Lost in the Mail: A Field Experiment on Crime

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Abstract: For long-distance trade to efficiently take place, the costs of safely delivering goods must not exceed the benefits. Crime in the mail sector can then hamper the development of trade. We use a field experiment to detect crime in this sector and measure its differential impacts. We subtly, and realistically, manipulate the content and information available in mail sent to households and detect high levels of shirking and stealing. Eighteen percent of the mail never arrived at its destination, and even more was lost if there was a slight hint of something additional inside the envelope. Our study demonstrates the importance of transaction costs created by crime and that not everyone in the population is equally affected. Crime is strategic and depends on the expectations of being caught.

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1 Introduction

According to the World Bank (2009), transportation now takes up a larger share in production costs than tariffs. In Latin America, it is estimated that costs would decline by 20% if countries were to match U.S. levels of efficiency. To put this in perspective, a doubling of transportation costs implies a one-half percentage point decline in GDP growth (Radelet and Sachs, 1998). Differences in these costs across countries not only reflect a lack of infrastructure but also the presence of opportunistic behavior and weaknesses in norms and the rule of law. For instance, Micco and Perez (2002) find that an important determinant of the efficiency in ports is the prevalence of crime. The added costs of crime can have large long-term consequences and are important to how well the public and private sectors function (World Development Forum, 2010). This paper looks at a particular sector, mail delivery, and shows the presence of significant opportunistic behavior. In addition, it shows that the negative consequences of such behavior are large and unequally distributed in the population.

An important condition for markets to develop and thrive is to have an efficient system for transporting goods and services. Without this, transaction costs may be too high to support some markets and only consumers with sufficient income and resources may be able to participate. To expand the breadth and depth of commerce, including electronic trade, a well-functioning, low-cost mail delivery system is needed. Inefficiency and crime in the system can hinder economies from developing, as well as prospering.

In many developing countries, corrupt behavior in the provision of public services is not only widespread but can create important inefficiencies and inequities (Bertrand, Djankov, Hanna, Mullainathan, 2007; Fisman and Wang, 2010; Fisman and Wei, 2004; Hunt and Laszlo, 2008; Reinikka and Svensson, 2005). Public services may be privatized sometimes, yet it is not clear if corrupt behavior is lower in such an environment. We show that private firms face the same moral hazard problems that a public firm would, as well as significant levels of corrupt and strategic behavior.

Theory and casual observation would suggest that people may be affected differentially

by crime and that crime may be strategic (Becker 1968). Therefore, neither the participation in illegal activities nor the diseconomies caused by criminal activities are expected to be uniformly distributed across the population. Indeed, there is evidence that the social and private benefits and costs associated with committing a crime are important to determine its incidence.[1] Deterrence, the risk of being caught, and social norms all seem to be important factors in deciding whether to commit a crime or not.

We use a unique field experiment that allows us to develop a behavioral measure of crime. Our design has the advantage that it allows us to *directly* measure crime and its differential impacts. Specifically, the design identifies whether crime has occurred or not, which segments of the population are more likely to suffer from crime, and whether this conforms with economic rationality broadly understood. Our study concentrates on the delivery of mail, and we do so for several reasons. First, the existence of a reliable mail sector is considered to be instrumental in the growth of electronic trade (World Bank, 2009). Second, mail services are widely used by all segments of the population, both rich and poor. Third, as we will describe, mail delivery is amenable to field experimentation with little or no intrusion. This is important since the study of crime is likely to be constrained by ethical considerations and measurement problems. Fourth, mail delivery is a highly decentralized activity likely to suffer from moral hazard problems regardless of firm ownership. For instance, sources of lost non-certified mail are nearly impossible to detect. Fifth, in our study environment, mail service, which is normally provided by a public firm, is done by a private entity. Finally, crime in the mail sector is expected to be highly correlated with the expected gains and losses of committing a crime and much less with social pathologies. That is, it is a crime of opportunity that can give us a window into understanding the economic motivation behind crime.

Our empirical strategy is novel and simple, and it allows us to measure the probability that a piece of mail arrives at its destination. We send identical envelopes to different

[1] For examples of empirical and experimental work, see See Erlich (1973), Levitt (1997), Duggan and Levitt (2002), Glaeser, Sacerdote and Scheinkman (1996), Jacob and Lefgren (2003), Di Tella and Schargrodsky (2003, 2004), Olken (2007), Fisman and Miguel (2007), Reinikka and Svensson (2004) and Armantier and Boly (2008), Hsieh and Moretti (2006), Olken and Barron (2009), among others.

households in Lima, Peru from two American cities and record arrivals. Peru is an interesting case study because it is representative of middle-level developing countries struggling to create market-based institutions and integrate with the global economy. The experiment includes a large population of volunteer households across neighborhoods of different socio-economic backgrounds. To better understand the motivation behind the commission of crime, we manipulated the contents and the sender of the mail. In particular, every household was sent four envelopes over the course of a year. Two envelopes had a sender with a foreign name and two had the last name of the sender and recipient matched (to indicate the letter came from a family member). Finally, one of each of the two envelopes contained something inside the enclosed card (a small amount of money) that could not be easily detected without careful attention.[2] The other envelope just contained the enclosed card. All these modifications were as subtle as possible, and the order in which each different envelope was sent was random.

By manipulating the information made available to the person handling the mail, our design allows us to test several hypothesis behind the commission of crime. First, mail can be lost because the cost of delivery is larger than the cost of being caught shirking. Lost mail might be a reflection of apathy rather than crime. Therefore, comparing rates of lost mail containing money with those containing no money permits us to detect if crime, rather than apathy, is taking place. Second, if those handling mail behave strategically, one would expect that they will make use of information on the socio-economic characteristics of the recipient and the social distance between the recipient and the sender. Therefore, comparing similar pieces of mail across subgroups can potentially reveal the expectations of those handling the mail. For instance, if a letter from a family member is more likely to contain something of value (i.e. money), then letters from family members would be lost at a higher rate.

The experiments show that the mail service in Peru is highly inefficient. The overall rate of mail lost is 18%.[3] The loss rate, however, hides the fact that mail containing money

[2]Sending money through the Peruvian postal service and the U.S. Postal Service is not illegal, although it is not advised.

[3]Compared to the less than 0.5% of mail reported lost in the U.S. or the U.K., this is very large. Note that loss rates in the U.S. and the U.K. are for *reported* mail lost. This will underestimate the problem if not all lost mail is reported. Our experimental measure is for all mail lost that should have arrived at a destination.

is lost 21% of the time while mail containing no money is lost 15% of the time. That is, we find evidence of shirking as well as crime. Also, crime is targeted primarily at letters coming from family members, and the quality of service is not independent of socio-economic status. Mail is lost at the same rate (roughly 18%), whether it contains money or not, when sent to a poor neighborhood. When sent to a more affluent neighborhood, however, mail without money is lost only 10% of the time and mail with money is lost 17% of the time. Households in middle income neighborhoods have the highest loss rates. This suggests two things. Crime is strategic, and not happening randomly, and loss is occurring within Peru rather than the U.S. We run several robustness checks and confirm that our main results still hold.

Our approach has several advantages. By randomly assigning treatments to different populations, it provides the necessary counterfactuals to test the presence of strategic behavior. It also avoids any potential demand effect by utilising an existing service that likely suffers from moral hazard problems. By using a widely used service and carefully selecting the sample, our study overcomes the criticisms of lack of external validity. Our behavioral measure of crime avoids common measurement problems and underreporting. Finally, we provide evidence suggesting that the observed patterns of behavior cannot be attributed to response biases. The results hold under several models of recipient misreporting.

Our research makes several important contributions. First, it shows that there still remains high barriers to expand commerce that relies on the mail sector to transport goods and services. Second, it speaks to the problems that developing countries face when trying to solve inefficiencies through privatization of public services. Private firms suffer the same asymmetric information that state-owned enterprises do. Our paper also suggests that monitoring of behavior might be costly since individuals seem to adjust to subtle changes in the environment. Third, our research presents new evidence that crime is not shared equally. The middle class is taxed more heavily. Finally, we show that crime is strategic and depends on expectations and the probability of being caught.

