# Measuring Local-Level Clientelism: A Bayesian Mixed-Membership Approach

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**Abstract**

Scholars of distributive politics often discuss the importance of the use of clientelism. However, since clientelist exchanges occur under the table, we lack strong observational data to estimate the actual prevalence of clientelism. The current solution is to use survey experiments designed to elicit sensitive information in order to create population-level estimates.This measurement strategy, however, does not permit us to estimate within-country variation in the use of clientelism. In order to address this challenge, I propose estimating local-level clientelism using a Bayesian Mixed-Membership model. Using data from Colombia on the employees who are employed as temporary teachers, I model whether the teachers are hired based on their meritocratic qualifications or to fulfill political aims, Specifically, I consider the type of vacancy the teacher fills, the level of education the teacher has, whether their education aligns with what they are teaching, where the school is located within the municipality, how the teacher is paid, and any bonuses received. I use these municipal hiring patterns to estimate the presence of clientelism at the municipal level. These estimates align with survey questions from the same time period.

# 1   Motivation

To what extent do politicians rely on clientelist strategies to build and maintain voter networks? Clientelism, or the targeted exchange of benefits for votes, turnout, or abstention (Kitschelt & Wilkinson 2007), is a tool that politicians use widely to win elections. However, studies of clientelism face challenges in estimating just how often politicians use this strategy to achieve political aims. Given the importance of clientelism in electoral politics, the existing challenges in estimating how often clientelist exchanges occur limits what questions studies of clientelism can answer. While the literature has made advancements in understanding where clientelism occurs, how it occurs, when it is likely to be successful, and the consequences for citizens (Dekel, Jackson & Wolinsky 2008, Calvo & Murillo 2012, Stokes, Dunning, Nazareno & Brusco 2013, Frye, Reuter & Szakonyi 2014, Lawson & Greene 2014, Holland & Palmer-Rubin 2015, Rueda 2015, Larreguy, Montiel Olea & Querubin 2017), it has not been able to fully explore within-country variation in the use of clientelism. As more studies evaluate the limitations of clientelism (Weitz-Shapiro 2012, Gingerich & Medina 2013, Greene 2017), measuring just how much politicians use clientelist strategies, as opposed to other strategies (Luna 2014), is increasingly important.

Measuring clientelism is a particularly difficult task for two reasons. First, clientelist exchanges are discrete and indirect: Targeted exchanges of cash or benefits are not listed in official budgets and jobs are not officially classified as patronage-based. Therefore, there is no explicit data available on clientelist exchanges. Second, in many contexts clientelism is seen as corruption or "dirty" politics. Social norms reduce citizens' likelihood of openly admitting their exposure to clientelist politics.

Three main techniques have been used to overcome these challenges: first, formal models have been used to generate predictions about clientelism that can be tested without explicit estimates of the prevalence of clientelism (Becker 1983, Snyder 1991, Myerson 1993, Lizzeri & Persico 2001, Khemani 2010, Persico, Pueblita & Silverman 2011). Second, many scholars have relied on in-depth qualitative interviews that provide rich data about the specific

nature of clientelist interactions and dynamics (Abers 1998, Muñoz 2014, Ocampo 2014, Zarazaga 2014). Both of these techniques have improved our understanding of clientelism as a phenomenon, but not on how often politicians use clientelist strategies. Third, in order to estimate the prevalence of clientelism, scholars have begun relying on survey list experiments designed to reduce social desirability bias and elicit sensitive information (Blair & Imai 2012, Blair, Imai & Lyall 2014, Greene 2017). These experiments have allowed scholars to estimate clientelism at the national level, but recruiting enough citizens to use survey list experiments for subnational estimates is logistically improbable. A possible risk of relying only on national-level estimates is that these survey experiments ignore areas with remarkably high (or low) levels of clientelism that may be important for shaping national politics. Furthermore, understanding variation in clientelism within country make it possible to conduct inference where clientelism is an independent variable.

I propose an alternative technique for measuring clientelism that makes it possible to generate estimates at the local-level using Bayesian analysis. I develop a Bayesian Mixed-Membership model in order to estimate clientelism using existing data on both the different demographics across subnational units and observed features of public sector employees. This estimation strategy addresses the limitations of existing measures because it uses existing data, rather than new survey data, to robustly estimate the use of clientelism in a way that highlights within-case variation. This estimation strategy helps provide new avenues for studying the effects of clientelism because it can be used to highlight the variance across time, regions, and localities.

