Autocratic Survival and the Introduction of Succession Rules

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Abstract

Why do autocrats have succession rules and successors? According to a recent wave of research, autocrats have succession rules when they expect to lose power. Successors increase certainty over the regime's future and protect the autocrat from coups. Previous work assumes that autocrats have succession rules when endangered and tests the effects of succession rules on survival. In contrast, I argue that secure autocrats are more likely to have succession rules because they can prevent coups from successors and ambitious elites. I conduct the first test of whether survival probability influences having succession rules and a create a novel measurement of survival probability using machine learning. I find support for my argument. Higher survival probabilities increase the probability of having succession rules and successors. My results suggest that the relationship between succession rules and survival needs to be revisited. They also demonstrate the importance of studying institutions' causes for studying autocracies. To understand the effects of institutions, we need to understand their causes.

1   Introduction

Why do autocrats have succession rules? Having a successor threatens the autocrat by introducing a new rival. The successor has the motivation to overthrow the autocrat and has increased resources to succeed in carrying out a coup. The current consensus is that autocrats who expect to lose power, despite the risk, establish successors and that successors help stabilize the autocrat's rule.[1] As a result, autocrats with successors are less likely to be overthrown.

While a new wave of studies tries to evaluate succession rules' effects, none has tested whether endangered autocrats are, in fact, more likely to have successors. Autocrats likely to survive have created succession rules, however. For one example, François "Papa Doc" Duvalier of Haiti formally wrote succession plans in the constitutions. His constitutional reforms in 1971 established his son Jean-Claude "Baby Doc" Duvalier as Haiti's next president for life. Papa Doc was extremely secure in power, unopposed even on his deathbed (Nicholls 1986; 1996; 1998). Retaining power could not motivate Papa Doc's introduction of succession rules.

In this paper, I conduct the first test of whether the probability that an autocrat retains power affects having a successor.[2] There are plausible reasons why a secure autocrat might have a designated successor. I focus on one explanation: Autocrats can use succession rules to reward key allies. But the most important point is that secure autocrats have fewer costs from successors because they have a greater ability to prevent coups. I find evidence that more secure autocrats are more likely to have succession rules. No evidence supports the existing argument that less secure autocrats have succession rules.

I test the relationship between survival probability and succession rules with two different definitions of succession rules used in previous empirical work. Broadly, succession rules establish a continuity of government. They provide procedures for when the chief executive leaves office, typically through death or incapacitation, before the executive's term expires. Succession rules can be informal. They can be norms that assign actors like ruling parties

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[1] A recent exception is Zhou (2023). In Zhou's formal model, the loyalty and threat of the successor is dynamic over time. Further, Marsteintredet and Uggla (2019) document how vice presidents have threatened presidents in Latin America, but their argument is not exclusive to autocracies.

[2] I use the terms "autocracy," "authoritarianism," and "dictatorship" interchangeably for political regimes where competitive elections do not determine political power (Cheibub, Gandhi, and Vreeland 2010). "Autocrat" and "dictator" refer to leaders of autocratic regimes.

the ability to choose successors. Succession rules can also come in the form of a designated successor. A designated successor is an office specified in the constitution, usually called the vice president. If the chief executive dies, the designated successor takes power for a pre-specified period of time.

I also measure survival probability with two methods. For a new measure, I use predicted survival probabilities from a machine learning algorithm, random forest. The random forest model estimates highly accurate survival probabilities. Political scientists have increasingly used machine learning predictions as covariates (Flaherty 2022; see also Knox, Lucas, and Cho 2022). No previous study has applied machine learning to leader survival as a covariate. Machine learning models have great predictive power but come with drawbacks like the risk of overfitting and increased uncertainty. I complement the machine learning predictions with a previously-used measure of stability, the number of leader turnovers divided by the number of years that the autocracy has existed (Li 2009; Przeworski et al. 2000, chap. 4). Both provide evidence that autocrats more likely to survive have successors.

