

LETTER GRADING GOVERNMENT EFFICIENCY

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Abstract

We mailed letters to non-existent business addresses in 159 countries (10 per country), and measured whether they come back to the return address in the United States and how long it takes. About 60% of the letters were returned, taking over six months, on average. The results provide new objective indicators of government efficiency across countries, based on a simple and universal service, and allow us to shed light on its determinants. The evidence suggests that both technology and management quality influence government efficiency, just as they do that of the private sector. (JEL: D24, H11, L32, L87, M11)

1. Introduction

A growing literature has tried to assess empirically the quality of government in different countries and its determinants (e.g., La Porta et al. 1999; Treisman 2000; Svensson 2005; Kaufmann, Kraay, and Mastruzzi 2008). Most of this literature uses surveys of citizens, businessmen, foreign investors, or local experts to measure the quality of government. While useful, survey responses capture the respondents' combined assessment of government policies, corruption, and productivity (Glaeser et al. 2004). As a consequence, both government efficiency and its political correlates and determinants influence survey indicators. In this paper, we propose a direct measure of the government's productive efficiency coming from a universal public service, mail

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delivery. Measuring efficiency in this way allows us to also examine its “production function” determinants, such as capital, labor, technology, and management. After all, public institutions such as courts, police, and the postal service are in effect organizations, and as such their productivity might be shaped by the same factors as that of firms. Unlike some of the earlier work (e.g., Verba and Nie 1972; Barro 1999; Reinikka and Svensson 2004, 2005; Olken 2007; Ferraz and Finan 2008, 2011; Djankov et al. 2010), we do not focus on broader political and economic forces shaping the government production function, such as democracy or accountability.

Our measure of government productivity describes the performance of the mail system in accomplishing one simple task: returning an incorrectly addressed international letter. Focusing on mail follows the suggestion by Edward Prescott in the early 1980s that postal economics is more central to understanding the economy than monetary economics.¹

Between December 2010 and February 2011 we sent letters to non-existent business addresses in 159 countries: two letters in each country’s largest five cities. Each envelope had a typed address using the Latin alphabet, as required by international postal conventions, and included a return address at the Tuck School of Business in Hanover, New Hampshire, as well as a clear request to “please return to sender if undeliverable”. The addresses included an existent city and zip code (where available), but a non-existent business name and street address. The letter inside was a standard one page business letter, written in English and requesting a response from the recipient. We included nothing else in the letter to avoid a temptation to open and steal the content (see Castillo et al. 2014).

All countries subscribe to an international postal convention requiring them to return letters posted to an incorrect address. We measured the fraction of letters that were actually returned, and how long it took the letters to come back from the date they were posted from Cambridge, MA. We stopped keeping track of returns one year after the final postings that took place on 4 February 2011. We do not believe this procedure aroused any concerns or delays at the US post offices. We use the data to construct the share of letters we got back and how long it took to get them back from each of 159 countries.

Our approach to measuring government efficiency has several advantages. First, we are looking at a fairly simple and universal government service. Although internet and Fedex have partially replaced mail recently, letter delivery by the postal service is still dominant (Guislain 2004). Mail is even more important for packages. Second, we have data on labor, capital, and technology in the mail system, as well as on public sector management in a country. Finally, by design we are looking at a government service where corruption plays no role. It is actually impossible to ask the American sender of the letter for a bribe, since he is not available to pay it. Furthermore, no larger political purpose is served by either returning the letter or throwing it out. Studying mail thus allows a sharp focus on the standard production function approach to government efficiency.

1. Personal communications from Edward Prescott, Patrick Kehoe, Timothy Kehoe, and Ellen McGrattan.

We verify that return of letters is a proper measure of government efficiency. One might argue, for example, that it is efficient for poor countries not to return the letters because they have scarce resources that are best allocated elsewhere or because their efficiency would make it too costly to send the letter back. In this regard, it is important to note that, under the Universal Postal Union, it is the sender country (in this case the United States) that pays for the return of an incorrectly addressed letter. Nevertheless, we show that our measures of mail efficiency are correlated both with indicators of good government (democracy, accountability, low corruption) and measures of government efficiency obtained in other studies, such as public worker absenteeism (Chaudhury et al. 2006) and low quality of public goods (La Porta et al. 1999).

We model the return of an incorrectly addressed letter using a standard production function that uses labor, capital, technology, and management as inputs. We have data on capital, labor, and technology in the postal system. For management, we have put together cross-country data on four aspects of management quality: professional or “Weberian” bureaucracies (hereafter WB) as defined by Evans and Rauch (1999), public sector wages, public sector employees’ attitudes toward their jobs, and quality of private sector management. According to Weber (1968), professional bureaucracies are needed to accomplish social goals. Evans and Rauch developed WB indices based on expert surveys for 35 countries, covering such aspects as skill- and merit-based as opposed to patronage-based hiring, career employment, civil service protection, and relative pay. Dahlström, Lapuente, and Teorell (2011) (hereafter, DLT) have updated and refined these measures for over 100 countries in our sample, so we can examine the influence of WB on postal efficiency, holding resources and technology constant.

We supplement WB indices with three other approaches to measuring public sector management. First, one reason for poor public sector performance may be low relative wages, which keep away talent and discourage initiative. Compensation is in fact part of WB indices. We assemble additional data on relative public sector wages, including for 25 countries those of postal employees, and consider their influence on postal efficiency. Second, DLT also collect data on objectives and attitudes of public sector employees. We examine the relationship between these attitudes and postal efficiency. Third, recent research shows that management quality is a key determinant of productivity in the private sector (Bloom and Van Reenen 2007, 2010; Bloom, Sadun, and Van Reenen 2012; Bloom et al. 2010, 2013; Gennaioli et al. 2013). We use survey measures of management quality in the private sector, but also Bloom/Van Reenen measures of management practices for a small sample.

To briefly summarize the results, we find enormous variation across countries both in how many letters come back, and how long it takes them to come back. About 30% of the variation is explained by postal system inputs and technology, but the rest remains unexplained. Indices of WB, particularly meritocratic recruitment, are also statistically significant determinants of postal productivity, while relative public sector wages are not. Private sector management quality helps explain mail efficiency across countries; some of the same aspects of management in the public and private sectors seem to matter.