## 2   A Model for Local-Level Clientelism

### 2.1   Bayesian Mixed Membership Models

Mixed-Membership models are used to classify data into latent classes (Airoldi, Blei, Erosheva & Feinberg 2014, Joutard, Airoldi & Love 2008). Unlike many classification models

that assume an item can belong to only one class, Mixed-Membership models have the advantage of allowing each observation to have partial membership in multiple classes. Thus, rather than assigning categorical measures, they classify items along a continuum. In the case of clientelism, this is particularly useful because it allows employees to be both qualified and clientelist hires.

In particular, I focus on Hierarchical Bayesian Mixed-Membership Models (Joutard, Airoldi & Love 2008). These models are especially nuanced in their approach to assigning class membership. First, these models are able to pool information at different levels of analysis. As a result, they can account for nested data, such as individuals within households or neighborhoods. Furthermore, using a Bayesian framework means that data at the individual level can be used to update the expectations generated by the group-level data. The approach is crucial for refining estimates when data availability varies widely across the units of interest.

These models have been applied in political science to study text-as-data (as the canonical LDA model is a type of mixed-membership model) and to improve our estimates of ideology (Gross & Manrique-Vallier 2014). Using this strategy permits more nuanced analysis since a unit's classification highlights the extent to which any label applies.

## 2.2 Applying Mixed Membership Models to Clientelism

I build on this tradition by applying mixed membership models to the study of clientelism. The goal of the model is to estimate the amount of clientelism in a given municipality using data at both the municipal level and the individual level.

At the individual level, I use data on public service hires. First, I stipulate that there are two classes of hires in public service: meritocratic hires and patronage hires. Patronage hires represent one particular type of clientelism (viz. the exchange of jobs for political support) but I assume that where patronage occurs, it is more likely that other forms of clientelism coexist. Thus, patronage is a meaningful proxy for clientelism broadly.

I begin with the argument that it is possible for a job to be given to a qualified candidate and still be used as part of a patronage-based exchange. The Bayesian Mixed-Membership model allows me to estimate the degree to which patronage was responsible for the allocation of any given job. The goal of the estimation is to understand what latent unit-level mixtures explain the observed data on temporary hires in order to better understand the use of patronage. In order to do this, I use available data on the demographic and political characteristics of each municipality that correlate with clientelism.

Past research has shown that clientelism is more likely in small municipalities with high levels of need (Kitschelt & Wilkinson 2007). Further, mismanagement of a municipality's finances may indicate hidden behavior, such as clientelism. These municipal demographics can be used to generate informative priors concerning the possible prevalence of clientelism in a municipality.

The initial expectation of clientelism is generated using the following process:

1. There is a matrix, $\mathbf{A}$ that contains $M$ rows and $X$ columns. Each row, $M$, represents a municipality while each column, $X$, is a demographic characteristic for the municipality.

2. Conditional on matrix $\mathbf{A}$, sample a coefficient, $\gamma$, for each municipal-level characteristic.

$$\gamma \sim N(0, 10) \tag{1}$$

3. Using the samples for $\gamma$, estimate $\mu_m$, an expectation of meritocratic hires for each municipality.

$$\mu_m | \gamma = \text{Logit}^{-1}(\mathbf{A}\gamma_m) \forall m \tag{2}$$

I then refine the estimate, $\mu_m$ using the available data about public service hires, in order to generate an estimate, $\pi_m$, for meritocratic hiring in each municipality. I argue that the data on hires is a function of how often any feature of a hire is likely to occur, $\theta$, and an

indicator variable that indicates whether any given observed trait of a hire occurs under patronage, Z. By including this data using the total count of how often any type of job or feature of a hire is observed, the model is able to fit the parameters $\theta$, Z, and $\pi_m$ that best explain the data. In order to do this, I assume the following data generating process:

1. For each municipality, sample a proportion of meritocratic hires, $\pi_m$, that estimates to what extent hiring decisions reflect meritocratic decisions given the number of hires, $n$, in each municipality

$$\pi_m | n \sim \text{Beta}(\mu_m, \phi) \forall m \tag{3}$$

$$\phi \sim \text{Gamma}(2, 2) \tag{4}$$

2. Each hire exhibits a series of characteristics, $J$. For each $J$, sample an indicator variable, $Z$, that tracks whether the observed characteristic is a member of the meritocratic class.

