

Pirates of the Mediterranean: An Empirical Investigation of Bargaining with Asymmetric Information

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Preliminary Draft

Abstract

This paper investigates the effect of delay on prices in bargaining situations with uncertainty about the buyer's evaluation, a question to which existing empirical and experimental research do not provide a conclusive answer. To do this we use a historical data set containing thousands of captives ransomed from the North-African-based Barbary pirates. Plausibly exogenous variation in the delay with which captives were ransomed provides evidence that negotiating delays decreased the size of ransom payments. The magnitude of the effect of a year of delay is more than ten times higher than the effect of one year increase in the captive's age, indicating that most of the effect stems from the signaling value of strategic delay on the buyer side. Since this effect is the central component of dynamic bargaining models with asymmetric information, our results establish the relevance of these models in ransoming environments.

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Throughout history individuals and governments have negotiated and paid ransoms to secure the release of prisoners and property. These negotiations have often been prolonged, imposing significant costs on the involved parties. Ransom negotiations for the release of individuals captured by Somali pirates provide one recent example of this phenomenon. Although delayed negotiations expose captives to greater mistreatment, such delays have been common with the average duration in captivity climbing to eight months in 2011 (One Earth Future, 2012).

Why are negotiating delays common in ransoming and other bargaining environments? The theoretical bargaining literature suggests the role of asymmetric information (Sobel and Takahashi, 1983; Fudenberg et al., 1985; Gul and Wilson, 1986; Admati and Perry, 1987). The central idea is that the same amount of delay is more costly for buyers with a higher evaluation, hence delay can credibly signal it to the seller that the buyer's evaluation is low. While this explanation is intuitively appealing, it has been difficult to empirically substantiate that negotiating delays lead to lower prices (e.g. Kennan and Wilson, 1989).

In this paper we use a historical data set on thousands of captives ransomed by the Spanish from the North-African-based Barbary pirates to investigate the empirical relevance of dynamic bargaining models with asymmetric information in ransoming situations. Based on historical evidence, we think about negotiations for the release of different captives as a dynamic bargaining game with asymmetric information. In particular, we assume that the relevant uncertainty is one-sided, regarding the exact value of each captive for the rescuers.

Empirically, we focus on establishing that negotiating delays caused a decrease in equilibrium prices.¹ We do this for two reasons. First, this prediction is common to all rational models of bargaining when the relevant private information is on the buyer's side. Second, our historic data set allows us to

¹In a companion paper we use the same data to structurally estimate a simple model of dynamic bargaining along the lines of Fudenberg et al. (1985), and use it for welfare analysis and counterfactual investigations.

exploit the poor communications of the day to derive a plausibly exogenous source of delay (see Koudijs (2012) for a related empirical strategy). Specifications using this variation help address endogeneity issues that are thought to have biased estimates of the relationship between delay and prices in previous studies.

We begin by providing qualitative evidence from contemporary ransom-ing instructions that information asymmetries played an important role in determining both the length of negotiations and equilibrium prices. These instructions advise negotiators to delay the ransom of captives and claim that such delays caused price decreases.

Using data on thousands of captives ransomed in Algiers, Algeria between 1575 and 1692 CE we show that the data are consistent with this claim. In particular, we find that on average the Spanish paid less for a captive the longer he had been in captivity (which is our proxy for negotiating delay). Although this correlation is consistent with the claim that delay led to lower prices through signaling low buyer evaluation, there are clearly other possible explanations for this result. One of these is that there were multiple types of captives that the pirates could tell apart, and negotiations for types of captives with a higher value lasted a significantly different amount of time than negotiations for types with a lower value.

To address such concerns we use an instrument for delay that is rooted in the slow speed of travel in pre-industrial Spain. The family and friends of captives whose home towns were closer to the cities where the bargaining teams were based were likely to learn about an individual's captivity with less delay -and to remit the necessary ransom funds sooner- than those whose home towns were farther afield. A similar relationship held for individuals closer to ports commonly used to sail to Algiers. Thus, the funds to rescue a given individual were likely to reach Algiers more quickly the closer the individual's home was to these cities. This exogenous cause of delay in negotiations could not be distinguished by the pirates from strategic delay.²

²Given the technological and informational limitations of the day, it would not have been cost effective and may have even been impossible for the Algerians to construct the relevant

We use the relevant distances to construct an instrument for delay and find that a year's increase in captivity was associated with approximately a 10% decrease in a captive's ransom price. As opposed to this, we find that a year's increase in the age of a captive at the time of captivity is associated with less than a 1% decrease in ransom price. Since qualitative sources suggest that the pirates were careful to preserve the value of captives that they hoped to get ransom payment for, this suggests that most of the decrease in ransom price over time was due to the signaling value of delay on the part of the buyer.

The available data are consistent with the validity of the exclusion restriction underlying the IV regressions. In particular, in a subsample of the data we observe one component of the buyer's evaluation directly: the amount of earmarked money that the captive's friends and relatives collected for rescuing the captive. Results on this subsample are similar to those in the broader sample, suggesting that systematic differences in unobserved valuations are not driving our results. Our empirical use of information that only one of the parties possessed adds to a growing empirical literature on adverse selection that aims to collect and utilize such information (Finkelstein and McGarry, 2006; Finkelstein and Poterba, 2006; Abramitzky, 2009). To the best of our knowledge, ours is the first paper to empirically use such information in the context of bargaining under asymmetric information.

