etc. in Goa, Ormuz, Mozambique, etc.) of the Portuguese empire.

Labor compensation is composed of two parts: a yearly fixed *wage* paid by the Royal

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[9]See Figure 3 for a detailed map of the Portuguese controlled cities in the late sixteenth century corresponding to the data extracted from the document.

[10]In the preface, Luz notes that the description is not merely statistical. The author often provides additional comments on the current state of a given location or job post as well as his critical opinion on as diverse issues as territorial defense or the nomination of personnel. Such statements help us understand the circumstances afflicting the Portuguese empire at the time, as well as the management and personnel practices within the firm.

Treasury, and a variable *bonus* in kind, in the form of imports of spices, for which the author provides the corresponding value over three years – the term of the contract.[11] The bonus varied with each location's trade conditions (e.g. war, good agricultural year) and worker's effort, for which the author is very explicit. Many a time, the author mentions that a given post accrued a certain value of bonus in the past, but such was no longer the case because of war, or because current workers were not as diligent as former ones. Also, the values are often mentioned as an upper bound, e.g. "The vice-royal post could import, if served with honest conscience for the time period of three years, sixty to seventy thousand *cruzados*, which include the fifths of the appraisals and seizings of Moor ships, yielding more or less imports according to the quantity and quality of appraisals" (Luz 1960:9-10).

There is a total of 198 observations, corresponding to overseas job posts of Portuguese workers, all of which provided by the monarch in Portugal and paid by the Royal Treasury.[12]

The Dutch data were collected from Lequin (1982), which provides a detailed historical study of the personnel of the VOC. The appendix of this volume shares a wide range of information concerning the VOC's administration. Among the collection, Lequin provides the complete career records of 115 VOC workers who spent some time of their careers in Bengal between 1669 and 1799, a year before the formal dissolution of the company.

From the year of entry to that of exit, Lequin observes each worker's name, place of birth, date of entry, chamber of origin within the company, civil status (when known), age at entry (when known), location and corresponding date, occupation with corresponding monthly wage and date, date of promotion with corresponding occupation and monthly wage, motive for exit, total career payments in wages (used as *wages* in the Dutch package), total career remittances to the family in Netherlands (part of the worker's salary), and total career payments in kind (spices) in the form of exports to the Netherlands. This last item is equivalent to the Portuguese payments in spices, and it is similarly interpreted as the *bonus*

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[11]Workers could have been rehired after the three-year contract. The author is silent on this matter.

[12]The Portuguese administration in the East certainly hired locally to the most various tasks (e.g. load and unload ships), but those jobs are not in the data.

in the Dutch compensation package. Like the Portuguese, all Dutch workers in the sample were hired in their home country.[13]

The Dutch dataset focuses on individual workers, allowing for a long run analysis of the careers in the VOC over more than a century. The Portuguese dataset, on the other hand, focuses on job posts and therefore does not provide as much detail. In terms of compensation structure I can, however, analyze both cases through the same lens as I have information on *career wages* and *bonuses* for both. Moreover, even though the time frames of the two datasets do not coincide, both occur when the two empires were already well established in the East, therefore both samples are comparable.

Table 1 shows the bonus shares in the Portuguese and Dutch firms, a convenient variable to analyze as it abstracts from the different monetary units in the two samples. The average Portuguese bonus share is larger than the Dutch counterpart by a magnitude of 1.65.[14] Also, the Portuguese shares are more dispersed than the Dutch, with a standard deviation almost doubled (.396 and .209, respectively) and the median more distant from the average.[15]

To address the *learning hypothesis*, I divided the Dutch workers in two groups according to the date they enter the sample (before and after 1724) in order to observe if better monitoring techniques would have lowered the need to use bonuses in a later stage. What we in fact observe is the opposite. Dutch workers entering the VOC after 1724 have higher bonus shares of compensation than workers entering before that year, that is, the older the VOC, the closer the compensation structure becomes to the Portuguese enterprise controlled by the crown. This phenomenon may be associated with the decline of the VOC, but it does not really endorse the *learning* theory.[16]

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[13]Of the 115 observed workers, seven were born in Asia but their first and last names are European. I therefore assume that they were descendants of VOC workers and not locally hired labor for low skilled occupations, which makes these workers comparable to the rest of the workers hired in the Netherlands.

[14]The Portuguese and Dutch averages are statistically different from each other.