$$z_{mj} | \pi, n \sim \text{Binomial}(\pi_m) \forall m, j \tag{5}$$

3. For each municipality, sample a mixed membership vector, $\theta$, which controls the likelihood of observing characteristics under the patronage and meritocratic regimes.

$$\theta \sim \beta(1, 1) \tag{6}$$

$$\tag{7}$$

4. The data for the presence of any characteristic, $J$, for each municipality, $M$ populate a matrix, $\mathbf{Y}$.

$$Y_{mj} | \theta, Z \sim f(y_{mj} | \theta_j, z_{mj}) \forall m, j \tag{8}$$

The final estimates for municipal-level clientelism are one minus the point-estimates for $\pi_m$ most consistent with both the municipal-level demographics and the profile of characteristics exhibited by the public service hires. The distributions I select are used to best accommodate the structure of the data. The characteristics of hires are all dummy variables where 0 indicates that the characteristic is not present while 1 indicates that the characteristic is present. Since there are multiple hires, the data is a count of how often each characteristic occurs across that municipality's temporary teachers. I use a binomial distribution to classify each indicator. The parameters for municipal-level indicators are estimated using a logit link so that they take values between 0 and 1. The final posterior estimates for $1 - \pi_m$ are the extent to which employment in the public sector reflects patronage.

# 3    Data

I test this estimation strategy using data on teacher hires in Colombia in 2013. In Colombia, clientelist linkages have persisted despite major constitutional changes in 1991 that reshaped the political party system, fractured the two traditional political parties, and facilitated the rise of non-traditional parties and personalistic candidates (Dargent & Muñoz 2011, Bedoya Marulanda & Arenas Gómez 2015). Furthermore, clientelist dynamics vary widely throughout the country, due in part to the intersection of a deinstitutionalzed party system and the presence of external actors throughout the long civil conflict (Eaton 2006, Holland & Palmer-Rubin 2015). Notably, these features make it difficult to trace the use of clientelism using political party networks and any national-level estimate risks underestimating the importance of clientelism in some regions where traditional personal networks are still central to politics.

I use patronage because during field research in 2016-2018, interview subjects throughout Colombia identified patronage as a particularly salient concern.[1] I focus specifically on teacher hires because, in addition to permanent employees, temporary employment occurs

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[1]Interviews conducted July-August 2016 and July-December 2018

frequently due to inefficiency in the civil-service appointment of teachers.[2]  Furthermore, qualitative interviews suggest that the number of teachers is often inflated to help the municipality receive additional funds from the central government, increasing the opportunity for politically-motivated hiring practices.[3]

My data is generated at two levels. At the municipal level, I create the base-estimates for the risk of clientelism using characteristics of municipalities that past research has shown to be associated with clientelism (Kitschelt & Wilkinson 2007, Weitz-Shapiro 2012, Lucciasano & Macdonald 2012, Stokes et al. 2013). First, I consider the fiscal responsibility of the municipality. In Colombia, this indicator is produced by the central government and considers whether the municipality manages their funds efficiently. A municipality with better transparency in their financial reporting and more efficient spending patterns should have lower levels of clientelism. Then, I consider the level of material need in the municipality using the number of homes enrolled to receive additional social benefits. Since clientelism often targets lower-income populations, municipalities with higher levels of enrollment should be more prone to clientelism. Third, I consider the population of the municipality. In particular, I use the school-aged population since I focus explicitly on teachers. This measure is essential since clientelism tends to occur more often in smaller municipalities where citizens can be more easily monitored. However, there may be more clientelism where the number of students is artificially inflated. Thus, I am agnostic about the effects of population.

In order to refine the estimates of clientelism for each municipality, I use the profile of characteristics of the employed teachers. I identify whether a teacher has the requisite qualifications by coding whether their educational attainment matches the requirements for the position they are hired for. Less qualified teachers are more likely to reflect politically-motivated hires. I then consider where the employee's job is located using two characteristics. The first is if they are at a single school, in a single district, or in a "floating position" where the teacher travels as needed. The second is whether the school they are employed in is in