December 1, 2010
Re: Confidential

URGENT RESPONSE REQUESTED

Rafael La Porta
Tuck School of Business at Dartmouth
100 Tuck Hall
Hanover, NH 03755, USA

Dear Mr. XXXXX,

I hereby confirm receipt of the previous correspondence.

Please let me know if you would like to continue with the collaboration project.

I will wait to hear from you, but please respond as soon as possible as this matter is of absolute importance.

Regards,

Rafael La Porta

FIGURE 1. The text of the one-page letter that was sent to each of the ten recipients in the largest five cities in all 159 countries.

In the next section, we present our data. We also check that our indicators of postal efficiency are plausible measures of the quality of government. Section 3 presents the basic results on the determinants of mail efficiency. Section 4 describes robustness checks. Section 5 concludes.

2. Procedure and Variables

We sent two letters to each of the five largest cities in 159 countries. These were airmail, first class letters, with correct international postage of 98 cents. The letters were dropped in street mail boxes in Cambridge, MA between 8 December 2010 and 4 February 2011. Both the letter inside and the information on the envelope used the Latin alphabet and Arabic numerals, as required by the postal convention. The letter inside, reproduced in Figure 1, was always the same, and written in English. It came from Rafael La Porta at Tuck School of Business at Dartmouth College in Hanover, New Hampshire. The letter stated that it was confidential, confirmed the receipt of previous correspondence, and requested urgent response regarding the recipient's willingness to continue the collaboration project. The idea of such a letter was to add a bit of urgency to the task of returning in the event that a postal employee opened the envelope and

read it. At the same time, we made sure there was only one piece of paper inside the envelope to minimize the temptation for postal employees to look for valuables inside (Castillo et al. 2014).

The name of the addressee was chosen as a common name in the country. In addition to the name of the addressee, each address on the front of the envelope had a generic name of a business, such as Computer Management Professionals, Smart Computer Services, Inventory Technology Partners, Professional Management Forum, Inventory Area Management Computer. Following the name of the business, the envelope had a printed address, which had a correct existing zip code for the city in question but a non-existent address. Names of Nobel Laureates in Economics and famous Western composers were used as street names. It is possible but extremely unlikely that, by coincidence, the street address existed in that city at that zip code. For all practical purposes, the street address was non-existent. The addresses were typed following the postal convention. Online Appendix K describes in detail the methodology of the experiment, provides the sources files, and presents the front of the envelope for several of the returned letters.

There is a specific reason we used incorrect street names. Had we used existing street names (which would be trivial), the letter would probably reach the mailman. Unless we used a crazy building number, the printed address would actually exist. In this case (as often happens in the United States), we would expect the mailman to actually deliver the letter to the existing address, so we could not distinguish throwing the letter out from delivering it to a non-existent addressee. To compute our measures of mail efficiency, we thus need a non-existent street, so that it becomes obvious at some point that the address is incorrect.

In addition, each letter contained the return address of Rafael La Porta at the Tuck School of Business at Dartmouth. Under the address, it said in larger bold letters **PLEASE RETURN TO SENDER IF UNDELIVERABLE**. This too was done to encourage the return of the letter.

All of the countries in the sample subscribe to the Universal Postal Union. Article 147 from the Universal Postal Union Letter Post Regulations Final Protocol of 2009 regulates the return of incorrectly addressed mail, and in particular mandates the return of such mail under normal circumstances (our letters did not contain biodegradable or radioactive material, etc.). The Regulations also require that the letters must be returned within a month of entering the country, and that the sending country (i.e., the United States) pays for the return (Articles RC 139.9, 202.1, and 202.2). The letters met all the requirements, such as how the addresses were typed, postage, return addresses, letter weight, to trigger the return under the Universal Postal Union.

Following the mailing, we kept track of the dates of return of the letters, checking every weekday when mail was delivered. Based on this information, we constructed three variables for each country. The first is the fraction of the ten letters that were returned. The second is the fraction of the ten letters that were returned within three months, as would be (generously) required by postal conventions. The third is the average time to get the letters back using the (equalizing) assumption that the letters that never came back actually did come back on 4 February 2012, the last day we kept

track of the data. Online Appendix A provides a detailed description of all the variables we use in the paper. Table 1 illustrates the construction of the mail variables for two countries: the Czech Republic and Russia. The ten letters for each country were mailed on separate days between December 2010 and February 2011. All the letters from the Czech Republic were returned within 90 days, with the average number of days for return of 52.3. None of the letters from Russia came back by 4 February 2012, which gives Russia the average number of days of 418.8.

Table 2 presents some statistics for our three mail variables, and lists the countries with the highest and the lowest share of returned letters. On average, we got 59% of the letters back, although only 35% of the letters came back within three months. We got 100% of the letters back from 21 out of 159 countries, including from the usual suspects of efficient government such as Canada, Norway, Germany, and Japan, but also from Uruguay, Barbados, and Algeria. At the same time, we got 0% of the letters back from 16 countries, most of which are in Africa but also including Tajikistan, Cambodia, and Russia. For high-income countries, we got almost 85% of the letters back, and 60% within three months, while for low-income countries these numbers fall to 32% and 9%, respectively. Table 2 also shows that more of the letters came back, and came back quicker, from countries with higher education than from those with lower education. Despite our focus on a very simple task, government efficiency measures vary enormously across countries, and in ways roughly related to per capita income and human capital, consistent with the evidence on subjective indicators of the quality of government (La Porta et al. 1999; Treisman 2000).²

As a first step, we need to establish that our measures of returned mail are indeed valid proxies for the quality of government. In the age of internet and Fedex, it may be efficient to downsize the post office. Moreover, it might be efficient to allocate scarce resources away from marginal activities, such as returning letters sent from abroad to incorrect addresses. If these views are valid, then the failure to return the letter is a proxy for high- rather than low-quality government.

In this regard, we make several points. To begin, despite the growth of Online Appendix: Letter Grading Government Efficiency and private package deliveries, the demand for postal services has, if anything, grown over time. It is true that letter delivery is down about 10% over the last two decades, but parcel deliveries are up sharply (UPU 2011). Even with a decline in letter deliveries, in rich countries the postal service still delivers over 200 letters per person per year. The sector remains large in terms of employment as well.