[15]It may be argued that the VOC may have compensated their workers with promotions instead of bonuses, which reflects in the observed pattern. This story however, does not contradict the monitoring argument: a promotion strategy likely requires more and closer monitoring of workers, than associating bonuses with observed outcomes. If indeed the VOC chose promotions over bonuses as opposed to the Portuguese company, then this is just another manifestation of divergent organizational control.

[16]The result is identical if the date of exit (and not entry) is taken into account.

The preliminary evidence on Table 1 is consistent with the model's predictions that the king controlled enterprise (Portugal) is associated with a poor information structure, which, according to the model, elicits a compensation structure with larger bonuses.

In the event Portuguese workers were re-hired after the three year term of the contract there can be three possible scenarios regarding the bonus share: (a) it is equal to that of the first contract, in which case the proportion is constant throughout the career; (b) it is higher than the bonus share of the first contract in which case the career bonus share for Portuguese workers is actually higher than the reported on Table 1; (c) it is lower than the bonus share of the first contract, which seems implausible – if a worker were to be re-hired after the first three years he would likely be a good worker, therefore there would be no reason to penalize him. In the plausible scenarios of (a) and (b) the relationship between Portuguese and Dutch shares reported on Table 1 remains intact.

The data allow for a more complete analysis of the compensation structure, as detailed information on worker's *location, sector* (both explicitly stated in both documents), and *rank* is available. These variables could be affecting the structure of labor compensation according to the following hypothesis: (H_1) workers in spice-producing locations, such as Indonesia, may have been easier to monitor than workers in other locations not providing a tangible outcome, where worker productivity could have been harder to assess. Such is the case of administrative regions of Goa and Bengal in India, other relatively less productive spice locations in the Malabar coast (Southwest India), or even locations that were kept only for strategic purposes, such as the Cape of Good Hope or Ormuz in the Persian Gulf. To account for these differences, I divided locations into India, Indonesia and Other Regions; (H_2) workers in the civil *sector* may be easier to monitor than workers in the sea or military sectors because they were less mobile, therefore I divided occupations into sectors of activity – Civil, Sea, and Military; (H_3) high *rank* jobs may encompass more complex tasks, which may be harder to monitor and therefore offer higher bonuses on average, so I constructed two variables concerning the rank of each job post based on the hierarchical ladder of each firm,

provided in each document: from the middle of the hierarchy up I classified the position as high rank, otherwise as low rank.

Descriptive statistics are presented in Table 2. The Portuguese document provides a survey of job posts, therefore the descriptive statistics are extracted directly from the data. In the Dutch case this required some treatment: since I have complete career paths, the statistics reported in Table 2 show workers' location, sector, and rank for each worker in more than 50% of his career.[17] The majority of the observations are located in India, though this is driven mainly by Portuguese workers. Both countries have a large majority of workers in the civil sector, and have 64% of the workers in a low rank job.

5 Results

Consider the following baseline regression for worker j

$$\frac{b_{ij}}{b_{ij} + w_{ij}} = \beta_0 + \beta_1 d(Crown) + \beta_2 d(H_i) + \beta_3 d(Crown) \times d(H_i) + \varepsilon_{ij}, \text{ with } i = 1, 2, 3$$

where the left-hand side represents worker j's bonus share of compensation; $d(Crown)$ is a dummy if the firm is controlled by the king – a proxy for the information structure according to the model –; $d(H_i)$ a dummy for worker j's *location, sector* or *rank* hypotheses described above ($H_1 = Indonesia$, $H_2 = Civil$, $H_3 = Low$, respectively);[18] and ε_{ij} the error term.

Given the tendencies on Table 1 we would expect a positive correlation between the bonus share and a firm controlled by the crown $\beta_1 > 0$. The *Location, Sector* and *Rank* hypotheses lead us to expect β_2 to be negative for all H_i. Coefficient β_3 explores the difference in

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[17]Starting and finishing variables vary considerably: most Dutch workers arrived in Batavia – Indonesia – and finished their careers in Bengal – India; most workers (64%) started in the civil sector, but almost all others transferred to this sector at some point in their careers and a total of 97% are last observed in the civil sector. Career progress in the VOC was very clear: 90% of the workers started in low rank positions but only 36% are last observed as such, and about half of those died on the job. These differences do not change the results.

[18]Though the categorical variables of Location and Sector can take more than two values, I am interested in the effects of working in a high spice producing location and working in the civil sector, therefore I estimate those coefficients with a single dummy.

treatment of workers in firms with different monitoring, with respect to the difference in treatment regarding each of the hypotheses H_1, H_2 and H_3.