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[2]Ibid

[3]Interview conducted July 2016

an urban or rural area within a municipality. These measures seek to explore how visible the teacher is: floating teachers in more rural areas are likely to be less monitored and may reflect more political hires. Next, I consider how the teacher is paid: using the municipality's resources or the resources from the national government ear-marked for education spending as well as if they received a bonus for their work. In Colombia, teachers are supposed to be paid through the national government education funds, the Sistema General de Participacion (SGP). Thus, receiving larger bonuses or being paid through the municipalities own resources may signal that clientelism is occurring. In order to fully understand the nature of temporary employment, I identify the type of vacancy the teacher fills (tenured permanent vacancy, a definite vacancy, a temporary long term vacancy, a temporary short term vacancy, or other temporary vacancy), the type of teacher the employee is, and if the employee is from a minority ethnic group. These variables help me observe patterns in who the municipality hires for public service jobs. The occurrences of each characteristic that employees posses, conditioned on the information about the municipality they work in, allow me to estimate the use of clientelism for each municipality.

# 4   Results and Validity Checks

I estimate the level of clientelism from 0 to 1 using one chain with 100000 samples and a burn-in of 10000. This model passes all standard convergence tests and has a maximum Rhat value of 1.000 I find that municipal estimates range from 0.158 to 0.662 with a mean level of clientelism of 0.362. The estimate suggests that clientelism is quite common in Colombia, but highlights the variation in just how often it occurs in any given municipality. A map with the distribution of levels of clientelism in 1086 municipalities can be found in Figure 1.

Figure 1 displays the variation across Colombia. On average, areas along the coast and the Amazon rainforest are darker, indicating higher levels of patronage. This offers some face validity for those familiar with the case of Colombia. The Colombian Civil conflict involved
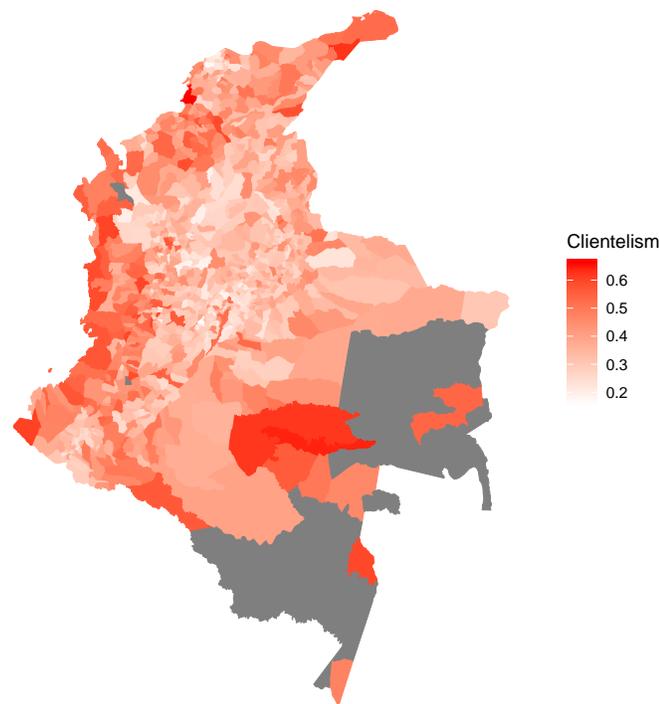
Figure 1: Estimates of Clientelism in Colombia, 2013

large concentrations of militant groups, including the FARC, near the Amazon rainforest. These groups were also involved in clientelist exchanges, acting as brokers for politicians in these areas (Eaton 2006). Moreover, qualitative research has established that clientelism is quite frequent along the coast. Ocampo (2014) draws attention to the prevalence of clientelism in the department of Córdoba from 1950-2010. In my data, the mean level of clientelism in Córdoba is 0.427 while in the rest of Colombia, excluding Córdoba, the mean is 0.366. This difference is statistically significant at the $p < 0.01$ level and suggests that clientelism is much more common in this region of the country.

## 4.1  Validation Tests: Clientelism and Corruption

While clientelism and corruption are fundamentally different concepts, they often tend to covary. I expect that more clientelist municipalities are also more likely to be municipalities that citizens perceive as corrupt. I test whether my measure of clientelism aligns with this expectation using data from the Latin American Public Opinion Project (LAPOP) surveys in Colombia from 2012, 2013, and 2014. These surveys were all taken during the mayoral term that ran from January 1, 2012 to December 31, 2015 so that the same leaders were in office as during the year used to estimate municipal-level clientelism. I identify two question from the 2012, 2013, and 2014 rounds of LAPOP surveys that measure perceptions of corruption.