The paper is organized as follows. The next section presents a model of crime. Section 3 presents a description of the Peruvian postal system. Section 4 presents the experimental design and Section 5 the results. In Section 6, we run robustness checks on our results, and

in Section 7, we check that our results are not due to response bias. Section 8 concludes.

2 A Model of Crime

Our experiment allows us to look at crime in equilibrium. By varying the content and information available on each piece of mail, we can better understand the strategy of crime and who is affected the most by it. Below we present a model of crime. The aim is to help clarify our hypotheses on how the experimental manipulations will affect mail loss.

We start from the premise that the incidence of crime in equilibrium is a function of the probability of being caught stealing and the probability that the victim has something of value to steal.[4] In the context of the mail sector, this implies that mail loss will be a function of the probability that the postal worker will be fired or punished if caught stealing mail and the probability, or the expectation, that the sender of a piece of mail includes something of value.

We assume that individuals choose the mail they send from a set of possible types of mail, $x \in \{1, 2, ..., K\}$. x represents the physical characteristics of the mail, i.e. the thickness of the envelope or whether the mail is a letter, greeting card, manila envelope or package. Individuals also have to decide whether to place something of value inside the mail. This is represented by a binary variable d that takes the value of 1 if something of value is in the mail and 0 otherwise. To model the expectation that there is something of value (or the risk to the sender of mailing something of value), we assume there is a signal θ associated with each piece of mail. The mailman observes θ. For instance, mail with valuables might require more packaging or might have some irregularities that are observable to a careful handler. Signal θ is distributed according to a continuous density function $f(\theta|x, d)$ over interval $[0, 1]$.

[4]Becker (1968) and Erlich (1973) present detailed models of decision making by individuals considering committing a crime. In the context of their models, the interaction between a mailman and a customer can be thought of as a zero-sum game. If a person sends valuables with probability one and there is moral hazard, mail will be certainly stolen. If the mailman never steals, a customer might feel safe sending valuables in the mail. In equilibrium, one would expect that those customers that have a larger marginal benefit of using the mail to send valuables will face a larger average level of crime. The model in this section borrows heavily from Anwar and Fang's (2006) model of discrimination.

To address the fact that pieces of mail containing valuables might be more likely to be found out, we assume that the ratio of $f(\theta|x,1)$ to $f(\theta|x,0)$ is increasing in θ. Since enough inspection might uncover whether a piece of mail has something of value or not, we assume that $lim_{\theta\to 1}\frac{f(\theta|x,1)}{f(\theta|x,0)} = \infty$ and $lim_{\theta\to 0}\frac{f(\theta|x,1)}{f(\theta|x,0)} = 0$. Finally, we denote by z the social (non-physical) characteristics associated with the mail. For instance, z might be the neighborhood of the recipient, where the mail was sent from or the relationship between the sender and recipient. A person with social characteristic z sends a piece of mail with characteristic x and something of value with probability π_{zx} and without valuables with probability $1-\pi_{zx}$. Note that the same distribution of signals will be interpreted differently depending on π_{zx}. In other words, the same evidence might be taken more seriously in a population where π_{zx} is higher.

The mailman decides whether to steal (search and destroy) or deliver the piece of mail. The expected return of stealing a piece of mail is

$$P(x,z)\Pr(d=1|x,z,\theta) - q(x,z)t \tag{1}$$

$P(x,z)$ represents the expected value of the content of the mail of type x with characteristic z. $q(x,z)$ represents the likelihood that the mailman is caught stealing. This might happen because the post office monitors more closely mail of type x with characteristic z or because those with characteristic z are more likely to follow up on the mail sent. The punishment a mailman faces when caught stealing or found to be at fault is $t > 0$.

We can use Bayes' rule to determine that the probability that a piece of mail contains something of value when signal θ is observed is: $\Pr(d=1|x,z,\theta) = \frac{f(\theta|x,1)\pi_{zx}}{f(\theta|x,1)\pi_{zx}+f(\theta|x,0)(1-\pi_{zx})}$. The expected return to delivering the mail is normalized to 0. Given the assumptions, we have that there is a unique value $\widehat{\theta}(x,z)$ such that the expected payoff of committing a crime (equation (1)) equals the payoffs of delivering the mail, or $P(x,z)\Pr(d=1|x,z,\widehat{\theta}(x,z)) - q(x,z)t = 0$. Since $\Pr(d=1|x,z,\theta)$ is increasing in θ, we have that a risk neutral mailman will steal the mail if he observes a signal θ such that $\theta \geq \widehat{\theta}(x,z)$.

Figure 1 shows the potential effect of a change in x on the behavior of the mailman.[5] If a change in x affects only the distribution of signals, we would expect that the conditional probability that a piece of mail contains something of value will shift for all values of θ. This can be seen in the figure where $\Pr(d = 1|\theta, x, z)$ shifts up as x changes to x'. All things constant, this change in expectations will affect the critical value $\widehat{\theta}(x, z)$ and, therefore, the probability of search (i.e. the likelihood a mailman tampers with the mail). In the figure, the critical value changes from that associated with point A to that associated with point B, and the probability of search increases.

However, it is possible that a particular piece of mail of type x is monitored more closely as well (e.g. certified mail) and so also affects $q(x, z)$. In this case, it is possible that enhanced incentives to commit a crime are completely offset by a change in the probability of being caught committing the crime (e.g. moving from point A to B to C). For instance, a piece of mail sent by a family member is more likely to contain something of value (a shift out of $\Pr(d = 1|\theta, x, z)$), but it is also more likely to be monitored (an increase in $q(x, z)$). Our experimental design includes some changes in x that are unlikely to affect $q(x, z)$ (e.g. slightly increasing the thickness of the mail by placing money inside).

Increases in π_{zx} will also shift the curve $\Pr(d = 1|x, z, \theta)$ upwards. Changes in π_{zx} might reflect the options available to those with characteristics z. Those who have safer ways to send valuables will be less likely to send them through the mail. For example, wealthier households can afford to send items through costlier, yet more secure, services.

This model is partial in the sense that we assume that π_{zx} and $q(z, x)$ are determined exogenously. While the model can be modified to make these variables part of an equilibrium, our experimental design does not require for them to be exogenous. Some of the treatments are subtle enough so as to consider the effect to be minimal. Finally, without explicitly modeling $q(x, z)$, we cannot determine if areas with higher levels of monitoring are also areas where more crime is detected. For instance, a monopolist firm might find it profitable

[5]The figure graphs the two components of equation (1): the probability that a piece of mail contains something of value and the probability of being caught stealing divided by the expected value of the piece of mail.

to secure better services in some areas by increasing the cost of committing a crime.

In our experiment, we manipulate information that we expect to affect the benefits and costs of search, as we have outlined in the model above. For example, by making the envelope slightly thicker with something inserted inside (changing x), we expect mail loss to increase as postal workers think the envelope signals something of value. Similarly, by decreasing the social distance between the sender and the recipient, such as having the sender be a family member (changing z), we expect mail loss to increase. By sending mail to different neighborhoods, we can see if mail loss decreases in wealthier neighborhoods, relative to poorer neighborhoods, because we would expect that the rich are more likely to complain if mail does not arrive (probability of being caught rises). The effects, however, may be nonlinear. While we expect service to be better as neighborhood income rises, this will interact with the expectation that recipients will receive something of value. People who live in wealthier neighborhoods may be more likely to receive something of value, but they may also be more likely to pay a higher price for more secure services (and potentially avoid the post office all together). Recipients in poor neighborhoods may not be expected to receive anything of value, so mailmen may not bother to look carefully.[6]

In sum, our hypotheses are as follows: (1) we expect mail loss to increase as the probability of being caught stealing declines and the probability of valuables increases; (2) the relationship across neighborhoods may be nonlinear because the probability that something of value is being sent will depend on the recipient's likelihood of receiving something of value, the likelihood that the recipient has alternative means for receiving valuables and the probability of being caught.