There are eighty-one workers with zero bonus (fifty-six Portuguese and twenty-five Dutch), which makes the dependent variable zero for a non-trivial number of observations (26%). A standard linear model would weight these zeros as any other observation, which would result in negative fitted values, when $\frac{b_j}{b_j+w_j}$ can never be negative. The results reported on Table 3 use a Tobit model to take care of this problem.[19]

The first three columns in Table 3 test H_1, H_2 and H_3 separately, while the last tests all three hypotheses jointly. Coefficient β_1 is positive and significant on all tests. Long-distance trade organized as a crown monopoly seems to have been associated with the way overseas workers were paid: working for the Portuguese king meant, on average, a higher fraction of compensation in the form of bonus. The *Location* hypothesis (H_1) is not supported by the data: the bonus share of compensation was not significantly different for workers in the administrative areas of India (mostly Goa and Bengal) and workers in spice producing regions of Indonesia. The *Sector* (H_2) and *Rank* (H_3) hypotheses on the other hand, offer significant coefficients on the single variable and/or the cross product: civil servants seem to have received larger bonus shares contrary to H_2, which however seems to still prevail for Portuguese civil servants, given the negative sign on the cross product in the second column; H_3 seems to be verified for Portuguese workers alone, with a negative and significant coefficient on the cross product, while the coefficient for low rank per se is not significant.

The last column in Table 3 includes all explanatory variables and cross products. Again the coefficient on *Crown* is positive and highly significant even after controlling for all other variables that may have been affecting the bonus share. The high magnitude of β_1 however, should be interpreted carefully because the estimated constant (equivalent to the Dutch average in the absence of any controls) is negative though not significant. Again, the rank hypothesis seems verified for Portuguese workers with a negative and significant

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[19] OLS regressions yielded the same signs and significance levels of the estimates of *Crown*, but it did not confirm any of the hypotheses.

coefficient, which if summed with β_1 indicates that on average Portugal paid a bonus share of compensation 53.1% higher than the Netherlands.[20]

The difference in magnitude of bonus shares could be associated with the construction of the data, which attributes location, sector and rank of Dutch workers to the place, industry or category in which they spent more than 50% of their careers. The initial 30% of Dutch careers could have been spent in low-wage/high-bonus location or sector or rank, while the last 70% in the reverse (high-wage/low-bonus location or sector or rank). The classification criterion only captures the latter part of the Dutch careers, helping the model and if the pattern was similar for Portuguese workers (of which I only capture the initial contracts) then the model fully explains the artificial result.

Columns (NL) and (PT) on Table 3 clearly demystify this conjecture. First, the only significant explanatory variable in the Dutch regression is that of the civil sector, to which all but two workers transfer to and spend most of their careers on; since *Civil* is positively significant, Dutch workers in the civil sector were associated with higher bonus shares and not the opposite as the conjecture above expects. Second, for Portuguese workers the only significant variable is *Low rank*, which is associated with lower bonus shares; even though 64% of Portuguese workers belong to this category, we still observe higher bonus shares for Portuguese workers relative to the Dutch.

The issues on data construction may be surpassed, but we may still have a problem with the datasets: even though the information from both is comparable, Portuguese data are expected compensation as established in the three-year term contract, whereas the Dutch data are realized compensation values throughout the worker's career (twenty-two years on average). It is plausible to argue that both firms had similar contractual arrangements, but that the observed differences in bonus shares are due to the assumption that Portuguese

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[20]For further investigation on whether the differences in the compensation structure are accounted by the ease of monitoring I also estimated separate tobits using Portuguese and Dutch data. Results show that the estimated coefficients are jointly significantly different. A decomposition of the average bonus shares shows that the observable country differences explain only 13% of the gap, leaving 87% to differences in the estimated coefficients.

workers in the sample have completed their contract, whereas Dutch workers may not have.

Table 4 shows the reasons for Dutch workers exiting the sample. Assuming that workers departing the East or arriving the Netherlands completed their contract, 70% of the workers have incomplete career paths, which may distort the observed bonus shares of the Dutch empire. If the VOC's personnel policy was one in which age-earnings profiles paid less than the value of marginal productivity for young workers and more for old workers (Lazear 1981), and if bonuses are seen as a reward to be achieved later in the career, then the observed Dutch bonuses are smaller than what VOC workers could achieve had they all completed their contracts.