With regard to the marginality of returning mail sent from the United States, we note three points. First, each country in our sample has signed a postal convention agreeing to do exactly that. Failure to return the letter thus constitutes a violation of an international agreement. Second, that convention also mandates that the sending

2. The coefficient of variation in our measures of postal productivity is 1.80 for getting the letter back, and 1.11 for getting it back in 30 days (see Online Appendix A). For comparison, the coefficient of variation for GDP per capita is 0.90. Postal productivity is as variable across countries as the more traditional indicators of development.

TABLE 1. Mail efficiency data for the Czech Republic and Russia.

Name	Street address	Postcode and City	Date letter sent	Date letter received	Got it back	Got it back in 90 days	Number of days (up to limit of 02/04/2012)
Panel A: Letters sent to the Czech Republic							
Zdenek Dvořák	Debreuská 1	110 00 Praha	12/09/2010	03/07/2011	1	1	88.00
Vaclav Veselý	Meadeská 4	602 00 Brno	12/09/2010	03/08/2011	1	1	89.00
Milan Růžička	Haavelmoská 2	301 00 Plzeň-Jižní	12/11/2010	01/04/2011	1	1	24.00
Petr Svoboda	Buchananova 1704	602 00 Brno	12/14/2010	03/04/2011	1	1	80.00
Jiri Kučera	Frišchova 7526	120 00 Praha 2	12/15/2010	02/03/2011	1	1	57.00
Milos Novotný	Millerská 7400	460 01 Liberec IV-Perštýn	12/29/2010	01/25/2011	1	1	20.00
Jan Sedláček	Lewisova 4051	702 00 Moravská Ostrava	12/29/2010	03/08/2011	1	1	69.00
Kazimir Svoboda	Markowitzova 6404	460 07 Liberec III	12/31/2010	01/31/2011	1	1	31.00
Kazimir Pospíšil	Hayekova 7	301 00 Plzeň-Jižní	12/31/2010	02/02/2011	1	1	33.00
Zdenek Pokorný	Arrowská 48	713 00 Slezská Ostrava	02/04/2011	03/08/2011	1	1	32.00
Average					1.00	1.00	52.30
Panel B: Letters sent to Russia							
Roman Avdeyev	Ulitsa Debreuska 8689	gorod Moskva 115487	12/08/2010	-	0	0	423.00
Ivan Zhakov	Ulitsa Modiglianaya 6802	Sankt-Peterburg 199178	12/09/2010	-	0	0	422.00
Oleg Golikova	Ulitsa Arrowlok 8547	Novosibirsk, Nizhengorodskaya Obl	12/10/2010	-	0	0	421.00
Fillylp Zubkov	Ulitsa Haavelmo ave 3	Ekaterinburg, Sverdlovskaya Obl	12/11/2010	-	0	0	420.00
Dmitri Avdeyev	Ulitsa Ohlinov 2	Sankt-Peterburg 199178	12/13/2010	-	0	0	418.00
Oleg Skryannik	Ulitsa Myrdalok 983	Nizhnij Novgorod, Nizhengorodskaya Obl	12/13/2010	-	0	0	418.00
Pavel Ivanov	Ulitsa Allaiska 45	Novoe Devyatkinno, Leningradskaya Obl	12/14/2010	-	0	0	417.00
Ivan Zhakov	Ulitsa Hayeka 63	Ekaterinburg, Sverdlovskaya Obl	12/14/2010	-	0	0	417.00
Eduard Zhakov	Ulitsa Frischpik 402	gorod Moskva 101000	12/15/2010	-	0	0	416.00
Ludvig Sobyamin	Ulitsa Stiglerova 2709	Nizhnij Novgorod, Nizhengorodskaya Obl	12/15/2010	-	0	0	416.00
Average					0.00	0.00	418.80

TABLE 2. Measures of mail efficiency.

	Got the letter back	Got the letter back in 90 days	Avg. number of days to get the letter back
Panel A: Top and bottom countries sorted by "Got the letter back"			
United States	100%	100%	16.20
El Salvador	100%	100%	39.00
Czech Republic	100%	100%	52.30
Luxembourg	100%	100%	68.00
Finland	100%	90%	51.60
Norway	100%	90%	53.30
New Zealand	100%	90%	53.60
Uruguay	100%	90%	54.00
Canada	100%	90%	54.30
Barbados	100%	90%	57.90
Angola	20%	0%	404.00
Malawi	20%	0%	414.70
Mauritania	20%	0%	416.20
Mongolia	10%	10%	383.60
Swaziland	10%	0%	387.40
Fiji	10%	0%	388.20
Congo, Dem. Rep.	10%	0%	397.60
Tonga	10%	0%	398.70
Honduras	10%	0%	408.70
Burundi	10%	0%	410.70
Cambodia	0%	0%	413.50
Russian Federation	0%	0%	418.80
Gabon	0%	0%	418.80
Panama	0%	0%	418.80
Egypt, Arab Rep.	0%	0%	418.80
Nigeria	0%	0%	418.80
Sudan	0%	0%	418.80
Cameroon	0%	0%	418.80
Tajikistan	0%	0%	418.80
Cote d'Ivoire	0%	0%	418.80
Ghana	0%	0%	418.80
Tanzania	0%	0%	418.80
Rwanda	0%	0%	418.80
Liberia	0%	0%	418.80
Myanmar	0%	0%	418.80
Somalia	0%	0%	418.80
Panel B: Full sample means			
Full sample (159)	59.31%	35.35%	228.22
Panel C: Means by GDP per capita			
High income (39)	84.87%***	60.00%***	125.91***
Upper middle income (38)	66.84%	43.16%*	196.27*
Lower middle income (39)	55.90%	30.26%	245.99
Low income (38)	32.11%***	9.21%***	336.02***
Panel D: Means by average number of years of schooling			
Above median years of schooling (72)	75.28%***	52.08%***	164.48***
Below median years of schooling (84)	46.07%	21.20%	281.65

Notes: The table presents the data of our three mail efficiency variables: (i) got the letter back; (ii) got the letter back in 90 days; and (iii) the average number of days to get the letter back in each country. The number of countries in each group is in parentheses. Detailed definitions of each variable can be found in Online Appendix A. Significance levels for the test of difference means between the group and the rest of the sample mean are: * $p < 0.10$; *** $p < 0.01$.

country—namely, the United States—pays for the return of the letter. The cost of the return is thus covered for the receiving country. And third, one might in fact argue that returning letters addressed to businesses and sent from the United States is one of the most productive activities a postal service can do in a developing country.