3 Mail in Peru

To better understand how and where crime may be happening when mail is sent from the U.S. to Peru, in this section, we describe the Peruvian postal system and how mail is delivered.

[6] A model of crime has enough degrees of freedom as to make it difficult to determine *a priori* the effect of income on public services crime. Our experiments provide data that might allow us to determine regularities, but not necessarily prove or disprove a theory.

The postal system in Peru is a private concession of the Peruvian government and was privatized in 1991 (Legislative Decree 685, 1991). The company does not have exclusive rights to deliver letters, as is the case in the U.S., but practically speaking, they are the only provider of low-cost, non-package mail service in Peru. Indeed, they are bound by law to provide service to isolated areas of the country. There are alternative means for sending mail, including certified services offered by the post office, but they are very expensive, costing about 100-200% more, depending on the destination. Mail tracking services are ten times more expensive than regular mail and the cost (in dollars) is higher than the cost of a similar service in the US.

Mail sent from overseas arrives in Peru at a central processing facility located in the capital city Lima. The facility sorts all mail, domestic and international, and sends it to large district or regional administration offices in Lima or other regions in Peru for further sorting and delivery. There are also small post office branches where further sorting of mail may occur. There are nine administration offices in Lima and Callao with an average of 72 employees per office, and there are 39 branches with an average of 2.5 employees per branch. The administration offices employ mail workers, mail carriers, and management. The post office branches employ workers and carriers.

Mail carriers are paid a fixed salary that is about two thirds above the minimum wage, and many have steady employment. However, about one fourth of the work force is not permanently employed. According to the firm's annual reports, several of the main distribution offices in Lima have installed cameras to monitor the handling of mail, suggesting that mail is likely not lost in the distribution offices.[7]

Table 1 shows the structure of the labor force in the mail sector in Lima and Callao in 2005 according to the company's publicly available data.[8] The data is disaggregated by job category and neighborhood income.[9] The table shows that the distribution of people

[7]See http://www.serpost.com.pe/transparencia/DocumentacionTransparencia/Docs 2009/Informacion Adicional/MemoriaAnual/MemoriaAnual2009.pdf

[8]See http://www.serpost.com.pe/transparencia/Documentacion Transparencia/Docs 2005/Informacion Adicional/Memoria Anual/MemoriaAnual2005.pdf

[9]We define low-income neighborhoods as ones where the percent of the population considered poor is 30% or higher. Middle-income neighborhoods are those where the percentage is between 10-30%, and high-income

across tasks is remarkably similar across neighborhoods. Around half of the work force deals with the delivery of mail, a quarter with mail in post offices and another quarter in administrative tasks. However, we find that wages and years on the job are different across neighborhoods. For instance, postmen and messengers earn less in middle-income neighborhoods. This difference is significant when we compare high-income neighborhoods to middle income neighborhoods (t-test p-value = 0.0183). This difference amounts to a 5 percent reduction in earnings across these two neighborhoods. Also, the earnings of postal employees is slightly lower in low-income neighborhoods relative to other neighborhoods (t-test p-value = 0.0489). This difference is about 1 percent. Finally, the number of years on the job of postmen and messengers in richer neighborhoods is significantly larger than those in other neighborhoods (t-test p-value = 0.0129). Postmen and messengers in richer neighborhoods have tenures that are 25 percent longer than those in other neighborhoods. This is consistent with the presence of efficiency wages in richer neighborhoods as a way to enforce higher quality in delivery in these areas, but it is also consistent with the firm not paying enough to retain its work force in more difficult areas. In either case, the data suggests that the firm discriminates across neighborhoods.

There is anecdotal evidence that mail loss does occur. Casual observation of ten post offices in Lima revealed that service is slow and cumbersome and that mailing a letter or package requires interaction with unresponsive tellers. Customers willing to send mail of intrinsic value went through great lengths to secure the mail, repeatedly taping the mail closed after postage had been attached. Conversations between customers standing in line tended to be about the reliability and risks of the mail arriving at its destination. An attendant in a small branch post office revealed to us that, in that particular office, mail from abroad almost never arrived or, if it did, it would arrive tampered with.

Readers writing to the newspaper El Comercio (June 06, 2007, June 23 and July 07, 2007) expressed their frustration for not receiving magazines and/or letters from family

neighborhoods are those where the percentage is less than 10%. The proportion of people living in poverty is from the closest available poverty map to the time of the experiment (2006) calculated by the Peruvian Ministry of Economy and Finance using expenditure surveys from the Peruvian Institute of Statistics.

members. The newspaper reported that many additional letters of similar tenor are received. Indeed, commenting on a letter sent by a reader, the newspaper noted that many informal magazine vendors offer magazines that show "strange addresses." Since there is a market for used magazines, there is no way to verify if these magazines are stolen or not. Similar comments are reproduced in ForosPeru.net, a Peruvian blogging site. Interestingly, comments are not always negative. Some people state that they have never experienced problems while others do. This suggests that problems might not be generalized and therefore unlikely to occur in the central office.

Finally, in terms of discipline, according to the company's 2005 annual report, twenty-five employees were fired due to major offenses.[10] Another twenty-three were separated for arbitrary reasons while twenty either retired voluntary or ended their trial period at the company.

4 Experimental Design

We send envelopes from the United States to Peru through normal mail services in both countries (U.S. Postal Service and the Peruvian postal service, respectively). We use a list of residential addresses in metropolitan Lima, Peru that are geographically representative of poor, middle, and high income neighborhoods. A resident of each address is the recipient of the envelope and reports to us if the envelope arrives or not.

The 2 x 2 design we employ varies the contents of the envelope and the sender's name. The contents of the envelope is a card and either two $1 bills folded in half or no money. The sender's name is either a foreign name (i.e. J. Tucker, M. Scott) or the same family name as the recipient (i.e. M. Sosa, L. Cordova).[11] Varying the sender's name allows us to test if names signal that something of value is in the envelope (i.e. money). The design is outlined in Table 2 and includes the number of envelopes sent in each treatment.[12]

[10] Report citation is listed in footnote 8.

[11] In South America, including Peru, everyone has two last names. The first is the last name from the father and the second is the last name of the mother. We use the first last name.

[12] There are not an equal number of observations in each cell for two reasons. First, some households moved before the experiment was complete, so they did not receive all four treatments. Second, thirteen households

To get a valid estimate of crime, it is important that the envelope look realistic and like something that would normally be sent in the mail. So, we chose an opaque solid-colored envelope and card (of the same color). The envelope looks like one that would be sent for a birthday or other special occasion. Keeping with that idea, on the inside of each card, we handwrite "Happy Birthday" or "Feliz Cumpleaños" – depending on the return addressee's name – and sign Josh or Mike or Marco or Luis. We do this because if the card is stolen or opened, we want it to appear, to the postal worker, like it was actually sent by the person whose name appears on the front of the card. Figure 2 gives examples of two of the envelopes that were sent to the same address in the course of the study. To preserve confidentiality, we have blackened out the addresses of the sender and recipient and the recipient's first name. The first envelope gives an example of mail sent by a foreigner to a recipient and the second envelope gives an example of mail from a family member to a recipient. As can be seen in the Figure, the treatment manipulation of family member is subtle.

Because the envelope is opaque, the greeting inside the card cannot be seen. If the card contains money, this also cannot be seen, even if held up to the light. One can feel that there is something in the envelope because the folded two $1 bills make a very slight bump. However, it is impossible to determine what exactly is in the envelope without opening it.[13] But, there is a hint that the envelope contains something other than the card. We chose this subtle manipulation so that anyone looking for something to steal would need to pay careful attention for signs that the envelope contained something that might be worth stealing.