Figure 1 shows the distributions of the Portuguese and Dutch bonus shares of compensation. Before addressing contract completeness, it is worth to note that the Portuguese distribution is more dispersed than the Dutch, which according to the model (specifically, the binding incentive constraint) is a sign of a poorer information structure in place.

Panel A shows the distributions of the bonus shares for all Portuguese and Dutch workers. The Portuguese distribution lies to the right of the Dutch distribution indicating a structure of compensation relying more on bonuses. Panel B shows the bonus shares for all Portuguese workers, and for Dutch workers that returned to the Netherlands or departed from the East, that is, Dutch workers with complete contracts. The previous tendency is reinforced: Dutch workers with complete contracts receive lower bonus shares than Portuguese workers.

The comparison of the Dutch distributions of bonus shares for complete and incomplete contracts on Figure 2 seems to either disprove Lazear's thesis, or the hypothesis that bonuses are late career rewards, or both, as Dutch workers with complete contracts are the ones getting lower bonus shares in the overall distribution.

The concern is now one of selection. It may be the case that Dutch workers who reach the term of the contract are of lower ability and either never reached high rank occupations, or self-selected into sectors of activity that were easier to monitor and therefore received lower bonuses throughout their careers. To account for a possible influence of contract

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completeness on the bonus shares I include a corresponding dummy variable on the right hand side of the Tobit estimation while controlling for all other available variables.[21]

Column (1) on Table 5 shows the Tobit results for Dutch workers. The bonus share does not seem to be affected by complete contracts, which is statistically insignificant. Column (2) reports the results for all Portuguese and Dutch workers controlling for the usual suspects as well as complete contracts. The coefficient for *Crown* is still significant, just as in Table 3 and the result also holds when the cross products are included on column (3).

6   Concluding Remarks

When the European overseas expansion began, countries were faced with a choice of how to organize their merchant empires. Even though sovereigns shared the same objective and technology, they chose to organize long-distance trade differently: the Portuguese opted for a crown monopoly whereas the Dutch opted by a merchant monopoly. Contract theory suggests that control at the top has significant impact in firm's performance as well as in the way a firm is run. One possible dimension to observe the latter is to analyze the personnel policies of the different merchant empires, which should have varied according to organizational type.

I use a principal agent model to illustrate the differences in compensation structures of merchant empires on the basis of differing contractual incentives within each of the firms: a firm in which managers have poor incentives to monitor, or in which monitoring is harder, offers a compensation package with higher bonuses relative to wages. I then compare the model's implications with the patterns observed in the compensation schemes of the Portuguese and Dutch overseas workers from the late sixteenth century to the eighteenth century. The data show that Portuguese workers had a higher share of their total compensation in the form of bonus than their Dutch counterparts. The result holds even after controlling for alternative explanations that may be affecting the ratios, such as worker's location, sector,

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[21]Given the tendencies on Table 4, it is likely that contract completeness is exogenous.

and rank, and also contract completeness. Given the large number of zeros in the dependent variable I used a Tobit model.

The different compensation schemes in the Portuguese and Dutch merchant empires are consistent with the theoretical implications of the model. In a royally controlled firm with less delegation of control, monitoring is more difficult when compared to a merchant controlled enterprise; as a result the compensation structure differs radically across firms: bonuses are more prevalent when control is less delegated.

Understanding the alignment of incentives, for example, in terms of the firms' personnel policies, is a step forward to explain the divergent economic performances of merchant empires and the long term divergence of the respective countries.

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Figure 1: Distribution of Bonus Shares of Compensation