Table 3 offers some evidence broadly inconsistent with the idea that returning mail is an indicator of poor rather than good government performance. Table 3 correlates our measures of government efficiency with a large number of standard measures (see La Porta et al. 1999, although here we use the most recent numbers).³ Two points emerge from Table 3. First, on nearly every measure, it is “better” governments—more democratic, more accountable, less corrupt—that perform better on returning letters, even if we hold per capita income constant. That is, the governments more responsive to their citizens have higher efficiency indicators according to our measures. If one believed that the better governments would curtail the mail service, or its marginal aspects such as returning letters from abroad, one would expect exactly the opposite (see Djankov et al. 2002). Second, our indicators of mail efficiency are also positively correlated with other indicators of government performance, such as teacher attendance (as opposed to absenteeism), efficiency of exporting and importing as measured by the Doing Business Report, Regulatory Quality, and so on. Again, if good postal performance was an indication of a failed government, we would expect precisely the opposite.⁴

In sum, both the broad facts about the economic and legal framework of mail delivery, and the basic correlations with other indicators of the quality of government, suggest that we have a valid measure of government performance. Returning incorrectly addressed letters, and doing so faster, are indicators of higher efficiency. We next examine the determinants of mail efficiency.

3. Determinants of Mail Efficiency

In this section, we estimate a “production function” for the number of returned letters R , assumed to take the form $R = A * F(K, L, S)$, where A is total factor productivity as shaped by technology and management, K is capital, L is labor, and S is the number of incorrectly sent letters. We interpret our experiment as measuring the increment in returned letters caused by an increment in incorrectly sent letters—that is, dR/dS

3. Nick Bloom has suggested that, since we send two letters to each city, we can use data about return of one as an instrument for return of the other, to correct for measurement error. We have done that, and found that R -squared of regressions of our mail efficiency variables on the quality of government variables in general rises (Online Appendix B.1). The results also hold if we control for per capita income (Online Appendix B.2). In fact, a variety of regression tests of the format used by Djankov et al. (2002) show that better governments have higher postal efficiency, controlling for technology and factor inputs.

4. Benmelech and Bergman (2013) show that the measures of mail efficiency presented in this paper are highly correlated with measures of efficiency of utilization of aircraft across countries, regardless of whether the airlines are private or public. There is independent corroborating evidence of the validity of our measures.

TABLE 3. Mail efficiency and alternative measures of government efficiency and accountability.

Variables	Sources		Got the letter back		Got the letter back in 90 days		Ln avg. number of days to get the letter back	
	Corr.	Obs.	Corr.	Obs.	Corr.	Obs.	Corr.	Obs.
Panel A: Government efficiency								
Bureaucratic quality (1995–2008)	0.559***	132	0.515***	132	-0.586***	132		
Extent of bureaucratic red tape	-0.627***	125	-0.556***	125	0.626***	125		
Teacher absenteeism hinders education a lot	-0.261**	70	-0.137	70	0.244**	70		
Overall ease of doing business rank	-0.493***	153	-0.495***	153	0.527***	153		
Starting a business day	-0.324***	153	-0.317***	153	0.342***	153		
Documents to export	-0.456***	153	-0.404***	153	0.464***	153		
Enforcing contracts procedures	-0.316***	153	-0.275***	153	0.348***	153		
Time firms spend meeting with tax officials	-0.333***	99	-0.208**	99	0.268***	99		
Infrastructure quality	0.436***	134	0.447***	134	-0.472***	134		
% household with running water at home	0.529***	128	0.567***	128	-0.548***	128		
Panel B: Accountability								
Disclosures by politicians required by law	0.380***	148	0.336***	148	-0.380***	148		
Disclosures by politicians publicly available	0.460***	148	0.438***	148	-0.484***	148		
Voice and accountability index (1996–2004)	0.641***	156	0.610***	156	-0.670***	156		
Judicial independence	0.439***	134	0.372***	134	-0.454***	134		
Democracy index (1990–2006)	0.581***	148	0.562***	148	-0.602***	148		
Executive constraints (1990–2006)	0.577***	147	0.559***	147	-0.588***	147		
Freedom of the press	-0.578***	157	-0.571***	157	0.625***	157		
ICRG corruption index (2000–2008)	0.581***	132	0.571***	132	0.631***	132		
% firms expect to give gifts for water connection	-0.384***	97	-0.386***	97	0.377***	97		

Notes: The table shows raw pairwise correlations between mail efficiency variables and alternative measures of government efficiency (Panel A) and accountability (Panel B) for the full sample of countries with letters data. The various measures of government efficiency and accountability are shown in the first column and the source of each variable in the second column. For each of the three mail efficiency variables, the first column of numbers shows the pairwise correlations between the mail variable and each of the other variables. The second column of numbers shows the number of observations for each correlation. Significance levels: ** $p < 0.05$; *** $p < 0.01$.

where dS equals 10. We assume the following functional form:

$$R = A(\text{technology, management}) * K^\alpha * L^{1-\alpha} * \text{Ln}(S). \quad (1)$$

This production function has two key economic properties: (1) constant returns to scale in K and L , and (2) increasing the number of incorrectly sent letters S increases the number of returned letters R .⁵ From (1), the empirical counterpart of the fraction r of the ten letters returned is given by dR/dS :

$$r * S = A * K^\alpha * L^{1-\alpha}. \quad (2)$$

Intuitively, multiplying r by S captures the idea that the marginal product of the postal service r falls as S increases because of congestion. Ignoring this effect would understate the contribution of K and L to productivity if K and L are positively correlated with S .