All envelopes have handwritten addresses, stamps for postage and an airmail stamp on the front of the envelope. There are two return addresses in Atlanta and two in Washington, DC. All addresses are real so that we could monitor if the card was returned to the U.S. for any reason. The envelopes are glued shut, making it difficult to steam open, reseal and deliver. Envelopes are always mailed from one of two locations. Envelopes with a return address from Atlanta were mailed from the main post office in downtown Atlanta, and

received four letters, two with money and two without, but the sender's last name was not equally divided between family and foreign.

[13]We could very well have placed folded pieces of paper in the envelope instead of money, but we want the envelopes and contents to be realistic, especially in case the envelope is lost or stolen.

envelopes with a return address of Washington DC were mailed from a post office mailbox in Washington DC. The color of the envelope, the return address and the handwriting on the envelope are randomized across the four treatments.[14] Envelopes were sent during the period November 2006 - November 2007.

Mailboxes in Peru are secure and not exposed to theft from people passing by on the street. Typically mail is placed in a locked mail box inside a locked gate or entryway. Or, it is placed under the door of the locked residence. Mail is not left in post boxes on the streets, as is the case in the U.S.

To find recipient addresses, we tapped into two networks of people who engage in research to recruit volunteers willing to receive the cards and report to us. These people are trained in data analysis and data collection and are aware of the importance of honest reporting. In section 7, we describe steps taken to insure data quality. The two networks include people from a variety of demographic and income groups. The important design element for us was that the addresses where the mail was sent were geographically diverse. So, even though the mail recipients might know one another, the addresses are disperse across locations. To minimize the number of addresses in the study for any given post office, no more than four households were within a 1-kilometer radius of each other (i.e. 0.62 miles or the equivalent of ten blocks). We mapped all the recipient addresses on a GIS updated street map of Metropolitan Lima to minimize agglomeration and also to verify that the addresses were correct and active. This ensures that non-arrival of mail is not due to an incorrect address.

Recipients of the mail reported the arrival or non-arrival of each envelope and kept any money if an envelope with money arrived. This removed any incentive to misreport to the contents. They were instructed to not ask the mailman about the card or go to the post office to inquire. After the envelope was put in the mail in the U.S., we sent an e-mail to the recipients telling them that an envelope was sent. They were instructed to inform us when the mail arrived, who it was from, the color, and the contents. They were not told ahead of

[14]We did this to insure that each envelope sent to a household by a different person was indeed handwritten by a different person.

time the characteristics of the envelope or if the envelope contained money. This was done to ensure no a priori bias in reporting and to allow us to check that reporting was accurate. In addition to collecting information on whether envelopes were received or not using several methods, we also asked for replies by email. This provided a simple way for us to check the responsiveness of the recipients. We use these data later in Section 7 to evaluate potential non-response biases. We also had ten supervisors who contact various recipients to check that the envelopes were received or not.

To compensate recipients for their time and help, at the end of the experiment, we conducted a lottery with cash prizes for recipients who reported. Recipients knew of the lottery before we began sending envelopes. To verify mail receipt responses, in December 2007, we conducted a follow-up survey and collected more individual data on mail recipients. This also allowed us to verify for a second time that addresses were correct. All addresses were verified, and all previous responses were confirmed. This gives us confidence that our data are accurate.[15]

5 Results

In this section, we explore the patterns of mail loss geographically, across various demographic characteristics and across our treatments. First, we turn to a description of the sample, then main findings, and finally evidence of strategic crime.

5.1 Sample Characteristics

Table 3 shows descriptive statistics on the individual and geographical characteristics of the mail recipients. The sample is split roughly half and half between male and female recipients. The distribution of residents across low, middle and high-income neighborhoods is not evenly distributed, with more people living in middle-income neighborhoods.[16] Most recipients have

[15] We asked the recipient if they received an envelope during a certain period of time and asked the recipient to report the return address and color of the envelope. Recipients were able to correctly confirm reports from 4-5 months earlier.

[16] See footnote 8 for definitions of neighborhood income. We show later that our results are robust to other definitions of economic status.

a university education, are married or living with their partner and have a family member that lives in the United States.[17] This latter result is important as it makes receipt of a card from the United States not seem strange and also attests to the degree of mail that could potentially come from the United States. Recipients have lived in their current residence for an average of 16.5 years, and the nearest post office is three minutes away.

An important component of our experimental design, in addition to a diverse and representative distribution of individual mail recipient characteristics, is that the distribution of recipient addresses is geographically disperse across neighborhoods and post offices and is representative of metropolitan Lima. Figure 3 shows the geographical distribution of residents in our study. The residents cover the majority of the city. There are fewer residents in some of the peri-urban areas of the city, but the addresses are nicely distributed across neighborhoods. This gives us observations across most areas of Lima and confidence that our results apply to the larger, city-wide mail sector.

5.2 Main Findings

Turning to loss rates, we see that mail service in Lima is inefficient and subject to crime. Table 4 shows loss rates overall and by experimental treatments. Overall, 18% of all envelopes sent through the mail never arrived at their destination.[18] Envelopes with money were less likely to arrive than envelopes without money, so it does not appear that mail loss is solely due to bad service. This confirms our first hypothesis and hints more of criminal activity. Over 21% of envelopes with money did not arrive, whereas 14.8% of envelopes without money did not arrive. This 50% increase in loss is statistically significant (t-test p-value=0.047).

How was mail lost across our four treatments? The bottom panel of Table 4 shows loss rates by the contents of the envelope and the sender's last name. Again, envelopes with money were more likely to be lost than those without money, whether or not the sender's last

[17]This is a reflection of our sample procedure, while recipients resided across many neighborhoods, they all were contacted through research institutions.

[18]For the mail that arrived, the average arrival time of a piece of mail was 7.2 days (4.2 s.d.). In high income neighborhoods, the arrival time is 7.2 days (4.3 s.d.). In middle income neighborhoods, it is 7.3 days (4.6 s.d.) and 6.9 days (3.7 s.d.) in poorer income neighborhoods. The differences across neighborhoods in arrival times are not significantly different.

name was foreign or a family name. The difference between money and no money envelopes for envelopes with a foreign sender is not significantly larger, but the almost 10 percentage point difference for envelopes with a family last name is (t-test p-value=0.047). Indeed, most loss happened for envelopes with money sent by a family member. Almost one in four of those envelopes never arrived.

Across low, middle and high-income neighborhoods, mail is lost at different rates. Table 5 shows residents in middle-income neighborhoods lose mail at the highest rate, 20.4%, and those in high-income neighborhoods lose mail at the lowest rate, 13.5%. The loss rate in middle-income income neighborhoods is significantly larger than in high-income neighborhoods.[19]

One might wonder if mail loss can be attributed to the Peruvian mail service or to the U.S. Postal Service. The results in Table 5 suggest that loss is happening on the Peruvian side. While it may be reasonable to think that envelopes with money might be lost on the U.S. side, it is highly unlikely that the significantly different loss rates we see across middle and high-income neighborhoods is due to the U.S. Postal Service. Such loss rates cannot exist without knowledge of neighborhoods in Lima. The next section provides further evidence of this.

Looking at the content of the envelopes, mail with money is significantly more likely to be lost than without money in middle-income neighborhoods. In middle-income neighborhoods the loss rate of envelopes with money is over 10 percentage points larger than for envelopes without money (t-test p-value=0.057). The loss rate in poor neighborhoods is around 18% and is similar for envelopes with and without money. High-income neighborhoods have an almost 7 percentage point increase for envelopes with money, but this is not significantly different (t-test p-value=0.232).

This pattern of loss confirms our second hypothesis and is consistent with an expectation that the poor are not receiving valuables by mail, so loss rates are no different with and without money. There is no search for valuables, rather the loss rates in poor neighborhoods

[19]t-tests yield p-values of 0.696 comparing low to middle-income loss rates, 0.080 comparing middle to high-income, and 0.189 comparing low to high-income loss rates

seem to be more a reflection of bad service than crime. Loss rates in middle-income and high-income neighborhoods, however, are consistent with the expectation that these populations have valuable items to receive through the mail. Search is relatively larger in middle-income neighborhoods, and this may reflect an expectation that people in middle-income neighborhoods have few alternatives for receiving and sending mail.