I consider a question asking citizens to what extent the government combats corruption. The citizen's respond on a scale from 1 "they do nothing" to 7 "they do a lot". If my estimate of clientelism is valid, I would expect citizens in municipalities with high levels of clientelism to be less likely to report that the government is working to combat corruption. I run an ordered logit and find support for this: the coefficient is negative and statistically significant.[4]  In Figure 2a, I highlight three categories of responses: the government does nothing, the central category where the government does some, and the government does a lot. As the level of clientelism increases, the probability that respondents answer that the government does nothing increases while the probability that respondents say the government does some or a lot decreases.

I repeat this test using a question asking citizens how widespread corruption is in public officials. Citizens could respond to this question on a four-point scale ranging from "not widespread" to "very widespread". If my estimates of clientelism are valid, I expect that citizens in municipalities with higher estimates of clientelism are more likely to respond that corruption is "very widespread". I find that citizens in more clientelist municipalities are more likely to perceive public officials as corrupt. The coefficient for clientelism is positive and statistically significant. As seen in Figure 2b, where there are higher levels of clientelism the

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[4]Regression Table is available in the Appendix

probability that citizens identify corruption as very widespread increases, and the probability that citizens respond that corruption is not widespread decreases. These tests, as well as the qualitative support, suggests that the measure is capturing where patronage is most common throughout the country.
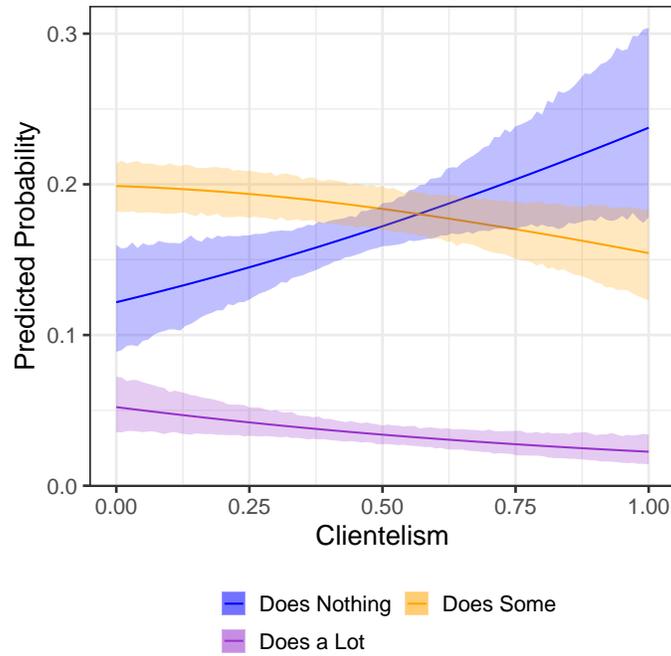
(a) Predicted Probability of Perceptions that the Government Prevents Corruption
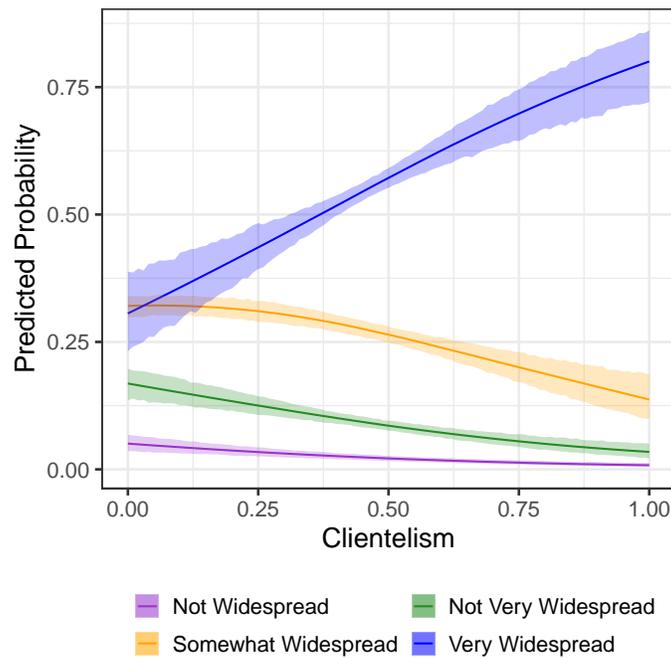


(b) Predicted Probability of Responses for Perception of Corruption in Public Officials