We can divide through by L and take logs to obtain

$$\text{Ln}\left(\frac{r * S}{L}\right) = \text{constant} + a * \text{technology} + b * \text{management} + \alpha * \text{Ln}\left(\frac{K}{L}\right) + \varepsilon. \quad (3)$$

Finally, since r is often equal to zero in our sample, we estimate an approximation given by

$$\begin{aligned} \text{Ln}\left(1 + \frac{r * S}{L}\right) &= \text{constant} + a * \text{technology} + b * \text{management} \\ &+ \alpha * \text{Ln}\left(\frac{K}{L}\right) + \varepsilon. \end{aligned} \quad (4)$$

We also estimate equation (4) replacing r by r_{90} , the share of letters returned within 90 days.

We also seek to adjust the output of the postal service for quality differences as reflected by the delay in returning letters to the United States. To this end, we define q as

$$q = \frac{\sum_{i=1}^{10} \frac{423-t_i}{423}}{10} \quad (5)$$

where t_i is how long it takes for letter i to return to the United States and 423 is the maximum value of t_i in our data. Equation (5) states that while a letter that is returned instantaneously contributes one unit to the output of the postal service, a letter that is returned in 423 days or later (or never) contributes nothing. In our empirical analysis,

5. Alternatively, one could adopt a Cobb–Douglas form: $R = A * K^\alpha * L^{1-\alpha} * S^\beta$, where $0 < \alpha < 1$ and $\beta < 1$. This would yield $r * S^{1-\beta} = \beta * A * K^\alpha * L^{1-\alpha}$, which approximates equation (2) for β close to 0.

we use (5) to estimate a production function based on quality-adjusted output:

$$\begin{aligned} \text{Ln} \left(1 + \frac{q * S}{L} \right) = & \text{constant} + a * \text{technology} + b * \text{management} \\ & + \alpha * \text{Ln} \left(\frac{K}{L} \right) + \varepsilon. \end{aligned} \quad (6)$$

The dependent variable in equations (4) and (6) is essentially the log of output per worker, where r , r_{90} , and q come from our experiment. To estimate equation (4), we need measures of S , technology, management, K , and L . Since we do not have measures of management specific to the postal service, we begin by estimating (4) without management. All the variables are defined in Online Appendix A. Since we do not have a direct measure of incorrectly addressed letters, we assume that S is proportional to the total number of letter-post items posted in a country. K is the number of letter boxes (i.e., receptacles situated in the street or at the post office for the posting of mail). We have tried other measures of K , as described in the robustness section. L is the number of full-time staff of the postal system.

Our first proxy for “technology” is the use of the Latin alphabet in a country, on the theory that even though each country is obliged by the postal convention it signed to accept (and return) letters with addresses spelled in the Latin alphabet, the task of doing so is more difficult in a country where the Latin alphabet is not used. The second measure of “technology”, also aimed to capture the difficulty of returning the letter, is the log of the geographical distance between the country’s most populous city and Hannover, NH in the United States. The third, and clearest, measure of technology is the sophistication of postcode databases. The variable equals 1 if postcode database includes street names, in which case the non-existence of the street name, and therefore the incorrectness of the address, would pop out immediately as soon as the envelope is machine read. The variable equals 0 if the postcode database only includes the names of localities, in which case the envelope-reading machine would not detect the wrong address at all, and a person is needed to do it. There are two intermediate values as well (see Online Appendix C for a precise description). This variable captures the basic technological difference among countries in the processing of letters.

The results of estimating equations (4) and (6) are presented in Table 4. The estimates of α vary across measures of postal output, but capital share is positive. The capital–labor ratio has a large effect on the efficiency of the postal service; a one standard deviation increase in the log of letter boxes per staff, equivalent to the difference between Georgia and Norway, is associated with an increase of about 55% in output per worker as measured by rS/L , 94% in $r_{90}S/L$, and 63% in qS/L . The use of Latin based alphabet is insignificant, although distance from the United States is significant in some specifications, and with the expected sign. In countries further from the United States, postal output is lower, other things equal. Most interestingly, postcode databases, the pure measure of technology, are consistently significant. Technology is not only statistically significant but also has a dramatic effect on postal efficiency: a one-standard deviation increase in the sophistication of the postcode

TABLE 4. Postal office characteristics, alphabet, and distance as determinants of mail efficiency.

Dependent variables:	$\text{Ln}\left(1 + \frac{r^*S}{L}\right)$	$\text{Ln}\left(1 + \frac{r_{90}^*S}{L}\right)$	$\text{Ln}\left(1 + \frac{q^*S}{L}\right)$
Ln letter boxes per staff	0.446* [0.259]	0.765*** [0.278]	0.511*** [0.158]
Postcode databases	3.805*** [0.639]	5.133*** [0.762]	3.144*** [0.423]
Alphabet used is Latin-based	0.247 [0.551]	-0.671 [0.649]	0.249 [0.381]
Ln distance from country to US	-0.588 [0.383]	-2.125*** [0.702]	-0.542* [0.322]
Constant	12.369*** [3.527]	24.840*** [6.554]	12.427*** [3.006]
Observations	157	157	157
Adj. R-squared	0.31	0.41	0.41

Notes: The table presents robust OLS regressions for all the countries in our sample. Robust standard errors are shown in parentheses under each coefficient. Significance levels: * $p < 0.10$; *** $p < 0.01$.

database is associated with an increase in our three measures of output per worker of about 155, 210, and 129% respectively. Together, capital–labor ratio and technology explain 30% of the variation across countries in postal output as measured by returned letters per staff.⁶

Since we do not have direct measures of management in the mail service, we measure management in several ways. We begin with objective measures of the professionalism of public bureaucracy. We supplement these measures with survey evidence on the attitudes of public sector employees, as well as with data on public sector wages. We then turn to indicators of the quality of private sector management, and examine their relationship to postal productivity.

The idea that a professional bureaucracy with nonpolitical rules of recruitment, promotion, and compensation of employees delivers public goods better than a politicized bureaucracy goes back to Weber (1968). Evans and Rauch (1999) measured such a WB in 35 countries using expert surveys. They distinguished three aspects of WB: meritocratic recruitment, predictable career ladders, and compensation practices. DLT significantly extended Evans and Rauch's work by both revising their variables and expanding the number of countries, while still collecting information from country experts. We use the DLT data.