Our results are most closely related to the empirical literature on bargaining under asymmetric information. Much of this literature has relied on experiments (Neelin and Spiegel, 1988; Ochs and Roth, 1989; Mitzkewitz and Nagel, 1993; Straub and Murnighan, 1995; Croson, 1996; Guth et al., 1996; Rapoport et al., 1996; Schmitt, 2004) and generally finds that play is far away from equilibrium predictions. These papers compellingly argue that the main reason for this is that many subjects exhibit other-regarding preferences, and in particular reject offers that would give them less than what they regard as a fair share of the surplus. One important advantage of our setting is that it is reasonable to assume that the professional bargaining teams on the Spanish side, and

distance metrics. The data are consistent with this hypothesis, in the sense that they show that the results do not qualitatively vary as we shrink the geographic region of analysis.

private slave holders on the corsair side only cared about their own physical payoffs.

The non-experimental empirical literature has also faced challenges. In particular, existing studies have struggled to establish a negative relationship between the length of negotiations and prices. For example, Card (1990) found virtually no relationship between agreed upon wage and the length of negotiations analyzing Canadian employment contract data for the period 1964-1985. Although McConnell (1989) finds a statistically significant negative relationship between average wage settlements and average strike duration using US contract data for the period 1970-1981 this relationship is sensitive to model specification. Our results robustly suggest that delay had a causal effect on prices, thus providing evidence consistent with one of the central predictions of the theoretical literature.

The results are also closely related to studies of the determinants of bribes and extortion payments (Hsieh and Moretti, 2006; Olken and Barron, 2009; Rose-Ackerman, 2010). Although ransom payments are believed to stimulate predation in weakly-institutionalized polities with significant welfare impacts (Besley et al., 2012) their determinants are poorly understood. The evidence presented in this paper suggests the relevance of bargaining theory in explaining ransoming outcomes.³

The remainder of the paper proceeds as follows. The first section provides an historical overview, the second section describes the data and investigates correlations. The third section provides the empirical results. A final section concludes.

1 Historical Background

Between the 16th and 19th centuries, the Barbary pirates preyed on commerce and coastal populations in the Mediterranean and Atlantic. These pirates

³In a broader sense our results speak to a growing literature investigating piracy from an economic standpoint (Leeson, 2007, 2009; Hillmann and Gathmann, 2011). Like these studies, our paper suggest the relevance of economic theory in explaining the actions of pirates.

derived important revenues from the sale of captured cargoes and captives, affecting both trade and coastal settlement patterns for centuries (Tenenti, 1967; North, 1968; Friedman, 1983). Recent scholarship estimates that the pirates captured and enslaved over one million individuals between 1530 and 1780 (Davis 2001, 2003).⁴

The city of Algiers (in modern-day Algeria) was an important center of pirate activity on the North African coast. Following its establishment as a center of piracy in the early 16th century, it was home to thousands of individuals who had been captured by pirates and subsequently sold into slavery.

The price of captured individuals in the Algerian slave market was primarily determined by two factors. The first of these was related to the present value of a captive's marginal product. Older captives were valued less and captives with special skills (such as carpentry) commanded higher prices. The second factor was a slave's potential for ransom. As this potential increased with a slave's social status, slave traders and potential buyers examined both the possessions and bodies of the captives in detail in an attempt to ascertain their social status. The Algerians also provided incentives to fellow captives to correctly identify high-ranking captives.

Once a captive had been sold into slavery, his captors encouraged him -or a fellow captive on his behalf if he was illiterate- to write home to secure ransom payments. Merchants, ransomed captives and returning Spanish ransoming expeditions carried these letters to Spain (Hershenson, 2011, pp. 64, 65).

How long did it take for this information to reach a captive's home? Although it is impossible to exactly measure, delay increased with the distance from the captive's home to what we refer to as the "bargaining bases." These cities were the three ports commonly used to travel from Spain to Algiers (Alicante, Cartagena and Valencia) and the two cities (Madrid and Seville) in which the Spanish bargaining teams were based (Martínez Torres, 2004, p.

⁴Since the Barbary pirates operated with the support of their local governments we should technically refer to these pirates as corsairs. For expositional simplicity, however, we follow popular convention and use the term pirates. For a detailed treatment of the history of the Barbary pirates see Julien (1970), Abun-Nasr (1977), Bono (1998), Davis (2003), Panzac (2005) and Weiss (2011).

107). The distance-induced delay in the arrival of news of a loved one's capture could be significant. For example, even if the bearer of the letter went directly from the bargaining base to a captive's home, he would have on average covered about 13 kilometers per day (Grafe, 2012, p. 110). In practice, this speed is likely an upper bound on the speed with which the news of an individual's capture traveled.⁵

Once the news of an individual's capture had reached home, the local community had various means to raise ransom funds. For the most part, the brunt of the financial burden for an individual's ransom lay with his family. To raise the necessary funds, family members resorted to a variety of strategies such as selling property, taking out a loan or using the dowries of unwed daughters. Those who were unable to raise the necessary funds could beg or directly petition the government for aid.