Succession rules have important consequences for autocracies and institutions. Succession rules are important in and of themselves. Succession is core to autocratic politics. Autocrats seek to retain power and must guard against threats from their inner circles (Bueno de Mesquita et al. 2003; Svolik 2012). The current consensus argues that succession rules help autocrats share power with elites, stabilizing their rule and prolonging their time in power.

Succession rules help reduce uncertainty over the regime's future. Elites, the most important and privileged members of the regime, want to ensure that the regime survives. Elites receive rewards for supporting the autocrat, but losing power risks exile, imprisonment, torture, and death. Elites are especially vulnerable after an autocrat dies. The regime could fall, or the next autocrat could reshuffle their core supporters. Elites may preemptively remove an autocrat from power to avoid the autocrat dying in office and ensuring that the regime survives (Bueno de Mesquita and Smith 2017; 2018). Having a designated successor can assure elites that the regime will survive the incumbent, dissuading a preemptive coup.

Designating a successor, however, has a natural danger. Herz (1952) introduced the crown-prince problem that subsequent scholars have sought to resolve. An autocrat may wish, or

find it advantageous, to designate and prepare a successor. But, "To select a man with the boldness and the ambitions which dictatorial leadership seems to require may make him a center of independent power during the dictator's régime" (Herz 1952, 30). The designated successor—the crown prince—has both the means and motive to overthrow the autocrat. The successor gains resources and influence through their position. They would rather take power immediately and not risk losing their position. A designated successor may placate elites but introduces a new rival to the incumbent autocrat.

Succession rules have been studied most extensively in the context of primogeniture in medieval European monarchies. Primogeniture is a succession rule in monarchies where the monarch's oldest child, traditionally the oldest son, inherits the Crown when the monarch dies. Tullock (1987) proposed that primogeniture resolves the crown-prince problem (chap. 8). Primogeniture provides the regime with an immediate heir to organize around who is also young enough to wait for the monarch's death (see also Kurrild-Klitgaard 2000). Consistent with Tullock's predictions, monarchs who implemented primogeniture were less likely to be violently overthrown (Kokkonen, Møller, and Sundell 2022; Kokkonen and Sundell 2014).

Increasingly, scholars are studying succession rules in modern autocracies. Succession rules, either formal or informal, reduce political instability after assassinations (Iqbal and Zorn 2008) and reduce the probability of attempted coups (Frantz and Stein 2017). The more recent theoretical innovation is the barrier effect. The barrier effect argues that successors, rather than posing a threat, commit to the regime. The designated successor protects the autocrat because the designated is most likely to take power if they wait for the autocrat's death. Overthrowing the incumbent also requires overthrowing the designated successor. The increased cost from the designated successor's "barrier" lowers the utility of committing coups (Konrad and Mui 2017; Meng 2020, chap. 7; 2021b).

If the current consensus is correct, succession rules are powerful tools for autocrats. Succession rules can resolve a core challenge in autocracies, assuring elites that the regime can continue without threatening the incumbent. Succession rules could have further effects not yet explored. Instability opens opportunities for democratization through mobilizing oppositions (Treisman 2015) and creating elite splits (Miller 2021). Succession rules reduce destabilizing

effects of leader turnover, creating fewer opportunities for democratization.

More broadly, succession rules speak to the challenges of studying autocratic institutions. The comparative study of autocracies has taken an "institutional turn" (Pepinsky 2014, 632). Most studies of autocratic institutions focus on major, nominally democratic institutions like constitutions, elections, legislatures, and parties (e.g., Albertus and Menaldo 2012; Boix and Svolik 2013; Brownlee 2007; Cox 2009; Ezrow and Frantz 2011; Gandhi 2008; Gandhi and Przeworski 2007; Magaloni 2006; Miller 2015; Wright 2008). Nominally democratic institutions facilitate bargains between autocrats and elites. Institutions provide means for elites to share power, influence policy, and monitor the autocrat's behavior. The autocrat, in return for their concessions, stays in power longer. Autocracies with institutions have longer-tenured leaders and more stable regimes.