DLT's WB index consists of nine components, divided into three categories: professional and nonpolitical administration, closed public administration, and salaries. The first category covers merit-based as opposed to political hiring. Experts answer four questions in this area: whether skills and merit decide who gets the job when recruiting, whether political connections decide who gets the job, whether political leadership hires and fires senior public sector officials, and whether senior public sector

6. We have rerun the regressions in Table 4 using logistic and Tobit specifications. The results are very similar.

officials are hired from the ranks of the public sector. The second category describes whether public administration is closed—that is, whether it employs lifetime workers governed by special rules and practices. Finer (1997) distinguishes two approaches to organizing a bureaucracy: the open bureaucracies with employees moving between public service and the private sector, adopted for example in the UK, Netherlands, and Denmark, and the closed/protected career bureaucracies of France, Germany, and Spain. Experts answer three questions: whether public sector employees are hired via a formal examination system, whether if recruited they stay in the public sector for the rest of their careers, and whether terms and contracts in the public sector are regulated by special laws not applying to the private sector. The third category deals with salaries, and includes two questions: whether senior officials have salaries comparable to those of similar private sector managers, and whether salaries of public sector workers are linked to performance appraisals. In the DLT data, each expert answers each question on a 1 (hardly ever) to 7 (almost always) scale, and DLT average the answers across experts in each country. DLT also construct a WB index that averages answers to the nine questions (with higher values representing more “Weberianism”). The correlation between their WB index and Evans and Rauch’s (1999) for the common 35 country sample is 0.67.

DLT supplement these questions on WB by questions about the attitudes and objectives of public employees, a topic also stressed by Weber (1968). In particular, they ask whether public employees strive to: (1) be efficient, (2) implement policies designed by top politicians, (3) help citizens, (4) follow rules, and (5) fulfill the ideology of parties in government. In addition, DLT construct an index of impartiality of public employees focusing on whether kickbacks, bribes, discrimination, or personal connections influence their decisions. They also separately ask whether public employees act impartially when implementing a policy in a case. We use these assessments both to check whether a higher WB leads to more pro-social objectives and attitudes of public employees, and as alternative indicators of management quality in the public sector. Online Appendix D presents cross-country correlations between various aspects of Weberianism of the bureaucracy.

Tables 5–7 add WB indicators, public sector salaries, and bureaucratic attitudes as determinants of postal efficiency to the Table 4 specification. We focus on the measure of postal output per worker derived from the share of letters that were returned; the results for other dependent variables are presented in Online Appendix E. In Table 5, we use three Weberian indicators: the WB index defined as the average answer to the nine questions summarized in Table 5, the average answer to the four questions on professional and nonpolitical public administration (professionalism subindex), and the average answer to three questions about closed public administrations (closedness subindex). We also use the individual Weberianism measure that seems most closely related to bureaucratic quality: an indicator of whether public employees are hired for skills and merits. Finally, we use as an independent variable “public management performance” from a German data source on the performance of political decision makers.

TABLE 5. Public sector management quality and mail efficiency.

	$\ln\left(1 + \frac{r^*S}{L}\right)$				
Ln letter boxes per staff	0.248 [0.255]	0.289 [0.268]	0.260 [0.283]	0.487* [0.265]	0.181 [0.325]
Postcode databases	2.066** [0.911]	2.231*** [0.800]	2.080*** [0.668]	2.661*** [0.914]	2.513*** [0.888]
Alphabet used is Latin-based	0.984 [0.681]	0.587 [0.651]	0.493 [0.647]	1.126 [0.808]	-0.341 [0.624]
Ln distance from country to US	-0.404 [0.348]	-0.426 [0.328]	-0.199 [0.313]	-0.229 [0.354]	-0.059 [0.557]
Weberian public administration	1.605*** [0.384]				
Professional and non-political public administration		0.953*** [0.220]			
Hired for skills and merits			0.933*** [0.239]		
Closed public administration				0.562* [0.309]	
Public management performance					0.639*** [0.203]
Constant	4.715 [3.366]	7.981*** [2.991]	5.860* [2.985]	6.762* [3.622]	4.099 [5.179]
Observations	102	103	103	103	117
Adj. R-squared	0.39	0.37	0.39	0.31	0.26

Notes: The table presents robust OLS regressions for all the countries in our sample. Robust standard errors are shown in parentheses under each coefficient. Significance levels: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

In Table 5, capital-labor ratios are either marginally statistically significant, or even insignificant, and the coefficient α falls to the 0.2 to 0.5 range. Distance from the United States remains statistically insignificant for this measure of productivity, while postcode databases remain highly significant. In contrast, measures of WB are consistently statistically significant and quantitatively large. For example, output per worker rises 108% for a one standard deviation change in the overall *Weberian public administration index*, equivalent to the difference between India and Japan. The Weberian variables that are part of the subindex of *professional and nonpolitical public administration* have higher statistical significance and an impact almost twice as large as that of the variables in the closed administration subindex: a one standard deviation increase in *professional and nonpolitical public administration* raises output per worker by 94%, while a one-standard deviation increase of closed administration raises output per worker by 49%. The inclusion of the WB variables raises the explanatory power of the regressions by about eight percentage points. Finally, a one standard deviation rise in *public administration performance*, equivalent to the jump from Mexico to South Korea, raises output per worker by 112%. Taken at face value, the impact of the management variables on postal efficiency is huge.

Table 6 turns to the attitudes of public sector employees. As in Table 5, the measures of public employee attitudes are consistently statistically significant, and

TABLE 6. Attitudes and decision making by public officials and mail efficiency.