The last two rows in Table 5 show that the pattern of loss across neighborhoods is primarily driven by envelopes where the sender and recipient share the same last name. Mail from a family member appears to be given special attention since loss rates vary across neighborhoods. This result is important, and consistent with our first hypothesis, because it suggests that those handling the mail attribute a similar probability of being caught across neighborhoods when disposing of mail sent by non-family members. It is also consistent with the expectation that mail from non-family members is unlikely to contain anything of value.

5.3 Evidence of Strategic Crime

The main findings in the previous section show that mail with money is lost more frequently and that crime is not distributed equally across the population. The mechanism for loss seems to be that envelopes coming from family members are scrutinized more closely than those from a foreigner. In this section, we look more closely at the patterns of loss and why they might exist.

Table 6 shows the joint effect of income and money on crime. The numbers in the table also allow us to calculate a difference-in-difference estimate of the effect of income on crime using our treatments variables. The presence of money in envelopes sent by a family member increases the rate of mail lost by 16.1 percentage points (30.9% - 14.8%) in middle-income neighborhoods and decreases it by 1.4 percentage points (18.2% - 19.6%) in poor neighborhoods. In other words, mail is 17.5 percentage points less likely to arrive when sent to middle-income neighborhoods when there is suspicion of valuable content. A comparison of the richer neighborhoods and poorer neighborhoods gives a similar estimate (15.0). This increase in the likelihood of loss from poor to middle and poor to rich neighborhoods could be due to expectations that something of value might be sent in the mail or the perceived

smaller risk of being caught.

In order to test whether the differential impact of crime across income groups is explained by differences in the quality of service and not expectations, we compare loss rates across types of envelopes in Table 7. This analysis is based on the assumption that quality of service by neighborhood affects loss rates uniformly conditional of who sends the mail. The results show that both expectations that the envelope contains something of value (money, no money) and the probability of being caught (which varies by the socioeconomic level of the neighborhood) explain loss rates. The table presents results from a fixed-effects Logit regression of loss on whether the envelope contained money, it was sent by a family member and interactions with neighborhood income (percent classified as poor). The dependent variable equals 1 if the mail did not arrive at its destination and 0 otherwise.[20]

It is important to note that the analysis controls for recipient fixed effects and our main results still hold. That is, our results are not due to idiosyncracies of our small sample.[21] The first column illustrates this. Envelopes with money are more likely to be lost. The second and third columns show results for the subsamples of mail sent by a family member and by a foreigner. By looking only at envelopes from family members or from foreigners, we attempt to keep constant the expected cost of committing a crime, so that we can focus on expectations that the envelope contains something of value.[22] We see that the effect of money for envelopes coming from family members, controlling for recipient fixed effects, is stronger as neighborhoods become wealthier. There is no significant effect of envelopes coming from foreigners. This confirms the results in Table 6 and suggests that expectations matter. This is so because we expect not only that both the rich and the poor care about receiving mail but that the cost of being caught stealing should not decrease with the wealth

[20]The same results hold with a fixed-effects linear probability model.

[21]This also implies that our results are not due to idiosyncracies in recipient reporting or postal carriers.

[22]This is a difference-in-difference estimate on the net benefit (expectation of something of value less the expected cost of being caught) of an envelope with and without money across neighborhoods. Or, rewritten, this is the net expectation of encountering something of value less the net cost of being caught taking something of value (as in equation (1) in Section 2). By splitting the sample into envelopes from family members and from foreigners, we can control for the net cost of being caught across neighborhoods. We expect this to be constant, since otherwise this would say that the rich care less about receiving mail with money. So, any significant effect on money or money interacted with neighborhood will be due to expectations.

of the neighborhood. The fact that envelopes with money are lost at a higher rate as neighborhood income goes up says there is an expectation that mail from family members contains something of value when sent to wealthier neighborhoods.

The results in the fourth and fifth columns of Table 7 of the regressions on money and no-money envelopes are also indicative of incentives. The previous regression on family envelopes suggests that family envelopes sent to richer neighborhoods are perceived to contain valuables. So, we would expect that the effect of family on money envelopes to be stronger in richer neighborhoods, not weaker. The fact that we do not find this suggests that there is a countervailing force limiting the incentive to commit a crime. Since larger expected costs of being caught reduce the incentives to steal, this result is consistent with the belief that the probability of being caught stealing is larger in richer neighborhoods. This result is also consistent with our model predictions that changes in social characteristics, z, can affect both the probability of there being something of value in the mail and the probability of being caught stealing.

All together, these results suggest that there is an expectation of valuables sent through the mail as neighborhood income rises and this interacts with an increasing probability of being caught. This gives us a nonlinear effect of neighborhood income on loss rates and a higher level of loss in middle-income neighborhoods.

6 Robustness Checks on Main Findings

This section presents regression analysis of mail loss rates to test the robustness of our main results to omitted variables and specification assumptions. We check that our results are not due to recipient-level fixed effects, our definition of neighborhood grouping by income, correlation between neighborhood income and the way mail is processed, misreporting, or other socio-economic variables. Table 8 presents logit regression marginal effects for a dummy variable that equals 1 if the mail did not arrive at its destination and 0 otherwise. Each regression presents the effect of covariates on different subpopulations.[23] Covariates include

[23]The results are robust to autocorrelation and other specifications.

treatment variables, nonlinear effects of neighborhood income, distance to the closest post office branch, whether there is an administrative center located in the neighborhood, number of post office branches in the neighborhood and the time effect of when the mail was delivered.

The first column in Table 8 (and the first column in Table 7) confirm our main findings. Envelopes containing money are more likely to get lost. The results in Table 7 confirm that this holds with recipient-level fixed effects, and the results in Table 8 confirm that it holds at the same time as does the nonlinear relationship with neighborhood income (percent classified as poor). This latter result still remains even controlling for the manner in which mail is processed across neighborhoods. The results are intuitive. Mail sent to neighborhoods with an administrative center is lost more frequently because, presumably, there are many more employees handling the mail and this helps to dissipate responsibility. Neighborhoods with more post office branches lose less mail because it is easier to identify responsibility.

In Table 8, columns two and three show that the effect of neighborhood income is stronger for the envelopes with money. The regressions dividing the population receiving envelopes from family and non-family members (columns 4 and 5) confirm that it is the envelopes with money coming from family members that are more likely to get lost. Finally, note that the patterns of lost mail across all regressions do not seem to respond to the proximity of post offices. The number of minutes it takes to get to the closest post office is not significant.[24]

The results reported above also eliminate two alternative explanations for higher loss of envelopes with money: systematic misreporting by recipients and misreporting envelopes with money. First, since the results hold when controlling for recipient fixed effects (Table 7), individual misreporting is not causing our main result that envelopes with money are lost more. Second, since the recipients did not know ahead of time what kind of envelope was sent, there is no reason to believe that the money effect is due to people not paying attention to the money envelopes more than no-money envelopes. Also, and this is crucial,

[24]The number of minutes to the closest post office is based on an accessibility model which calculates the least cost path surface (based on time) from any place, using GIS. The accessibility measure uses three different levels of roads with different speeds of movement.

they could keep the money and therefore did not need to say it was lost.

Finally, the nonlinear effect of neighborhood income on loss rates, especially for envelopes with money, is not what one would expect if it were only due to differential shirking by neighborhoods. Table 1 showed that years on the job for postmen and messengers were lower in low and middle-income neighborhoods. If years on the job reflects the consequences of shirking (i.e. getting fired), we would expect loss rates to be similar in low and middle-income neighborhoods, not different.

The results in Table 8 are also robust to learning and the inclusion of other socio-economic information, such as family size, time in residence and marital status. Envelopes with money are more likely to be lost and neighborhood income is nonlinearly related to loss rates.[25] Also, the fact that money envelopes are more likely to be lost, even when controlling for recipient fixed effects, is strong evidence that this result is robust. Finally, we do not find that the results are altered if we control for household size (results not shown).