Most families entrusted their ransom funds to one of the two Catholic religious orders who transported these funds to Algiers and negotiated the ransom payments on a family's behalf (Martínez Torres, 2004, p. 79). As with the travel of the news of an individual's capture, the time required to transport ransom funds to these religious orders increased with the distance of a captive's home from the bargaining bases (Anaya Hernández, 2001).

In sum, after a captive had been captured and sold in the Algerian slave market, the distance to the bargaining bases affected the delay with which his ransom money reached Algiers in two ways. First, it increased the delay with which his family learned of his captivity. Second, it increased the time necessary to transfer funds to the religious orders that negotiated ransoms in North Africa.

1.1 Negotiations in Algiers

After arriving in Algiers, the Spanish focused on ransoming two groups of individuals. The first group included those "earmarked captive" whose families

⁵For example, it is probable that distance also increased the likelihood of a letter being lost. The loss of letters also contributed to overall delay as captives routinely had to write many times before letters reached their destination (Hershenzon, 2011, pp. 63-64)

and friends had raised funds for their ransom. Funds for the ransom of these captives on average accounted for 40% of all ransom funds (Friedman, 1983, p. 115). The second group of captives were ransomed using the remaining funds which came from alms and bequests. Some of these funds could be used at the discretion of the religious orders although a portion were to be used for the ransom of specific types of captives such as women, children, clerics or soldiers.

Before the ransom negotiations began, the ransoming team was instructed to ‘visit the dungeons where the miserable captives live [...] and identify all the Christian vassals of the King [of Spain...] their home towns, names [and] the names of their parents’ (BNM MSS 2974, 1675, f.4) and to note those captives they wished to ransom.⁶ The Spanish seem to have done this for every captive possible, thus not disclosing the identity of the captives they wanted to ransom.

At the start of the negotiations -which appear to have been held in a government building- the Algerian government required the Spanish to ransom some of its slaves at inflated prices. After this, the Spanish were generally free to negotiate ransoms with Algerian slave owners. When an agreement was reached, the Spanish recorded the relevant information in a book and gave the slave owner a signed piece of paper. At the end of the negotiations, the Spanish paid the slave owners and the ransomed slaves returned with the negotiating team to Spain (BNM MSS 2974, 1675, f. 6).

Although the Algerians knew that the Spanish preferred to ransom certain types of captives and were very adept at correctly identifying the highest-ranking individuals (Friedman, 1983, p. 151), there is evidence that they faced uncertainty regarding both which captives the Spanish wanted to ransom and how much the Spanish were willing to pay. The Spanish used this information asymmetry to their advantage, delaying the ransom of some captives to obtain lower prices. For example, surviving instructions to the ransoming teams consistently advise the negotiators to “delay the ransom [...] and pretend to

⁶Lists with the physical descriptions of earmarked captives further helped the negotiating team correctly identify these captives (Martínez Torres, 2004, p. 41).

not be interested in the captives that they most want to rescue [...since the Algerians after this delay] will often sell their slaves for less than they thought they were worth” (BNM MSS 2974, 1675, f. 5). The remainder of the paper examines the claim that delay had a causal effect on prices using the ransom prices and durations in captivity of thousands of captives ransomed by the Spanish from Algiers.

2 Data

2.1 Data Collection

Our data come from surviving records of the notaries that accompanied 22 ransoming missions to Algiers between 1575 and 1692.⁷ The Spanish crown appointed this notary who was responsible for keeping detailed records of all financial transaction and verifying their accuracy. These records are believed to be accurate and have been described as “extremely thorough” (Friedman, 1983, p. 107).

The ransom record of Juan Antonio Sandier from the year 1667 provides an example of a typical entry in these records and reads: “Juan Antonio Sandier son of Juan de la Peña and of Luisa Rodriguez from Valladolid of 41 years of age and 15 months of captivity [...] his ransom cost 160 pesos of which 50 pesos came from earmarked money [...] the remainder came from the alms of the holy cathedral of Valladolid” (BNM MSS 3586, 1667, f. 62). In this entry we learn that Juan Antonio Sandier was ransomed after 15 month of captivity for the price of 160 pesos.⁸ In addition, his family (or friends) had sent 50 pesos for his ransom. The remaining funds came from alms collected in the cathedral of his home town of Valladolid.

⁷We omit ransoming missions after 1700 because after this date the ransoming missions had different procedures, expenditures and goals than those prior to this date (Martínez Torres, 2004, p. 34). There are also numerous records from ransoming trips to Tetuan, Morocco. As we explain in a companion paper where we use these data, the bargaining environments in the two areas were quite different.

⁸The silver peso (also known as the *real de a ocho*, piece of eight or Spanish dollar) was a currency unit in the Spanish Empire.