(A) All contracts
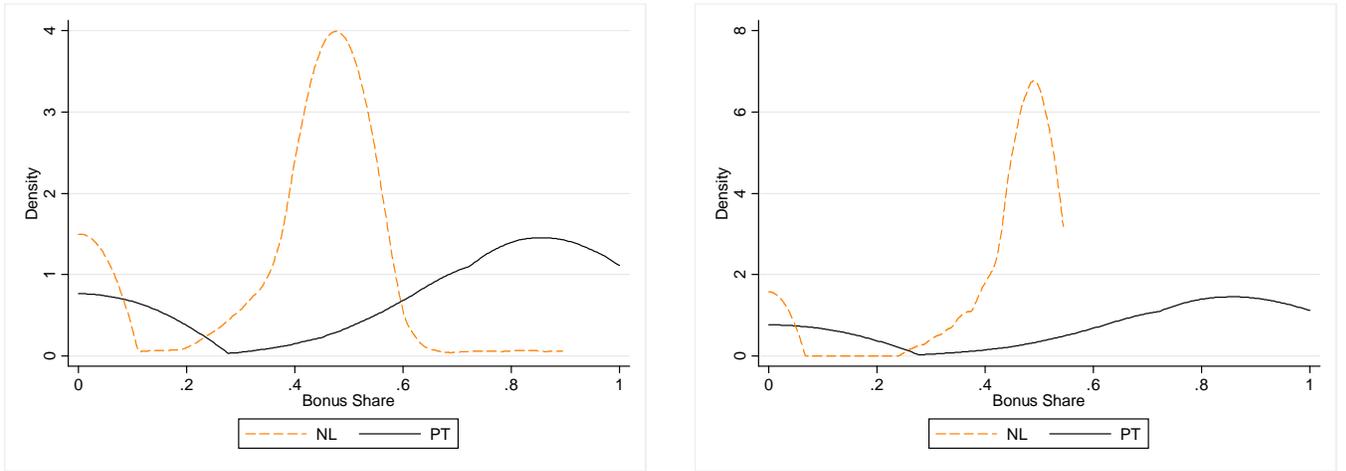
(B) Complete contracts only
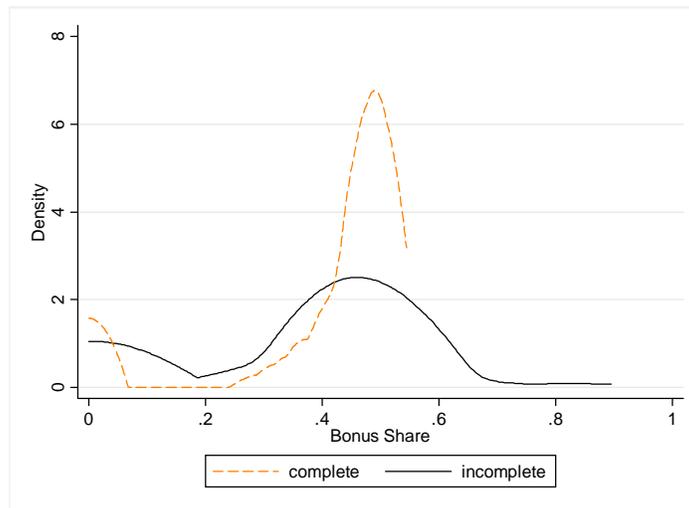