Studying the effects of institutions faces a fundamental problem. Institutions are themselves political outcomes. If institutions shape outcomes, actors have induced preferences over institutions. Institutions, certainly, can affect outcomes, but the forces that shape outcomes likely influence institutions too (Riker 1980). The institutional turn in comparative autocracy has struggled to address the endogeneity of institutions (Pepinsky 2014). Succession rules confront the same problem. If secure autocrats are already likely to have successors, existing findings are potentially spurious.

Studies of succession rules recognize possible endogeneity, but the problem still needs to be addressed. The most common strategy, from the European monarchy literature and following Jones and Olken (2005), uses natural deaths of autocrats as quasi-random variation. Outcomes are compared between monarchs who died of natural causes based on whether they had succession rules (e.g., Abramson and Rivera 2016; Kokkonen, Møller, and Sundell 2022; Kokkonen and Sundell 2014, 2020). The natural death approach can only test outcomes after the autocrat's death. An autocrat who dies in office, by definition, was not overthrown. The natural death approach cannot test whether succession rules affect stability during the autocrat's life.

Frantz and Stein (2017) use an instrumental variable strategy. They instrument for institutionalized succession using the first regime after independence. Institutionalized succession has a significant, negative effect on coup attempts in the instrumental variable estimates. But

the instrumental variable likely violates the exclusion restriction.[3] The exclusion restriction, practically, requires that the instrument does not have a direct or unobserved alternate effect on the dependent variable. But the first leader and regime after independence survive longer and are more stable (Bienen and van de Walle 1989). Unless the effect occurs only because the first leader and regime are more likely to have succession rules, the exclusion restriction is violated. Even mild violations of the exclusion restriction can severely inflate coefficient estimates (Lal et al. 2021).

Finally, Meng (2020; 2021b) argues against endogeneity as a concern. Meng (2021b) writes that

> a leader who is *already* secure and anticipates a smooth succession has no reason to create succession policies since a peaceful leadership transition is possible *without* institutions...We should therefore expect incumbents who are *most likely* to experience *violent* leadership transitions to create succession policies. (957; emphasis in original)

The goal of this paper is to test the assumption that autocrats have succession rules when they are less likely to survive. Once this contention is tested, the opposite conclusion is supported.

In the next section, I provide an argument for why we should expect to see more secure autocrats have successors. More secure autocrats are less vulnerable to coups and, therefore, have lower costs for successors. Section 3 overviews the research design. I model the probability of having succession rules with a dynamic probit model and random effects. I use two different measurements of succession rules and survival probability, including a novel measurement from machine learning. In section 4, I discuss the results. I find that succession rules and successors are more likely when autocrats are more likely to survive, contradicting the current consensus. Section 5 concludes.

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[3]Whether the post-independence regime instrument satisfies the strong instrument requirement is also questionable. In political science, the conventional standard is that the first-stage F-statistic surpasses 10. Both of Frantz and Stein's (2017) instrumental variable estimates meet the conventional standard ($F = 51.59$ and 16.02). Lee et al. (2022), however, find that the standard should be $F > 104.9$. Neither model meets the revised standard.

2 Argument

I argue that secure autocrats are more likely to introduce designated successors. Successors provide leaders with a powerful mechanism for distributing patronage, but the successor comes with costs. The successor can evolve into a powerful rival who may stage a preemptive coup. Ambitious elites not chosen for succession may also see a coup as a means of taking power. Although a marginal increase in survival is more valuable to endangered leaders, designated successors are narrow, targeted institutions. An endangered autocrat needs more comprehensive institutions to stabilize their rule. The costs, meanwhile, are much lower for a secure leader who can better protect themselves from coup attempts. When weighing the benefits and costs of appointing a successor, the benefits are more likely to outweigh the costs when the autocrat is likely to retain power.