Using thousands of similar entries we have identified 4684 individuals ransomed in the 22 ransoming expeditions. Of these, we have omitted 75 captives that are missing ransom prices or have a recorded price of zero. Of the remaining 4609 ransomed individuals, we have information on the time in captivity for 4491 captives. In addition, we have been able to identify the latitude and the longitude of the captive’s home for 4462 individuals.⁹

In Figure one we provide a map showing the geographic locations of the homes of the non-American captives ransomed in our data set and use larger gray circles to denote locations with more ransomed captives. This figure makes clear that the majority of ransomed captives were from locations in modern-day Spain although just over 800 captives were from locations outside these boundaries. Most of these were from Spanish possessions such as southern Italy or Portugal.¹⁰

2.2 Empirical Results: Correlations

We begin by investigating the correlation between a captive’s time in captivity and his ransom price. Our baseline estimating equation is:

$$100 * \log(\text{ransom}_{ib}) = \alpha_b + \beta \text{timecaptive}_{ib} + \gamma' \mathbf{x}_{ib} + \varepsilon_{ib} \quad (1)$$

where i indexes individuals and b ransoming trips. The variable $\log(\text{ransom})_{ib}$ denotes the natural logarithm of a captive’s ransom price. α_b denotes ransoming trip fixed effects which we include to account for trip-specific unobservables such as the possibility that some negotiating teams were more skilled than others. The variable timecaptive_{ib} is the time an individual spent in captivity before he was ransomed and is the proxy for negotiating delay that is used in this paper.¹¹ The vector \mathbf{x}_{ib} contains a set of individual-level covariates,

⁹We set the home town of the 21 ransomed captives who were born in captivity (18 captives that were born in Algiers; 1 in Fez, Morocco and 3 in al-Araish, Morocco) to missing. Identifying the latitude and longitude of the vast majority of locations was straightforward. To do this, we relied on the website <http://itouchmap.com/latlong.html>.

¹⁰In the supplementary appendix, we provide a detailed description of the construction of the data set as well as relevant summary statistics.

¹¹In practice, the pirates also observed the delay with which the Spanish ransomed a

including age at being captured. Throughout we cluster standard errors by the captive’s home town.¹²

It is important to note that our sample only contains ransomed captives and consequently all of our estimates are conditional on being ransomed. In other words, throughout the analysis we identify the effect of time in captivity on ransom prices by comparing ransomed captives within ransoming missions. Consequently, a negative estimate of β is indicative that within ransoming trips captives ransomed after a greater time in captivity cost less than those ransomed with less time in captivity.

Estimates of equation (1) using the entire sample are reported in Table 1. When we omit the vector of covariates in column (1) we find that a year increase in captivity was associated with roughly a one and a half percent decrease in the ransom price. In column 2 we add an indicator variable equal to one if the captive had a non-zero amount of earmarked money sent for his ransom. These results show that earmarked captives cost roughly 34 percent more than non-earmarked captives.

In column 3, we add the captive’s age at capture, a dummy equal to one if he was owned by the government, a female indicator and an interaction between this indicator and age at capture. These results show that a year increase in age was associated with a 0.64% decrease in the captive’s ransom price. This result allows for a test of the extent to which the negative relationship between years in captivity and a captive’s ransom price is simply a product of the captive’s ageing. In the row labeled p-value we present the p-value for the test of the null hypothesis that the coefficient on age at capture and time and captivity are equal. The data reject this null hypothesis, suggesting that an additional year in captivity led to a larger decline in a captive’s value than an additional year of age prior to captivity.¹³

captive within a trip. Here we abstract from this delay.

¹²We have also experimented with double-clustering the standard errors by a captive’s home town and by bargaining trip using the approach of Cameron et al. (2011). Since we only have 22 clusters on the book dimension and the results are qualitatively similar to those presented in the paper we have opted to only cluster on the dimension in which we have a large number of clusters.

¹³Of course, this difference could reflect the fact that captives “depreciated” at a faster rate

The finding in column 3 that captives owned by the government cost more than other captives is consistent with historical evidence that the Algerian government forced the Spaniards to purchase government captives at inflated prices. The coefficient on the female indicator and its interaction with age are also consistent with historical evidence that the value of women -who were often purchased to enlarge a slave owner's harem- declined more rapidly with age.

In column four we include occupation dummies. These group captives into one of ten occupations: Soldier, In King's Service (if an employee of the King of Spain), En Route to/from the Americas (i.e. captured while on the *Carrera de Indias*), Cleric, Sailor, Fisherman, Shepherd, Peasant, Other (which contains a variety of other occupations with a small number of ransomed captives) and captives for whom the ransoming manuals did not identify an occupation. The coefficients on these dummies (which are omitted due to space constraints) are largely consistent with the historical record. For example, soldiers and clerics were ransomed for higher prices than other captives. Moreover, the coefficients on the remaining variables are similar when these profession dummies are included.

2.2.1 Earmarked Captives

In the ideal world, we would always divide the sample by captives who had and did not have earmarked money sent for their ransom. Unfortunately, while the ransom records details the total amounts of ransom funds that came from earmarked donations, they do not always report the funds used to ransom each captive. We have used two sources to identify the 928 earmarked captives in our sample, and the amount of money sent for each of these captives. First, we have used the information available in the ransom records. As demonstrated in the example in section 2.1, these entries often report the source of funds used to ransom a given captive.

in captivity. However, historical evidence suggests that the Algerians were worried about such depreciation and "in the vast majority of cases acted to protect their investments" (Friedman, 1983, p. 76).