Figure 2: Distribution of Dutch Bonus Shares

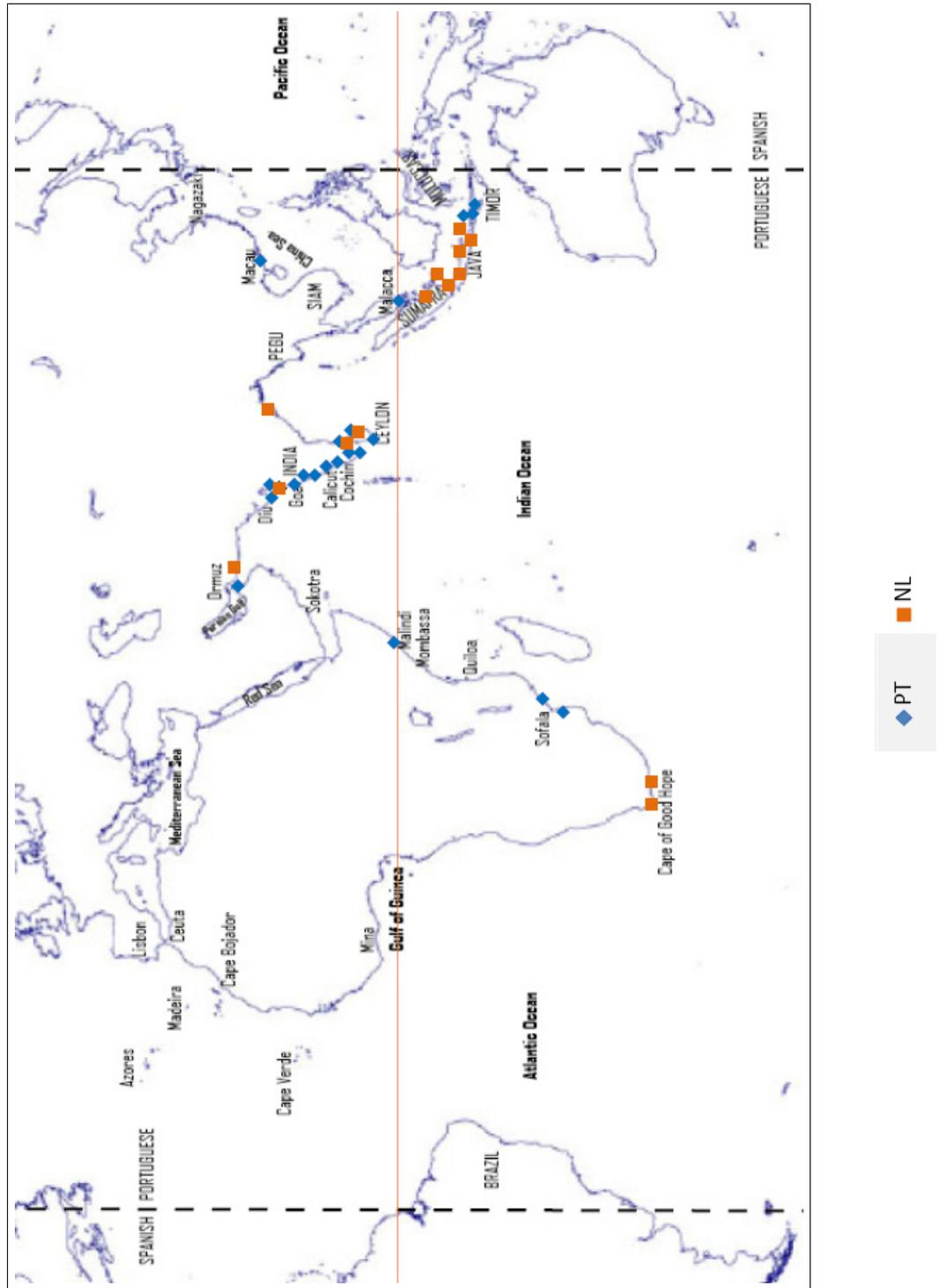Figure 3: Portuguese and Dutch Locations

Table 1: Descriptive statistics: Bonus Shares of Total Compensation

	Portugal	Netherlands	Total	NL early	NL late
Average	.600	.363	.511	.287	.425
Median	.765	.466	.500	.400	.471
St. Dev.	.396	.209	.358	.240	.156
Min.	.000	.000	.000	.000	.000
Max.	1.00	.895	1.00	.753	.895
N	198	115	313	52	63

Sources: Lequin (1982), Luz (1960).

Table 2: Descriptive Statistics: percentage of workers by Location, Occupation and Rank

	Portugal	Netherlands	Total
India	0.73	0.23	0.54
Indonesia	0.11	0.58	0.28
Other	0.16	0.19	0.18
Civil	0.76	0.97	0.83
Sea	0.06	0.03	0.05
Military	0.18	0.00	0.12
Low rank	0.64	0.64	0.64
High rank	0.36	0.36	0.36
N	198	115	313

Sources: Lequin (1982), Luz (1960).

Table 3: Tobit Estimations for the Bonus Share of Compensation

	(H_1)	(H_2)	(H_3)	(All)	(NL)	(PT)
Crown	.272***	.803***	.474***	.944***	NO	YES
Indonesia	.058			.040	.030	-.085
Civil		.523*		.491*	.367**	.083
Low rank			.104	.100	.076	-.338***
Crown*Indonesia	-.120			-.121		
Crown*Civil		-.606**		-.414		
Crown*Low Rank			-.385***	-.413***		
_Cons	.272***	-.203	.240***	-.258	-.087	.678***
N	313	313	313	313	115	198
Pseudo R^2	.039	.048	.079	.091	.131	.047

Significance: *10%, **5%, ***1%.

Table 4: Exit Motives for Dutch Workers

	#	%
Arrival to the Netherlands	15	13
Death	53	46
Departure from the East	20	17
Fired	1	1
Retired	1	1
Unknown	25	22
Total	115	100

Table 5: Tobit of Bonus Shares Controlling for Complete Contracts

	(1)	(2)	(3)
Crown	NO	.155*	.890***
Indonesia	-.031	.001	.041
Civil	.370**	.040	.498*
Low rank	.066	-.161***	.088
Complete	.062	.117	.076
Crown*Indonesia			-.121
Crown*Civil			-.420
Crown*Low Rank			-.401***
_Cons	-.102	.336***	-.281
N	115	313	313
Pseudo R²	.151	.057	.093

Significance: *10%, **5%, ***1%.