2.1 Why Designate a Successor?

Designated successors offer the autocrat a vehicle for distributing patronage. Research on African politics shows that executive cabinets are critical tools to autocrats for distributing patronage (Arriola 2009; Francois, Rainer, and Trebbi 2015; Jackson and Rosberg 1982; van de Walle 2007). Autocrats appoint key allies to the cabinet, and appointees receive rents in return for their loyalty. The appointees can use their positions to distribute rewards to their own supporters, securing loyalty from larger groups.

The designated successor provides a particularly valuable office for distributing patronage. The designated successor comes with resources and importance. The designated successor also has a unique source of utility. If the autocrat dies, the designated successor becomes the autocrat. A weaker designated successor may still need to compete against other members of the regime to take power permanently, but they have a structural advantage. From being the designated successor, they gain more power than others in the regime. They also serve as a focal point for the military and elites to organize around in a potentially chaotic fight over succession. Nobody else in the regime has the designated successor's advantages in the succession process.

Creating a designated successor provides the autocrat with a powerful tool for distributing

patronage. Designated successors can be used for securing essential alliances and supporters. Designated successors have been held by leaders of another major ethnic group, political faction, or even other political parties. Military regimes have occasionally used successors to shore up support with the civilian sector. If a secure autocrat wants to further strengthen their position, a designated successor is among the autocrat's most valuable strategies.

Robert Mugabe, who ruled Zimbabwe from 1980 to 2017, illustrates how an autocrat can use a designated successor to secure key alliances. Mugabe's appointment of Joice Mujuru as first vice-president from 2004 to 2014 bolstered Mugabe's hold on power. Mujuru led one faction of the ruling ZANU-PF. She was rivaled by Emmerson Mnangagwa, a protege of Mugabe who controlled his own faction in the party. Mujuru's husband, the general Solomon Mujuru, was arguably the second most powerful person in Zimbabwe until his death in 2011. Her appointment to the vice presidency balanced the competition between Mujuru and Mnangagwa and ensured that a critical ally remained loyal (Chan 2019).[4] Mugabe's own strength was critical to having the vice presidency as a tool for managing his regime.

2.2 Why *Not* Designate a Successor?

Designating a successor creates two potential sources of rivals. The first, as identified in the crown-prince problem, is the successor themselves. The successor gains power and resources from their position and has incentives to take power as soon as possible. The second source, which has not been considered in previous arguments,[5] is elites not designated the successor. Naming a successor names who is *not* the successor. An ambitious elite not named the successor may attempt a coup as their only path to power.

The designated successor has obvious motivations to remove the incumbent autocrat. Most successors will want to maximize their utility by maximizing the time that they rule as the autocrat. Designated successors can stage a coup to remove the autocrat early and hold power

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[4]Mugabe would later prove less adept at using the vice presidency. In 2017, Mugabe removed Mnangagwa as first vice-president to position First Lady Grace Mugabe as the ultimate successor. Mnangagwa led a successful coup against the Mugabes less than a month later.

[5]Konrad and Mui (2017) are a partial exception. Their formal model has three players: the ruling autocrat, or the king; the designated successor, or the prince; and a member of the elite, or the duke. They focus on how the prince prevents the duke from committing a coup through the prince forming an additional obstacle to an additional coup. In my argument, the appointment of the prince itself could spur the duke to coup.

longer. Not all designated successors will have the ability to stage a successful coup when appointed. Over time, the designated builds their power and increases the probability that a coup succeeds.

Further, the designated successor is more likely to lose their position the longer that they wait for the incumbent to leave. The laws of politics do not supersede the laws of biology. A designated successor becomes more likely to die as they wait. The designated successor's growing power also suggests a strategic response from the incumbent. The incumbent can remove the designated successor before they grow too powerful. Regularly rotating designated successors minimizes the risk of a coup because the successor will not amass sufficient power. Elites will be less likely to develop relationships with the designated successor because they do not expect the current designated successor to remain in office for an extended time. Committing a coup can prevent the designated successor from losing power.