Second, many of the notarial records have a section detailing the names of captives for whom earmarked money was donated. We have used this information and matched by hand these funds to the ransom records. Although the 928 captives we have identified as having non-zero earmarked funds sent for their ransom represent roughly 20% of ransomed captives in our sample, it is unlikely that we have identified all captives that were ransomed with earmarked funds. Indeed, historical evidence that on average 40% of all ransom funds were for earmarked captives suggests that we may only have correctly identified half the earmarked captives in our sample.

What are the implications of this measurement error? On the one hand, it is straightforward to show that under plausible assumptions the coefficient on the earmarked dummy will be attenuated. In addition, this measurement error makes it impossible to correctly identify the coefficients for captives ransomed with non-earmarked funds.

Despite these limitations, the subsample of captives that we have identified as earmarked provides a useful check on the general results for at least two reasons. First, inasmuch as the omission of mention of earmarked money in the sources was random, these results will be representative of the entire (unobserved) earmarked subpopulation. Second, in this earmarked sample we are able to directly control for the quantity of money sent to ransom each earmarked individual. This information was only held by the Spanish, and it can be considered as an additively separable term in the ransoming team's private valuation of these captives.

In column 5, we limit the sample to earmarked captives. In this specification we control for the logarithm of earmarked funds. These results show that a 1% increase in earmarked funds led to a 0.44% increase in the ransom price, suggesting that the Algerians were unable to perfectly extract all of the earmarked money sent for a captive. In addition, in this subsample the coefficient on years in captivity rises in absolute value and remains statistically different from that on age when captured.

In sum, the results presented in this section have documented a robust negative correlation between time in captivity and ransom payments. Fur-

thermore, results using the earmarked subsample provide evidence that this negative correlation is not driven by unobserved valuations. In the following section, we develop an instrumental variable strategy to further investigate the relationship between time in captivity and ransom prices.

3 Did Delay reduce Ransom Payments?: IV Results

In the previous section, we have documented a robust negative correlation between time in captivity and ransom prices. There are reasons to suspect, however, that the OLS relationship between time in captivity and ransom prices may be biased. Perhaps the clearest source of potential bias stems from measurement error since time in captivity is at best a noisy proxy for negotiating delay. For example, many captives who were ransomed after a long delay were sent to regions where the ransoming teams did not travel and were only ransomed when they were sold to owners in Algiers (Friedman, 1983, p. 45). Inasmuch as this noise is random, our OLS estimates will be attenuated.

To address this possible bias, we use the distance of a captive's home from the cities in which the bargaining teams were based as an instrument for his time in captivity. Intuitively, this empirical strategy compares within a ransoming trip two types of captives: (i) those whose homes were in close proximity to the bargaining bases, and; (ii) those whose homes were further afield. As noted in section 1, there is evidence that the ransoming funds for the first type of captive arrived in Algiers sooner than those for the second type of captive. Our identifying assumption is that -conditional on covariates- the Algerians could not distinguish this distance-induced delay from strategic negotiating delay. In other words, we assume that the only reason that captives from further afield were ransomed for less was because they had been left in captivity for longer. The Algerians, in turn, interpreted this delay as a credible signal that the Spanish valued these captives less.

We faced two practical difficulties implementing this IV strategy. First,

note that our distance metric should only affect the delay with which earmarked captives are ransomed.¹⁴ Consequently, in the ideal world we would separate the sample by earmarked and non-earmarked captives. As noted above, unfortunately we are unable to identify all of the earmarked captives. However, since only earmarked captives will be “compliers” we expect the IV results in the entire sample to be similar to those in the complete (unobserved) earmarked subsample.

Second, the historical evidence suggests the distance from the bargaining bases affected the delay with which ransom funds reached in Algiers in two steps. In the first step, this distance increased the time it took news of a captive’s ransom to reach his home. In the second step, the distance increased the time it took to transport the ransom funds to the negotiating orders. We would have liked to exactly construct the delays induced by each step for each home town. Unfortunately, the information necessary to do this is not available. As a proxy for this quantity we use the natural logarithm of one plus the minimum great circle distance (i.e. the distance as the crow flies) of the captive’s home town to the bargaining bases. We prefer to use the logarithm of this distance in our baseline specifications since it ensures that captives from such far-flung locations as the Americas do not play a disproportionate role.¹⁵

In Figure 2 we present the relevant reduced form and first stage omitting all covariates and trip dummies. The upper graph provides the first stage and shows that there is a strong relationship between distance from the bargaining centers and time in captivity. The point estimate implies that a 10% increase in the distance of a captive’s home to the bargaining centers was associated with a 12 day increase in his time in captivity. The lower graph plots the reduced form which is also statistically significant. This point estimate implies that a 10% increase in the distance of a captive’s home to the bargaining centers was

¹⁴This is because non-earmarked captives were ransomed with general funds and thus the distance of their home to the bargaining bases did not affect the delay with which these general funds were available.