7 Robustness Checks on Reporting Bias

This section presents additional evidence that the results in the paper are not due to misreporting by the mail recipients. As discussed in the data section, recipients in our experiment were recruited among people involved in field research. They are trained in survey methods and are aware of the problems associated with misreporting. In addition we had ten monitors coordinating the collection of data as a way to keep close vigilance on the process. Despite all this, it is always possible that mail recipients mistakenly reported lost mail, or worse, purposely reported losses when they did not exist. While our post-experiment survey gives us confidence that the envelops received were indeed received, it is harder to check if reported losses did indeed occur. This section presents a series of tests that suggest that the patterns of lost data are not biased and therefore that the main results of the paper are not due to misreporting.

Table 9 checks the significance of the effect of money on loss rates. These are OLS

[25]Learning is tested by the inclusion of a lagged term for loss or a dummy variable that equals one if the first envelope did not arrive. Our main results still hold. These results are not included in the paper.

regressions of mail loss on the treatment variable and response time.[26] The estimation exploits the fact that we had a measure of recipients' responsiveness with the time they took to respond to and check their email. One hypothesis is that less responsive recipients or those unable to respond quickly might be more likely to report missing mail due to distraction. Since we sent an email each time the envelopes were sent out, it also allows us to see if our results are associated in some way to periods in which subjects were busier or more distracted. We see that, even controlling for response time, our results still hold. The first three columns show the rate of mail loss as a function of whether it contained money and whether the subject responded to the email or not. As expected, recipients who do not send an email response are more likely not to receive the envelope. However, we see that envelopes with money are still more likely to be lost and that this result is explained mainly by the loss of envelopes sent by family members (coefficients are similar to those reported in Table 8). The last three columns show the rate of mail loss as a function of money and the time it took subjects to respond to emails. Again, we find that money envelopes are lost more frequently and that this is significant among the envelopes sent by family members.

Table 10 checks the significance of the effect of money on loss rates. The estimations exploit the variation in time to confirm receipt of the mail to see if those confirming relatively later were driving the results. Confirmation times are measured from the day the envelopes were mailed from the US and takes advantage of the fact that those receiving the mail were not equally easy to reach. This is so because some recipients had to travel for work or because they had no internet connection at home or work (and therefore checking email regularly was less convenient).[27] Table 10 makes the assumption that the longer the time the mail is not reported the higher the likelihood that reasons other than crime or bad service explain the results. The first three columns estimate the effect of money after all observations which confirmed receipt of the mail after four weeks are dropped. The regressions show that

[26]Note that all results on the effect of money on loss rates in Tables 9 and 10 hold with Logit fixed-effects regressions. We report OLS results because the regressions do not drop observations and give us more robust results.

[27]Part of the research was done concurrently with the 2007 National Census which required several of our recipients to be away from home.

envelopes with money are still more likely to be lost in this restricted sample. The regressions also confirm that the effect is only significant in the envelopes from family members. The last three columns repeat the analysis under the strong assumption that later reports were false positives (i.e., made up data). The regressions show that the effect of money on loss rates persist. In all, these regressions show that if misreporting is correlated with time to confirm, misreporting is not serious enough to eliminate our main results.

Finally, we next test for random misreporting. The estimates assume that some of the reported losses were mistakes and that these mistakes were random. To do this, we randomly select some reported losses and change them to no loss. This amounts to assuming that reported losses are measured with error. Table 11 presents the estimates of 10,000 repetitions of linear regressions with recipients fixed effects. The first three columns report results when 20% of the reported losses are assumed to be mistakes and the last three columns report results when 30% of the reported losses are assumed to be mistakes. As expected, the estimated parameters are smaller. However, neither the significance nor direction of the results are affected. Money envelopes are lost more frequently, and the losses are significant in the envelopes coming from family members.

While none of our robustness checks is proof that no misreporting occurred, the checks should dispel concerns that any misreporting is large enough as to invalidate our results.

8 Conclusions

Using a simple and novel field experiment that gives the opportunity for crime to occur, we examine strategic behavior in the mail sector in Lima, Peru. We hypothesize that the very nature of mail delivery gives an opportunity to those who handle the mail to "lose" mail if it is beneficial to do so. Our design allows us to differentiate poor service from targeted crime and to investigate what information is pertinent in crime and who suffers the most from it.

We have several key findings. First, loss rates are very high. Over 18% of all mail sent never arrived at its destination. These losses are huge and present large barriers for the development of efficient commerce. Second, this high loss rate is partially explained by poor

service but not completely. Envelopes containing money were 50% more likely to be lost than those without money. So, mail loss is not random and hints at strategic behavior. Third, when the sender's last name matched the recipient's last name, the mail was almost twice as likely to be lost if it contained money. Clearly, those who handle the mail are looking for clues that might suggest that an envelope holds something of value. Fourth, middle-income neighborhoods suffer the highest loss rates and high-income neighborhoods suffer the lowest. This result (and the previous) lends support for the crime occurring in Peru rather than the U.S. since it would require the U.S. Postal Service to know which neighborhoods were rich or poor.

Finally, the patterns of crime we observe are consistent with expectations that the recipient could receive something of value and the perceived probability of being caught stealing. This results in a nonlinear effect of neighborhood income on loss. Looking only at mail from family members, we see that loss increases as neighborhood income rises if the mail contains money, suggesting that there is an expectation that residents in middle-income and wealthy neighborhoods may have something valuable to steal. The magnitude of loss is higher in middle-income neighborhoods though, supporting the notion that the probability of being caught is more likely in wealthy neighborhoods. So, we see the highest loss rates in middle-income neighborhoods when there is a hint that the envelope contains something of value.

Put together our results suggest a model of crime where those who handle the mail are looking for items of value to steal, but they take into account the likelihood that valuables are being sent in the mail and the probability of being caught stealing. Moreover, crime is not independent of the neighborhood's characteristics.

While our study cannot speak to the presence of large inefficiencies in all the sectors dealing with the transaction of goods and services, it highlights the large barriers to market development that developing economies face. Our study further shows that private firms providing public services also face incentives problems due to moral hazard in the same way state-owned enterprises do. The nature of the good seems to be as important as the nature of ownership. The sophistication in criminal activity found in our study suggests that there

is a need to design more careful monitoring mechanisms, including appropriate incentives to minimize strategic behavior. Incentive problems can prevent market development as much as inefficiencies in governance and lack of competition.

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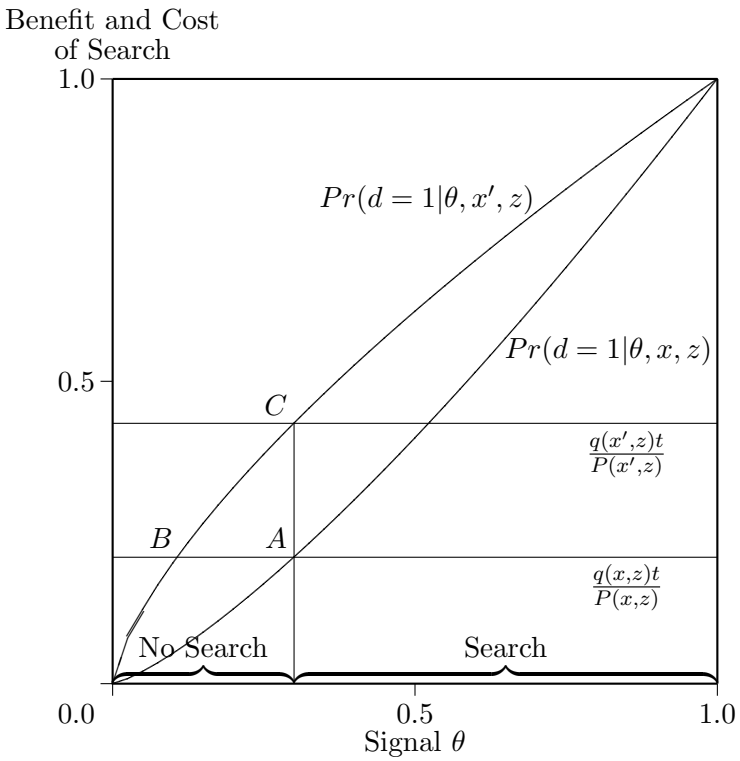