The successor is not the only potential challenger. Several elites in the regime may aspire to take power. Appointing a successor cuts off other elites from taking power peacefully. Once the succession is established, a coup may provide the only method through which a non-successor can gain power. Certainty can provide utility for elites looking to the regime's future, but too much certainty can trigger a backlash. The overthrow of Mugabe, for example, was triggered by his firmly establishing the first lady as his successor. The choice of a successor made a coup the only strategy available to the opposing candidate.

Strategic ambiguity was also a key feature of the success of the *dedazo* system in Mexico. The *dedazo* facilitated 11 peaceful transitions of power every six years from 1934 to 2000. Under this system, the outgoing president would select their successor from the cabinet near the end of their term.[6] Regardless of the candidates being considered, the president always maintained the appearance that three or four people were under consideration. The president waited as long as possible until relaying the decision to the party, who would organize around the successor before the losers could take any action (Castañeda 2000; Langston 2006). Maintaining partial uncertainty helped prevent coups by reducing the ability of those not chosen to act.

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[6]The term *dedazo*, typically translated to "tap of the finger" or "finger strike," referred to president singlehandedly choosing his successor.

The focus on European primogeniture has overlooked the role that uncertainty also plays in monarchies. The Middle Eastern monarchies, which compromise most of the remaining ruling monarchies, do not practice primogeniture. The choice of successor requires consensus from the ruling family, and the designated successor position, usually called the crown prince, can remain vacant for extended periods (Herb 1999). Historic monarchies practiced rules that created even further uncertainty. For two centuries, the Ottoman Empire practiced no formal succession rule at all. The sultan distributed his sons across provincial governorships. When the sultan died, the princes raced to the capital. Whoever convinced the court and military to support them became sultan. The rest were murdered (Quataert 2005). Creating certainty over succession can introduce threats from both the successor and ambitious elites.

2.3   Who Appoints a Successor?

Appointing a successor has countervailing effects. If the successor is dissuaded from staging a coup, the autocrat can gain a powerful ally and increase their hold on power. The successor, if they gain sufficient power, can also evolve into a rival for power. The relationship is not necessarily constant over time (Zhou 2023). Even if the successor is placated, elites excluded from succession may stage coups as their only path to power. The decision to introduce a successor, then, follows a basic cost-benefit analysis. An autocrat introduces a successor when they believe that having a successor is more likely to create a supportive successor than spur coups. A successor is most likely to have a net positive effect on the autocrat's security when they are secure enough to prevent coups.

A more secure autocrat is less threatened by the designated successor. An autocrat is more secure when they are less likely to lose power through any reason other than death. I look at any type of removal because institutionalized autocracies can lead to regular, peaceful transfers of power. The autocrat's primary goal is to keep power. Autocrats likely prefer peaceful removals to violent ones. Sacrificing power until the regime can fully control leader turnover, nonetheless, contradicts the autocrat's interests.

Several factors contribute to an autocrat's security. Secure autocrats typically have more control over the regime, which involves control over appointments to important offices and a

lack of constraints from institutions (Gandhi and Sumner 2020). While most autocracies have institutions like elections, legislatures, and parties, not all effectively constrain the autocrat's control over the regime. The most important element of an autocrat's power is their control over the military and security services. Violence and the threat of violence are key to autocratic regimes (Svolik 2012). In many regimes, violence directly determines who holds political power; in others, the threat of violence keeps elites together. They threaten the autocrat and other elites with rebellion if they violate agreements. An autocrat who controls the military and security services can better withstand challenges to their rule and control other elites. A designated successor must use violence to preemptively overthrow the leader. Coups require cooperation with the military and security services. An autocrat with more control over the military and security services can ward off threats from the designated successor.