¹⁵In addition, it is useful to note that in two stage least squares “consistency of the second-stage estimates does not turn on getting the first-stage functional form right” (Angrist and Krueger, 2001, p. 80).

associated with a 0.3% decrease in his ransom price.

In column 1 of Table 2 we present the IV coefficient derived from these relationships. The point estimate in column 1 suggests that a year delay in a captive's ransom led to a 10% decrease in his ransom prices. Results in columns 2 and 3 show that this point estimate remains stable when trip dummies and the vector of covariates are added. Throughout Tables 2 and 3, we provide 95% confidence intervals for the IV coefficient in brackets beneath the relevant standard errors. These intervals are robust to both weak instruments and arbitrary correlations between ransomed captives within towns.¹⁶

The exclusion restriction implied by our instrumental variable regression is that, conditional on the controls included in the regression, the distance from a captive's home town to Algiers had no effect on prices aside from increasing the delay with which he was ransomed. One concern with this approach is that the ransoming missions systematically valued captives from further afield less than those from areas in closer proximity to the bargaining bases.

The earmarked subsample of allows us to investigate this possibility. In this subsample we directly observe the amount of money sent for each captive and thus can directly control for the bargaining team's valuation. The results from these regressions are presented in columns 4-6 of Table 3. Although the point estimates are slightly smaller and the standard errors larger than in the larger sample, these results are similar to those in the broader sample and weigh against interpretations stressing the importance of unobserved valuations in generating the results.

3.1 Robustness Checks

How robust are the IV results? Although the use of logged distance has advantages, a detailed inspection of Figure 2 raises concerns that the results may be driven by the bargaining cities. To address such concern, we both include an dummy equal to one if the captive's home was within 50 kilometers of the

¹⁶These confidence intervals are derived from the AR test statistic as described in Finlay and Magnusson (2009).

bargaining cities and drop these observations. The results are robust to this exercise and are presented in columns 1 and 2 of Table 3.

Were the Algerians unable to use the information regarding a captive's home to estimate that ransom funds would take longer to arrive in Algiers the further a captive's home was from the bargaining centers? Even if the Algerians perfectly observed the relevant distances, the uncertainty regarding which captive were earmarked meant that delays in the ransom of captives from further afield should have led to a decline in their prices, but one that was less than for captives whose homes were in closer proximity to the bargaining center. This is because the effect of distance on delay was asymmetric: it had no effect for captives who were to be ransomed with the general funds. In general, it is straightforward to show under plausible assumptions that the IV coefficients of interest will be biased upwards if the Algerians partially observed the relevant distances.

There are reasons to doubt, however, that the Algerians could have perfectly calculated the relevant distance metrics given the technological and informational limitations of the day. This would have required both a detailed knowledge of how the relevant information and funds traveled in early modern Spain. We argue that such information would have been excessively costly to gather.

We argue that given the technological and informational limitations of the day, it would not have been cost effective and may have even been impossible for the Algerians to construct the relevant distance metrics. The data are consistent with this hypothesis, in the sense that they show that the results do not qualitatively vary as we shrink the geographic region of analysis..

In columns 3-5 of Table 3 we further investigate the empirical relevance of our maintained exclusion restriction by progressively restricting the sample to smaller geographic areas. The idea behind this exercise is that as the geographic region becomes smaller, the assumption that the pirates did not observe the relevant distance become more plausible. In columns 3 and 4 we limit the sample to the mainland kingdom of Castile (which is highlighted in gray in figure 1) since this was the kingdom where the ransoming teams

were based. These results show that when the sample is limited to this kingdom both the point estimates and the standard errors increase although the coefficients of interest remain statistically significant.

The specification used in column 4 uses the untransformed distance to instrument for time in captivity. The first-stage coefficient shows that a 100 kilometer increase in the distance from the bargaining bases was associated with a 0.22 year or 80 day increase in time in captivity. The IV results are robust to this exercise.

Finally, in column 5 of Table 3 we limit the results to all locations within 50 kilometers of the southern coast of the Kingdom of Castile which are denoted by the black dots in Figure 1. The fact that the results in this more homogenous subsample of towns are qualitatively similar to those in the larger sample is reassuring.

4 Conclusion

Using a historical data set containing detailed information on thousands of captives ransomed from the Barbary Pirates, we documented a robust negative relationship between negotiating delays (as proxied by time in captivity) and ransom prices. This result is both consistent with qualitative evidence from contemporary bargaining instructions and with the predictions of all rational models of bargaining when the relevant private information is regarding the buyer's evaluation.

To address potential endogeneity concerns we developed an instrumental variable strategy rooted in the slow speed of travel in pre-industrial Spain. The family and friends of captives whose home towns were closer to the cities where the bargaining teams were based were likely to learn about an individual's captivity with less delay -and to remit the necessary ransom funds sooner- than those whose home towns were farther afield. A similar relationship held for individuals closer to ports commonly used to sail to Algiers. Thus, the funds to rescue a given individual were likely to reach Algiers more quickly the closer the individual's home was to these cities. We use the relevant

distances to construct an instrument for delay and find that a year's increase in captivity was associated with approximately a 10% decrease in a captive's ransom price.