Figure 2: Predicted Probability of Survey Responses Given Clientelism in the Respondent's Municipality

# 5    Applying the Measure

With a new method of estimating local-level clientelism, researchers can answer a series of questions that could not be answered before. For example, we can ask how the presence of clientelism changes citizens perceptions of their local officials. In the LAPOP surveys, citizens are asked "to what extent do you have confidence in your mayor?". The respondents answer on a scale from 1 to 7, where 1 is no confidence and 7 is the most confidence. Using an ordered logit regression, I find that citizens in municipalities with a higher level of clientelism are less likely to have confidence in their mayors.[5] In figure 3 I plot the predicted probabilities that citizens respond they have no trust, some trust, or complete trust in their mayors based on the presence of clientelism in their municipality.
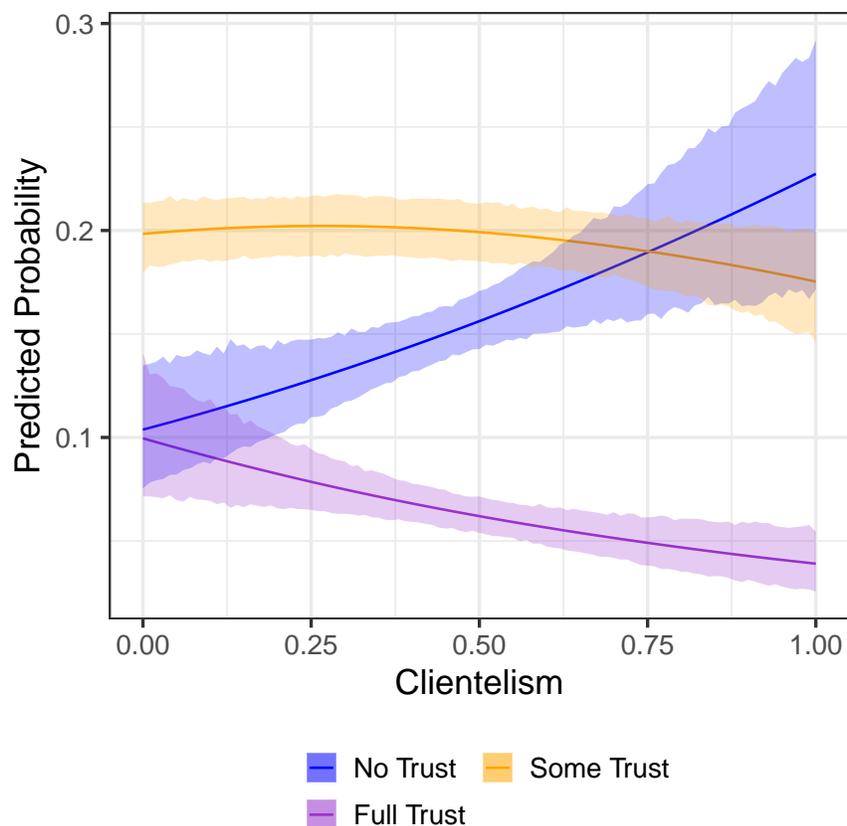
Figure 3: Predicted Probability of Responses for Trust in Mayor

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[5]See appendix for regression table

Moreover, with an estimate of clientelism at the local level it is possible to test whether mayors who are reelected are more likely to engage in clientelist behavior than mayors who are serving their first term in office. I use election results from the 2003 and 2011 elections in Colombia in order to identify which mayors serving from 2012-2015 had been in office the last term they could legally serve, from 2004-2007. In 2011, 6.43% of elected mayors had served from 2004-2007. I use a difference of means test to compare estimated levels of clientelism in 2013 between the two groups. I find that the average estimate for clientelism in municipalities with reelected mayors is 0.333 while the average estimate of clientelism in municipalities where the mayor did not serve from 2004-2007 is 0.362. This difference is significant at the $p < 0.01$ level and suggests that the returns from using clientelism may decrease as politicians have served more terms in office.

# 6  Discussion

In this paper, I present a novel application of mixed-membership models as a tool to estimate clientelism at the local level. Using data from Colombia in 2013, I find that mixed-membership models help to distinguish which municipalities have higher relative levels of clientelism. This measure is validated using survey questions from the Latin American Public Opinion Project on corruption during the same mayoral period.