	$\text{Ln} \left(1 + \frac{r^*S}{L} \right)$						
Ln letter boxes per staff	0.444 [0.296]	0.397 [0.282]	0.354 [0.263]	0.435 [0.303]	0.538* [0.273]	0.402 [0.315]	0.291 [0.264]
Postcode databases	2.397*** [0.795]	2.587*** [0.717]	1.993** [0.768]	2.321*** [0.747]	2.575*** [0.878]	2.419*** [0.824]	2.254*** [0.747]
Alphabet used is Latin-based	0.511 [0.652]	0.691 [0.656]	0.302 [0.633]	0.612 [0.698]	0.686 [0.674]	0.264 [0.664]	0.359 [0.649]
Ln distance from country to US	-0.242 [0.337]	-0.155 [0.301]	-0.169 [0.294]	-0.192 [0.322]	-0.100 [0.347]	-0.057 [0.313]	-0.164 [0.311]
Public sector employees strive to be efficient	0.738*** [0.264]						
Public sector employees strive to implement policies decided by top politicians		0.913** [0.396]					
Public sector employees strive to help citizens			1.168*** [0.262]				
Public sector employees strive to follow rules				0.613** [0.267]			
Public sector employees strive to fulfill the ideology of the parties in government					-0.546** [0.230]		
Impartiality of public sector employees						0.684*** [0.216]	
Public sector officials act impartially when deciding to implement a policy in a case							1.038*** [0.220]
Constant	7.049** [3.095]	4.671 [2.865]	4.851* [2.786]	6.753** [2.923]	11.226*** [3.307]	5.878** [2.897]	5.031* [2.921]
Observations	103	103	103	103	103	101	103
Adj. R-squared	0.34	0.35	0.40	0.32	0.32	0.35	0.40

Notes: The table presents robust OLS regressions for all the countries in our sample. Robust standard errors are shown in parentheses under each coefficient. Significance levels: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

with expected signs. These results provide additional support for the proposition that the quality of public sector management, as proxied for by bureaucratic rules or attitudes, predicts public sector productivity. The two variables with the largest positive economic impact from this table are *public employees striving to help citizens* and *public sector employees acting impartially when implementing policy*. A one standard deviation increase in *public employees striving to help citizens*, equivalent to the distance between Philippines and Canada, leads to a 109% increase in output per worker. Similarly, a one standard deviation increase in *public employees impartiality when implementing policy*, equivalent to the distance between Estonia and Canada,

TABLE 7. Public sector wages and mail efficiency.

	$\text{Ln} \left(1 + \frac{r^*S}{L} \right)$			
Ln letter boxes per staff	0.547*	0.423	1.051***	1.059*
	[0.291]	[0.267]	[0.331]	[0.515]
Postcode databases	2.783***	2.732***	2.653**	2.468
	[0.849]	[0.834]	[0.994]	[1.568]
Alphabet used is Latin-based	0.842	0.512	1.023	2.153
	[0.703]	[0.698]	[0.813]	[1.779]
Ln distance from country to US	-0.059	-0.221	-0.290	-0.012
	[0.375]	[0.357]	[0.443]	[0.485]
Senior officials with salaries comparable to to salaries of managers of private sector	0.312			
	[0.224]			
Salaries of public administration workers are linked to performance appraisals		0.665**		
		[0.289]		
Avg. government wage/GDP per capita			0.016	
			[0.123]	
Postman salary/GDP per capita				1.292
				[1.494]
Constant	7.266**	7.817**	10.474**	6.590
	[3.643]	[3.172]	[3.980]	[6.010]
Observations	103	102	84	25
Adj. R-squared	0.30	0.34	0.39	0.34

Notes: The table presents robust OLS regressions for all the countries in our sample. Robust standard errors are shown in parentheses under each coefficient. Significance levels: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

leads to a similar 110% increase in output per worker. Interestingly, a one standard deviation increase in *public sector employees striving to fulfill the ideology of the governing party*, equivalent to the difference between Canada and Mexico in this variable, leads to a 51% decrease in output per worker.

Table 7 shows, in contrast, that neither the comparability to the private sector wage variable from DLT, nor the two relative public sector and postal service wage variables we added to the data set, help explain postal output. The result that relative wages of public officials are not important in predicting productivity is consistent with earlier findings of La Porta et al. (1999) and Evans and Rauch (1999). However, there is some evidence that linking public sector wages to performance appraisals increases postal performance, although this is probably best interpreted as a quality of management rather than a wage level variable.

An alternative approach to measuring management quality is to consider private sector management. If economic development leads to improvements in management quality, we should see this in both public and private sectors. This approach also provides an independent check on our evidence for the Weberian hypothesis. After all, the issue in returning the mail is how to get a postal employee to actually do his job of putting the incorrectly addressed letter into a correct (return) container, rather than

throwing it out. This seems to be fundamentally a management task of monitoring employees (it is hard to see how incentives would work).

We consider two groups of management variables. First, we found three survey-based cross-country measures of management quality: will to delegate authority, innovation capacity, and quality of management schools. Second, for 20 countries, we have the Bloom/Van Reenen management practices index, as well as the three sub-indices of monitoring management, targets management, and incentives management. Online Appendix D presents the correlations between nine Weberian questions from DLT and the seven quality of private management indicators we found. Remarkably, measures of professionalism of public administration are strongly positively correlated with the cross-country indicators of the quality of private sector management. In addition, private sector management quality is highly correlated with salaries of public employees being linked to performance. However, there is no relationship between closedness of public administration and private sector management quality. These correlations suggest that, in general, similar management practices shape efficiency in both public and private sectors.

Table 8 presents the results for private sector management and mail efficiency. With the exception of *incentives management* from Bloom/Van Reenen, all the indicators are highly statistically significant. The magnitude of the effect on postal output per worker of increasing the private management variables is also important. Increasing *will to delegate authority* by one standard deviation, or the difference between South Africa and Canada, leads to a 77% increase in output per worker. The *quality of management schools* has the largest economic impact in this table: a one standard deviation increase, equivalent to a move from Malaysia to Canada, raises output per worker by 118%. For the smaller sample of countries, increasing the Bloom/Van Reenen *management practices* index by one standard deviation, the difference between Mexico and Canada, leads to an increase in postal output per worker of 67%. The estimates show that the *monitoring management* subindex has the strongest impact on postal output per worker among the management practice variables: a one standard deviation increase in *monitoring management* is associated with a 78% increase in output per worker. *Targets management* has the smallest impact on postal output per worker but still a one standard deviation increase in this variable is associated with an increase in output per worker of approximately 59%. Professional management in both public and private sectors are key determinants of mail efficiency.

In summary, measures of management quality in the public and private sectors, obtained from very different sources, help explain the variation in postal productivity across countries, just as they do for private sector productivity. We next discuss the robustness of these results.