While the Barbary Pirates have long ceased to roam the seas, the practice of ransoming captives continues today. The empirical results presented in this paper suggest that theoretical work on bargaining under asymmetric information can inform our understanding of such ransom negotiations.

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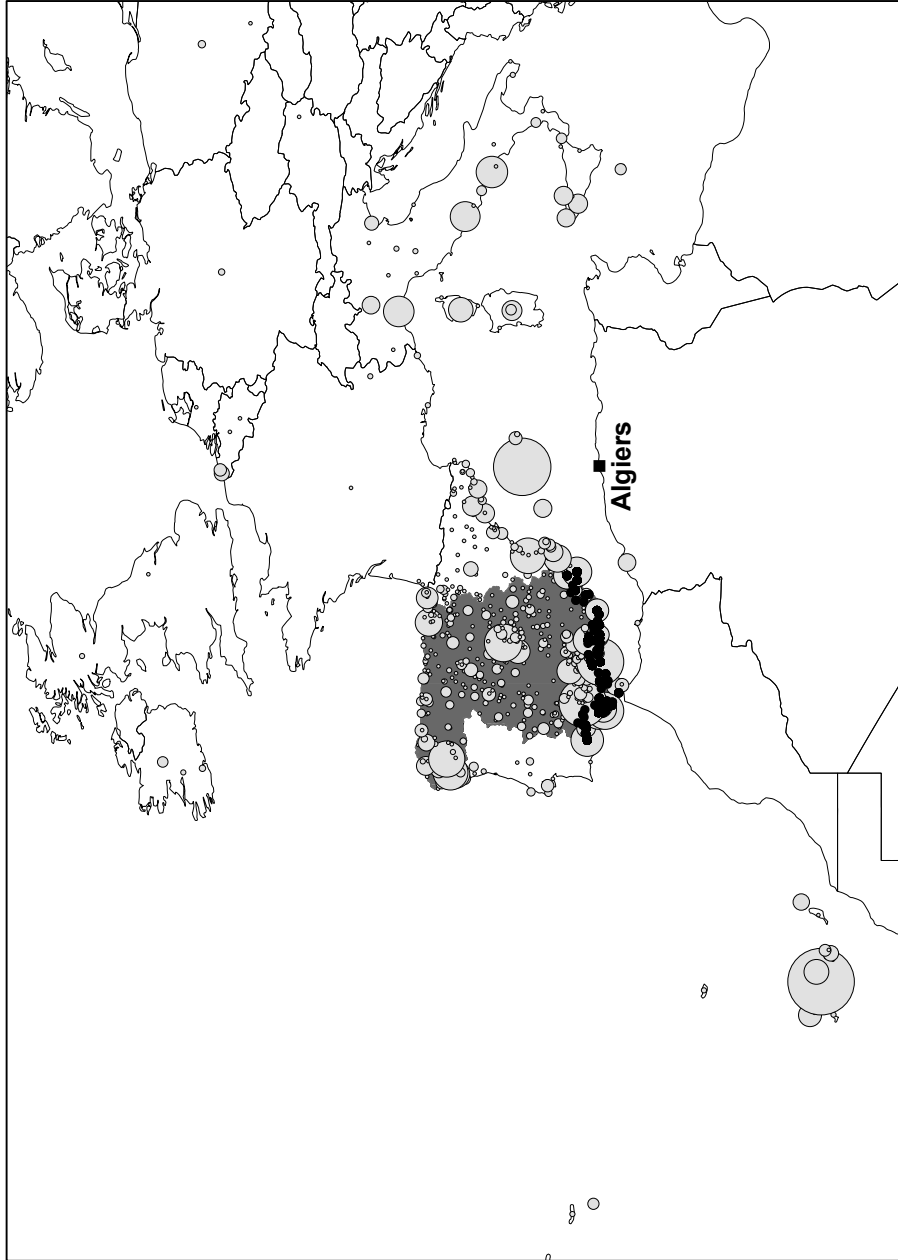