Having a method to estimate local-level clientelism greatly contributes to our ability to answer questions about the effect of clientelism on politics. For example, with information about clientelism at the local-level, we can better evaluate how the use of patronage affect the probability of reelection or how the use of patronage correlates with politician's margins of victory. These advances will bring scholars of clientelism closer to estimating the actual effect of clientelism on electoral outcomes.

This model can easily be applied in additional contexts. The same strategy can be used in any country that uses patronage to target voters. When there is available data on temporary

hires, it is possible to apply my Bayesian Mixed-Membership estimation strategy in order to estimate relative levels of patronage across geographic units. Similarly, this estimation strategy can be used to evaluate how the use of patronage varies across public sectors. Using data from other sectors, scholars can answer questions about how the public sector using patronage affects the types of voters who can benefit. Finally, this strategy can be used to observe how the use of patronage has changed over time in the same geographic unit. Using a Bayesian hierarchical mixed-membership model to estimate clientelism opens a new avenue for clientelism research. With an estimation strategy for observing variation in the use of clientelism across geographic units, scholars can better analyze the extent to which clientelism affects elections and redistribution.

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# Appendices

## A Regression Results for Validity Checks

|  | Ordered Logit: Government Combats Corruption |
| --- | :---: |
| Municipal Clientelism | −0.879** |
|  | (0.362) |
| AIC | 11650.459 |
| BIC | 11704.585 |
| Log Likelihood | −5816.230 |
| Deviance | 11632.459 |
| Num. obs. | 3023 |

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table A.1: To what extent does the government combat corruption?

|  | Ordered Logit: Corruption in Public Officials |
| --- | :---: |
| Municipal Clientelism | 2.213*** |
|  | (0.391) |
| AIC | 7022.569 |
| BIC | 7058.653 |
| Log Likelihood | −3505.285 |
| Deviance | 7010.569 |
| Num. obs. | 3023 |

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table A.2: How widespread is corruption in public officials?

# B    Results for Model Application

|                       | Ordered Logit: Trust in Mayor |
|-----------------------|:-----------------------------:|
| Municipal Clientelism | $-1.010^{***}$                |
|                       | $(0.361)$                     |
| AIC                   | 11921.486                     |
| BIC                   | 11975.612                     |
| Log Likelihood        | $-5951.743$                   |
| Deviance              | 11903.486                     |
| Num. obs.             | 3023                          |

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table B.1: To what extent do you trust your mayor?
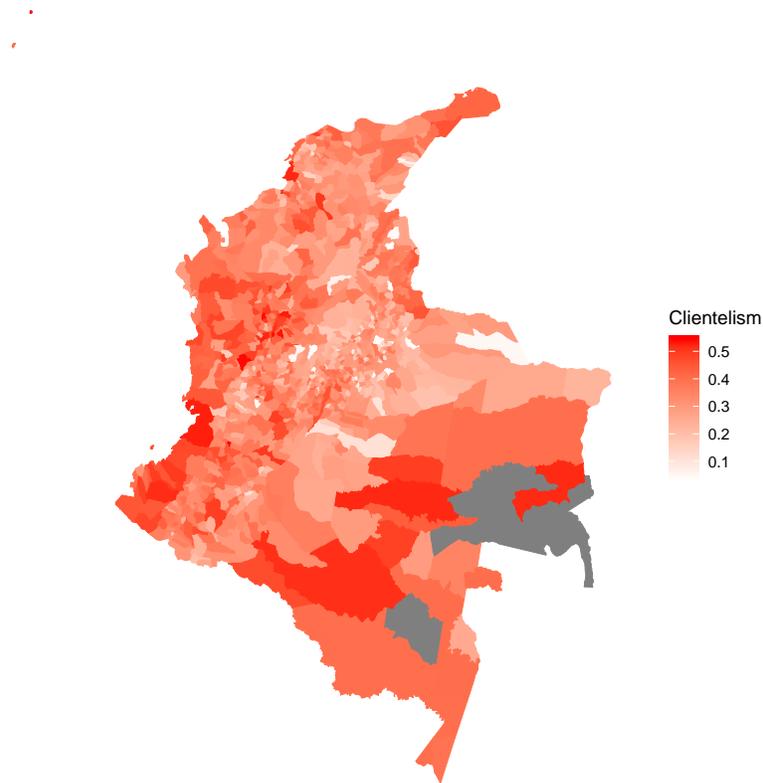
# C    Imputation Results for Municipalities Without Hires



Figure C.1: Patronage Map with Imputations