4. Robustness

Our results on management are cross-sectional, and as such cannot be interpreted as causal. Omitted country characteristics could influence both management quality

TABLE 8. Private sector management quality and mail efficiency.

	$\text{Ln}\left(1 + \frac{r^*S}{L}\right)$						
Ln letter boxes per staff	0.345 [0.283]	0.232 [0.293]	0.259 [0.270]	0.323 [0.200]	0.265 [0.181]	0.293 [0.218]	0.468* [0.218]
Postcode databases	2.746*** [0.696]	2.214*** [0.706]	2.274*** [0.680]	0.183 [0.874]	0.244 [0.783]	0.118 [0.982]	0.565 [1.154]
Alphabet used is Latin-based	-0.022 [0.582]	0.287 [0.571]	-0.106 [0.547]	0.544 [0.513]	0.250 [0.463]	0.599 [0.574]	0.742 [0.753]
Ln distance from country to US	-0.500 [0.382]	-0.323 [0.356]	-0.227 [0.355]	0.078 [0.198]	0.019 [0.183]	-0.092 [0.199]	0.141 [0.303]
Will to delegate authority	0.973*** [0.244]						
Innovation capacity		1.058*** [0.225]					
Quality of management schools			1.388*** [0.222]				
Management practices index				3.049** [1.113]			
Monitoring management Targets					2.790*** [0.818]		
Incentives management						2.357** [0.967]	
Constant	8.700** [3.733]	7.388** [3.389]	4.309 [3.551]	1.025 [4.241]	1.943 [3.161]	4.622 [3.550]	2.435 [5.959]
Observations	137	134	137	20	20	20	20
Adj. R-squared	0.32	0.34	0.37	0.46	0.57	0.39	0.29

Notes: The table presents robust OLS regressions for all the countries in our sample. Robust standard errors are shown in parentheses under each coefficient. Significance levels: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

and postal efficiency. In a cross-section, we found it difficult to come up with a plausible instrument satisfying the exclusion restriction. Alternatively, we examine the robustness of our findings to the inclusion of some additional controls.

These controls can be divided into two categories. First, there are geographic, legal, political, and social controls that are specific to the possible efficiency of the mail system. We have conducted a large number of these checks, and present the results in Online Appendices F, G, H, and I. While the extra controls are significant on occasion, they do not alter our basic findings on the importance of technology and management for mail efficiency. Here are the checks we have done.

We have considered an alternative measure of capital stock, the number of permanent offices per capita (Online Appendix F). The coefficient on capital-labor ratio is lower for this variable, and is not statistically significant. However, technology and management remain consistently significant. Next, we have verified that state monopoly on some postal activity does not affect our results. We have also examined several geographic and population controls related to mail specifically: distribution

area, population density of a country, a dummy for the country being landlocked, and some measures of cost and fee adjustment based on geography that are produced by the Universal Postal Union. Some of these measures are significant and add modest explanatory power, but their inclusion does not alter our main results (Online Appendix G). As additional controls, we have considered many standard determinants of the quality of government, such as legal origins, latitude, trust, religion, ethnic heterogeneity, and GDP per capita (La Porta et al. 1999). Religion is noteworthy on this list because Moslem countries might be hostile to the United States and not return the letter. Nonetheless, these variables do not alter our results for technology and management (Online Appendix H).

We have also tried to take advantage of geographic diversity of our addresses within countries. Generally speaking, letters come back faster and more consistently from capital cities, but otherwise we did not find much. There is no evidence, in particular, that letters come back faster from richer places within countries.

A tougher set of robustness checks includes variables such as a country's education, tax capacity, or even GDP. These indicators may proxy for determinants of productivity other than management. For example, education might influence productivity through employee attitudes, yet be correlated with management. Tax capacity could proxy for the quality of postal inputs that we do not pick up, technology, or management (see for example Besley and Persson 2009).

Critically, there is a major risk of over-controlling in such specifications. For example, suppose that more-developed or better-educated countries are more productive in part because they have better management, as shown empirically by Gennaioli et al. (2013). If our management input is measured with error, as it almost surely is, then including indicators such as education or GDP per capita might eliminate and reduce the significance of our management variable not because management does not matter, but because it is measured with error. Similarly, tax collections to some extent reflect how well the government is managed.

Online Appendix I shows the results of adding to the regressions with statistically significant variables in Tables 5–8 one at a time the log of GDP per capita, years of education of the population, years of college of the population, and tax revenues over GDP as a measure of fiscal capacity. We find that per capita income and college education of the population reduce the size and occasionally eliminate the statistical significance of management variables. But even with these enormously powerful catch-all controls, most management variables remain statistically significant. Other controls, such as years of schooling and fiscal capacity, do not reduce the influence of management variables. So, while we cannot conclusively establish the causal influence of management on productivity, the evidence is consistent with the hypothesis that management is the pathway explaining cross-country variation in public sector productivity.

5. Conclusion

This paper has made two contributions. First, we constructed new objective measures of government efficiency in 159 countries, based on return of incorrectly addressed international mail. These measures correlate with other indicators of the quality of government, yet have the advantage that we know precisely what goes into them.

Second, we used these measures to argue that low public sector productivity is in part explained by the same factors as that in the private sector: poor technology and poor management. We document that a range of management variables, such as indicators of professionalism of the bureaucracy, attitudes of public sector employees, and private sector management quality, help account for differences in postal efficiency.

Our findings could shed light on some fundamental puzzles related to the quality of government. The first puzzle, illustrated by this paper, but seen in other research as well (e.g., La Porta et al. 1999; Treisman 2000; Botero, Ponce, and Shleifer 2014) is that the quality of government improves as countries grow richer, even in dictatorships. This fact is surprising if one focuses on the uniqueness of government and on political explanations of its improvement, but makes more sense once it is recognized that government is subject to the same productivity dynamics as the private sector, including the central roles of capital, technology, and management.

The analysis suggests that even the more political aspects of poor government, such as corruption, could be a reflection of problems similar to those of the private sector, such as poor management. Corruption, for example, might be in part a manifestation of the weakness of monitoring and incentive systems in less-developed countries. Perhaps our small findings on the post office could be developed into a broader approach to the efficiency of public and private sectors and their evolution in the course of economic development.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Online Appendix: Letter Grading Government Efficiency.