Figure 1: **Total Number of Non-American Captives Ransomed by City of Origin**

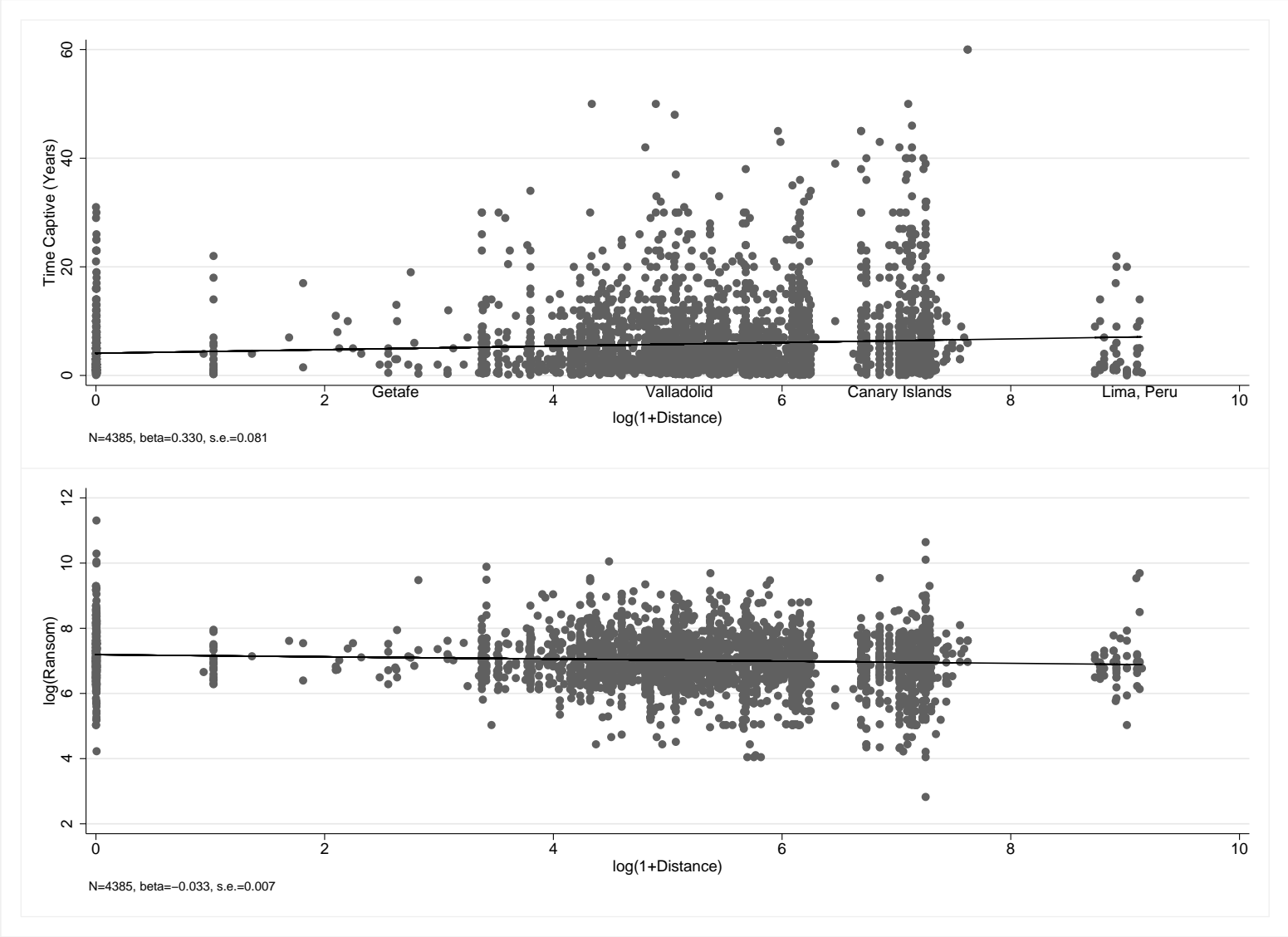


Figure 2: First Stage and Reduced-Form

Table 1: **The Correlates of Ransom Prices**

	Dependent Variable: 100*log(Ransom)				
	(1)	(2)	(3)	(4)	(5)
Years Captive	-1.54	-1.41	-1.56	-1.47	-2.26
	(0.21)	(0.21)	(0.21)	(0.20)	(0.64)
Earmarked		34.11	36.79	35.73	
		(2.97)	(3.10)	(2.84)	
log(Earmarked Funds)					44.13
					(3.07)
Age When Captured			-0.64	-0.64	-0.36
			(0.08)	(0.08)	(0.18)
Owned by Government			42.08	43.77	4.95
			(3.61)	(3.62)	(8.28)
Female			15.65	22.70	40.46
			(11.47)	(11.71)	(18.93)
Female*Age When Captured			-0.48	-0.49	-0.68
			(0.25)	(0.25)	(0.74)
N	4491	4491	4457	4457	928
Sample	All	All	All	All	Earmarked
Trip Dummies?	Yes	Yes	Yes	Yes	Yes
Profession Dummies?	No	No	No	Yes	Yes
p-value			[0.00]	[0.00]	[0.00]

Table 3: Robustness Checks for IV Regressions

	(1)	(2)	(3)	(4)	(5)
			Panel A: Two-Stage Least Squares		
Years Captive	-8.76 (2.91)	-7.32 (2.81)	-14.66 (4.87)	-13.74 (6.45)	-9.47 (4.48)
	[-16.94,-3.34]	[-14.56,-1.21]	[-32.19,-7.14]	[-39.02,-3.78]	[-27.02,-3.26]
Bargaining Base	3.73 (4.26)				
			Panel B: First-Stage for Years Captive		
log(1+Distance)	0.48 (0.13)	0.63 (0.19)	0.16 (0.05)		0.21 (0.11)
Bargaining Base	1.21 (0.62)				
Distance/100				0.22 (0.08)	
Sample	All	No B.B.	Mainland Castile	Mainland Castile	M. C., S. Coast
N	4356	3691	2536	2536	959