Figure 1. Incentives to Search

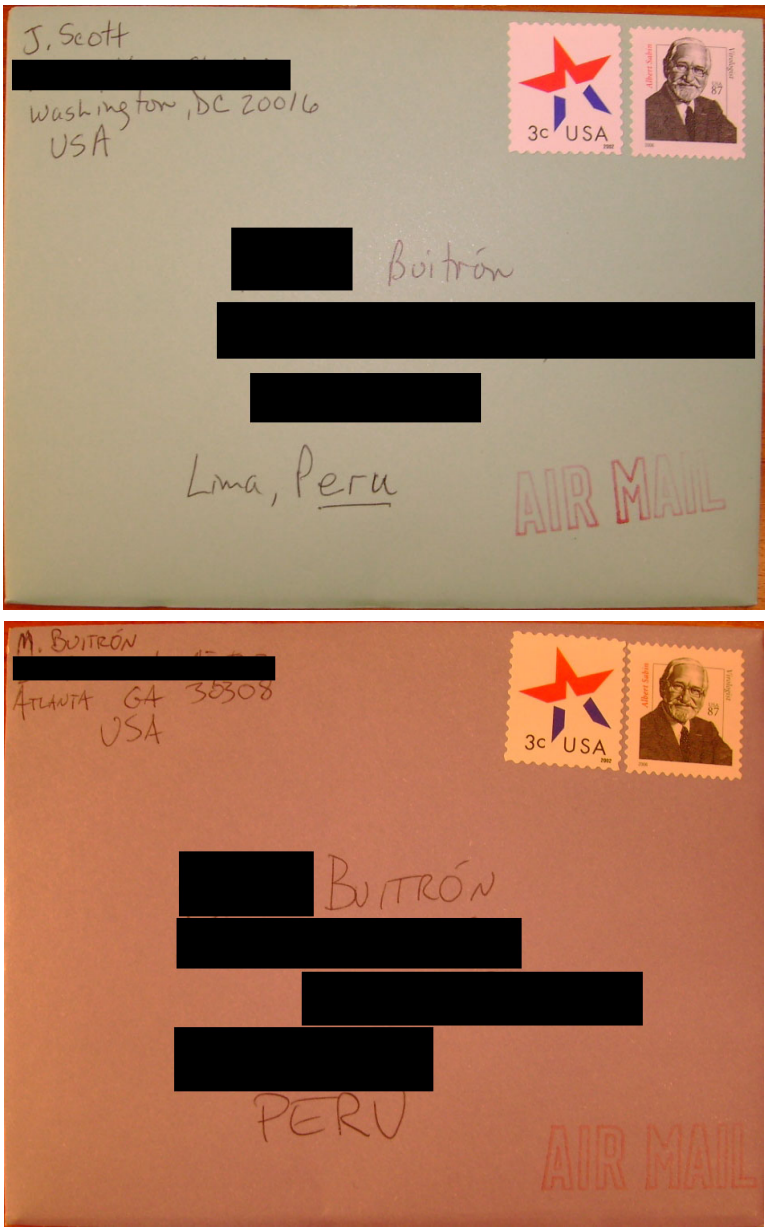

Figure 2. Examples of Envelopes Sent
(To preserve confidentiality, addresses and first names are blocked)

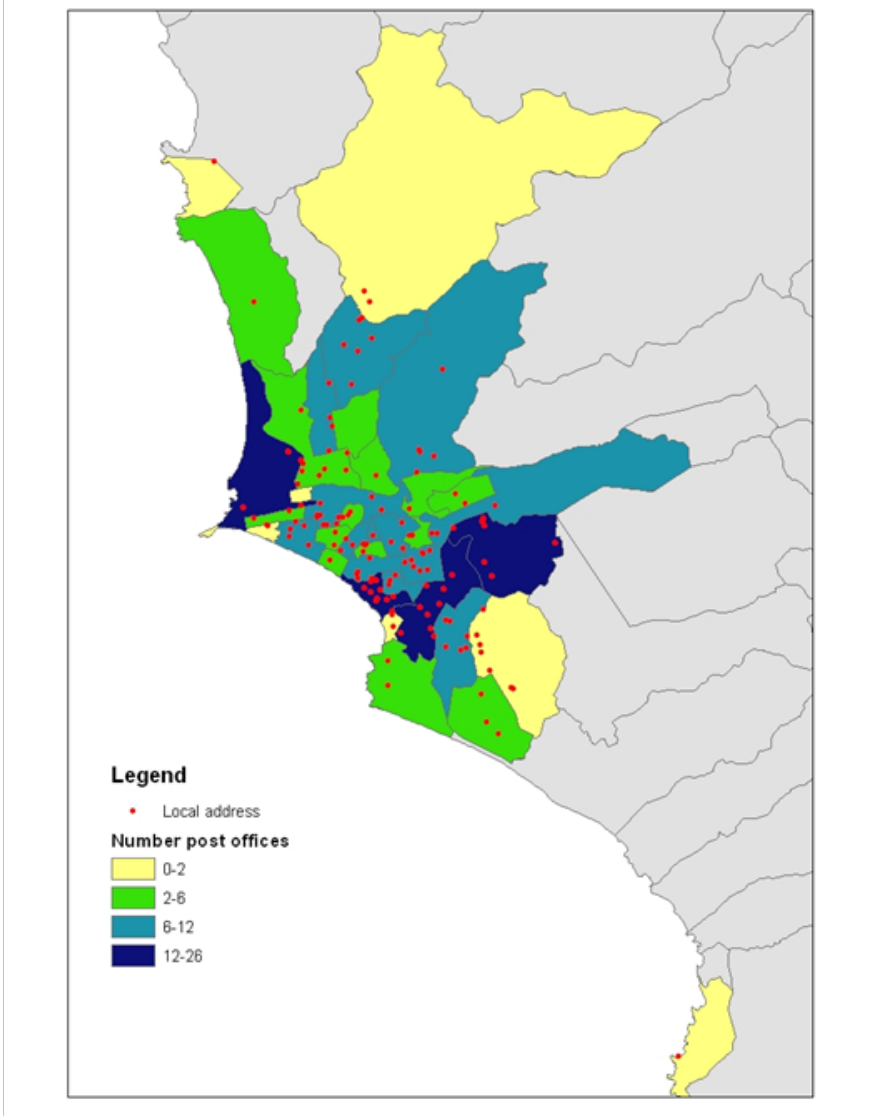

Figure 3. Distribution of Addresses Across Lima, Peru

Table 1

Labor Force Characteristics across Neighborhoods

Neighborhood		Labor Category: Postmen & Messengers	Postal Employees	Other
High Income	*Monthly Income (soles)*	840.9	957.3	1032.6
	Years on the job	6.5	10.0	6.0
	Number	128 (51%)	63 (25%)	59 (24%)
Middle Income	*Monthly Income (soles)*	798.6	959.8	1061.4
	Years on the job	5.2	10.1	5.9
	Number	124 (43%)	90 (32%)	72 (25%)
Low Income	*Monthly Income (soles)*	829.1	947.1	1142.5
	Years on the job	5.2	9.6	6.5
	Number	60 (46%)	44 (34%)	26 (20%)

Table 2

Experimental Design

	Contents of Envelope	
Sender Last Name	Money	No Money
Foreign	n=136	n=131
Family	n=135	n=139

Table 3

Descriptive Statistics of Sample Recipients

	Percent	Std Dev	# Obs
Male Recipients	47.5		141
Low Income	34.8		49
Middle Income	39.7		56
High Income	25.5		36
Age (mean, years)	37.2	10.1	124
University Education	57.4		136
Married or Cohabitating	44.1		136
Family size (mean, number)	4.1	1.5	124
Family in U.S.	47.1		136
Time in Residence (mean, years)	16.5	12.8	124
Minutes to Post Office (mean)	3.0	8.4	140

Note: some variables have missing values because of survey non-response.