7 Appendix

7.1 Efficiency Wages in the VOC

Beyond bonuses, efficiency wages are also a recognized mechanism to deal with monitorign porblems. In this case, firms choose to pay wages above market clearing levels in order to attract better workers and avoid moral hazard problems. This mechanism might have been used in merchant empires, but this hypothesis is hard to evaluate given that wages overseas had to compensate workers for the high risk associated with their job posts in locations often afflicted by wars, as well as the non-negligible probability of not concluding the original voyage to the East due to ship-wreckage. Even so, it is worth to calculate the magnitude by which overseas wages exceeded those paid in Europe in each empire. Portuguese wage series are not available.

The 1755 Lisbon earthquake destroyed two-thirds of the city, including the national archives, which makes it impossible to evaluate the efficiency wage argument in Portugal. For the Netherlands the data is available. Allen (2001) calculates Amsterdam wages in grams of silver per day, whereas O'Rourke and Williamson (2005) provide the ratio of grams of silver per guilder for the relevant years. Combining both I generate Amsterdam's daily wages in guilders for the same years as VOC's wages also in guilders. Table 6 shows the average waiting time as well as the monthly wages throughout the VOC career.

Table 6: Time and Wage in VOC Occupations

	Till junior merchant	Till merchant	Till senior merchant	Till director	TOTAL
waiting time (yrs)	9.78	9.01	5.86	5.05	29.71
wage (mo. florins)	13.3	40	57.5	80	-

Source: Lequin (1982).

Using this information I calculate the total wage payments for the average VOC worker as

$$TWP = \sum_j (\text{years in occupation}_j \times \text{average monthly wage}_j \times 12)$$

and get TWP in the VOC conditional on the 22 year career length of the average worker or the 30 year career of the worker who reaches high hierarchy, shown on Table 7.

Table 7: TWP on the VOC Conditional on Career Length

Career Length in the VOC		Conditional Expected Wage Payments	
Average	22 years	$E[TWP|career = 22)$	8,098.59
High hierarchy	30 years	$E[TWP|career = 30)$	14,780.51

Using the 22 and 30 year career lengths for Allen's Amsterdam monthly wages and assuming that workers spend half of their careers as laborers and half as craftsmen I get average TWP for Amsterdam workers on Tables 8 and 9, respectively.

Table 8: Wages in the Netherlands
Amsterdam Monthly Wages (month = 22 days)

	Labourers	Craftsmen	Average
$E[TWP|career = 22)$	$5,241.13$	$7,159.52$	$6,200.32$
$E[TWP|career = 30)$	$7,146.99$	$9,762.98$	$8,454.99$

Table 9: Wages in the Netherlands
Amsterdam Monthly Wages (month = 30 days)

	Labourers	Craftsmen	Average
$E[TWP|career = 22)$	$7,146.99$	$9,762.98$	$8,454.99$
$E[TWP|career = 30)$	$9,745.90$	$13,313.15$	$11,529.53$

Table 10 compares the career wages at the VOC and Amsterdam.

Table 10: VOC Wages Divided by Amsterdam Wages

	22 days	30 days
$E[\frac{TWP_{VOC}}{TWP_{Amsterdam}}|career = 22)$	1.31	0.96
$E[\frac{TWP_{VOC}}{TWP_{Amsterdam}}|career = 30)$	1.28	1.28

For the regular VOC career of 22 years, the month length becomes relevant: if we consider a month of 30 working days the expected career wages in the VOC were inferior to those of Amsterdam, but with a month of 22 working days the VOC salary exceeds Amsterdam's by 31%, the maximum size of the efficiency wage incentive. For the 30-year long VOC career, assuming the worker would reach the job post of director (a rare event, only 11 out of 115 workers in the sample), the VOC wage payments would exceed Amsterdam's by 28%.

As for the VOC bonus policy, the size of the average bonus (payments in goods) was 63% of the actual wages paid in the VOC, roughly twice the size of the efficiency wage incentive.

xxxxx VOC wages exceeded those paid in Amsterdam, in the same time period, was much lower than the size of bonuses relative to wages in the VOC. Bonuses seem to have been more relevant than efficiency wages in the Dutch empire. xxxx