Table 4

Loss Rates
(in percent)
Overall and by Contents

		Number
Overall	18.1	98
Money	21.4	58
No Money	14.8	40

Experimental Treatments

	Contents of Envelope	
	Money	No Money
Foreign	19.8	16.0
Family	23.0	13.7

Table 5

Loss Rates by Income Groups (in percent)

	Low Income	Middle Income	High Income
Overall	18.9	20.4	13.5
Money	19.8	25.7	16.9
No Money	18.0	15.3	10.0
Foreign Sender Name	18.9	18.3	16.4
Family Sender Name	18.9	22.4	10.3

Table 6

Loss Rates

by Money, Income Groups and Sender Name (in percent)

	Envelope with Money		
	Low Income	Middle Income	High Income
Foreign Sender Name	21.3	20.4	17.1
Family Sender Name	18.2	30.9	16.7

	Envelopes with No Money		
	Low Income	Middle Income	High Income
Foreign Sender Name	16.3	16.0	15.8
Family Sender Name	19.6	14.8	3.1

Table 7

Probability of Mail Loss

Logit Fixed-Effects Regressions

	All	Family	Foreign	Money	No Money
Money	0.606**	3.200***	0.491		
	(0.278)	(1.196)	(0.798)		
Family	0.025			0.749	-1.218
	(0.276)			(0.827)	(0.906)
Money*Percent Poor		-0.082**	-0.017		
		(0.034)	(0.028)		
Family*Percent Poor				-0.017	0.040
				(0.031)	(0.030)
Recipient Fixed Effects	yes	yes	yes	yes	yes
N	199	63	46	44	48
Log likelihood	-71.96	-15.87	-15.74	-14.73	-15.60

Note: standard errors in parentheses. *p-value < 0.10, **p-value < 0.05, ***p-value < 0.01. Some observations dropped because the dependent variable is all zeros or all ones for the recipient. Dependent variable is Mail Loss (=1 if mail never arrived and =0 if mail arrived). Independent Variables: Money=1 if envelope contained money, Family=1 if sender's last name was the same as recipient's, Percent Poor=percent of population in neighborhood living in poverty.

Table 8

Probability of Mail Loss

Logit Regressions - Marginal Effects

	All	Money	No Money	Family	Foreign
Money	0.064*			0.099**	0.028
	(0.034)			(0.048)	(0.046)
Family	0.006	0.031	-0.021		
	(0.032)	(0.048)	(0.041)		
Percent Poor	0.012**	0.014*	0.010	0.013*	0.011
	(0.005)	(0.008)	(0.007)	(0.008)	(0.007)
Percent Poor	-0.000**	-0.000*	-0.000	-0.000	-0.000
Squared	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Minutes to	0.001	0.004	-0.001	-0.000	0.003
Post Office	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
Administrative	0.116***	0.137**	0.095**	0.076	0.160***
Center	(0.037)	(0.056)	(0.048)	(0.051)	(0.053)
Number of Post	-0.028**	-0.024	-0.032**	-0.033**	-0.023
Office Branches	(0.011)	(0.017)	(0.015)	(0.017)	(0.016)
Mailing number	0.001	-0.003	0.006	0.012	-0.011
(1-4)	(0.015)	(0.023)	(0.020)	(0.021)	(0.021)
N	537	269	268	272	265
Log Likelihood	-240.01	-132.07	-106.11	-122.49	-115.59

Note: standard errors in parentheses. *p-value < 0.10, **p-value < 0.05, ***p-value < 0.01. Dependent variable is Mail Loss (=1 if mail never arrived and =0 if mail arrived). Independent Variables: Money=1 if envelope contained money, Family=1 if sender's last name was the same as recipient's, Percent Poor=percent of population in neighborhood living in poverty, Minutes to post office=number of minutes from residence to closest post office, Administrative Center=1 if an administrative center is located in neighborhood, Number of Post Office Branches=number of branches in neighborhood, Mailing number=1 if first mailing, =2 if second mailing, etc.

Table 9

OLS Fixed-Effects Regression on Mail Loss

VARIABLES	All	Family	Foreign	All	Family	Foreign
Money	0.073***	0.102**	0.017	0.062**	0.079*	0.011
	(0.028)	(0.042)	(0.038)	(0.028)	(0.042)	(0.039)
Responded by email in a week				-0.165***	-0.198**	-0.097
				(0.047)	(0.082)	(0.076)
Responded by email in 2 weeks				-0.104**	-0.156*	-0.031
				(0.050)	(0.093)	(0.080)
Responded by email in 3 or more weeks				-0.022	0.043	-0.032
				(0.050)	(0.087)	(0.082)
Responded to email	-0.121***	-0.130*	-0.089			
	(0.037)	(0.069)	(0.056)			
Constant	0.210***	0.203***	0.219***	0.203***	0.199***	0.203***
	(0.026)	(0.045)	(0.038)	(0.026)	(0.043)	(0.037)
Recipient Fixed Effects	yes	yes	yes	yes	yes	yes
Observations	541	274	267	541	274	267
R-squared	0.039	0.059	0.020	0.047	0.106	0.013
Number of recipients	141	139	139	141	139	139

Note: standard errors in parentheses. *p-value < 0.10, **p-value < 0.05, ***p-value < 0.01. Dependent variable is Mail Loss (=1 if mail never arrived and =0 if mail arrived). Independent Variables: Money=1 if envelope contained money, Responded by email in a week=1 if recipient responded to initial email informing the mailing of a card within a week of us sending the email, Responded by email in 2 weeks=1 if it took 1-2 weeks, Responded by email in 3 or more weeks=1 if it took 3 or more weeks to respond.

Table 10

OLS Fixed-Effects Regression on Mail Loss

	Observations Confirmed After 4 Weeks Dropped			Losses Confirmed After 4 Weeks Switched to No Loss		
	All	Family	Foreign	All	Family	Foreign
Money	0.070**	0.062*	0.052	0.048**	0.065**	0.027
	(0.029)	(0.035)	(0.045)	(0.023)	(0.033)	(0.035)
Constant	0.093***	0.091***	0.108***	0.063***	0.052**	0.076***
	(0.020)	(0.023)	(0.023)	(0.016)	(0.023)	(0.024)
Recipient Fixed Effects	yes	yes	yes	yes	yes	yes
R^2 within	0.025	0.042	0.022	0.011	0.028	0.005
N	366	189	177	541	274	267

Note: standard errors in parentheses. *p-value < 0.10, **p-value < 0.05, ***p-value < 0.01. Dependent variable is Mail Loss (=1 if mail never arrived and =0 if mail arrived). Independent Variables: Money=1 if envelope contained money.

Table 11

Average and 90% Confidence Interval of Bootstrapped OLS Recipient Fixed-Effects Regression on Mail Loss

	20% of reported losses changed to no loss at random			30% of reported losses changed to no loss at random		
	All	Family	Foreign	All	Family	Foreign
Money	0.042	0.066	0.006	0.036	0.056	0.004
	[0.011,0.070]	[0.026,0.103]	[-0.033,0.044]	[0.004,0.065]	[0.017,0.101]	[-0.039,0.045]
Constant	0.107	0.098	0.123	0.091	0.084	0.107
	[0.087,0.125]	[0.075,0.122]	[0.096,0.150]	[0.070,0.110]	[0.056,0.112]	[0.072,0.137]

Note: 90% CI in brackets. 10,000 bootstraps. Dependent variable is Mail Loss (=1 if mail never arrived and =0 if mail arrived). Independent Variables: Money=1 if envelope contained money.