A potential counterargument is that designated successors provide greater marginal benefits to insecure autocrats, so the benefits could outweigh the costs. An insecure autocrat needs tools to keep power. Adding a designated successor could dramatically change their fortunes while granting a secure autocrat only marginally more security. Designated successors, however, do not provide the resources to stabilize an insecure leader. Autocrats frequently need to "co-opt" the opposition, bringing them into the regime or at least earning their support (Gandhi and Prze-worski 2006). Autocrats can pursue two types of strategies to co-opt the opposition. They can cooperate with the opposition. Cooperation involves giving policy concessions and expanding access to political office. Elections, legislatures, and parties can facilitate cooperation and make agreements between the autocrat and new supporters more credible.

Autocrats can also distribute rents to new supporters. Distributing rents buys support for the autocrat by directly giving them resources and power. Designated successors facilitate distributing rents. Whereas elections, legislatures, and parties give benefits to large groups, designated successors have an extremely narrow target. Only the designated successor directly benefits from their position although they can redistribute some of their rents to supporters. The autocrat would need a powerful person to appoint the as successor to secure their position, reintroducing the crown-prince problem. Designated successors do not create bargains between autocrats and supporters where the autocrat sacrifices some power. Instead, the autocrat buys

support.

Designated successors are also poor tools to enforce commitments between autocrats and elites. Institutions can crystallize power-sharing agreements. If the autocrat reneges, the elites remove the autocrat (Boix and Svolik 2013). Enforcing institutions require the autocrat to distribute rents and sufficiently reallocate power (Meng, Paine, and Powell, forthcoming). The designated successor, as discussed, is the most dangerous office in which to place a powerful individual. The designated successor is a focal point for dissatisfied elites to organize around, presaging a coup. An insecure autocrat could further threaten their position by using a designated successor to enforce agreements.

In short, the costs of having a successor are more likely to outweigh the benefits for threatened autocrats. Having a successor can increase an autocrat's security, but because it is a targeted strategy, the potential benefits should be similar between weak and strong autocrats. The autocrat needs to believe that the successor is unlikely to stage a coup and that other elites will not commit coups to take power. Coups are more likely to succeed against weaker autocrats, so successors and elites are more likely to favor coups against them. In contrast, stronger autocrats can dissuade coups and keep successors placated. They can expect that the successor will strengthen their position and not plan coups against them. Weaker autocrats—because the costs of potential coups outweigh the benefits of a potential ally—should favor alternative strategies that satisfy elites and provide fewer motivations for preemptive coups.

3   Research Design

I identify the sample of autocracies using the Democracy-Dictatorship dataset (Cheibub, Gandhi, and Vreeland 2010). The data primarily span from 1946 to 2008, but the data can extend to the 1870s for autocracies that began before 1946. A country is autocratic if it violates at least one of the following criteria: One, the chief executive is chosen by popular election or by a body chosen by popular election; two, the legislature is popularly elected; three, multiple parties compete in elections; and four, an alternation in power has occurred under the same

electoral rules that brought the incumbent party into power.[7]

I group autocracies into spells and years. Autocratic spells are consecutive years that a country is autocratic. I use spells rather than the entire country because there can be substantial breaks in time between spells in a single country. Years in the same spell are more proximate. Additionally, I keep the data at the spell-year level rather than leader years. The variables are almost entirely macro-level. Splitting the data into leaders does not provide additional information.

I model the probability that a spell year has succession rules or a successor. I use a dynamic probit model with a random intercept for spells. The dynamic probit simultaneously models the probability of introducing and retaining succession arrangements. The random intercepts capture unobserved heterogeneity constant across the spell. The model specification is

$$\Pr(\text{Rules}_{i,t} = 1) = \Phi(\alpha_i + \beta \, \text{Survival}_{i,t} + \delta \text{Rules}_{i,t-1} + \boldsymbol{\tau}' \textbf{Controls} + \varepsilon_{i,t}), \qquad (1)$$

where $\Phi(\cdot)$ is the inverse probit, or normal cumulative distribution, function; i and t index autocratic spells and years; Rules $= 1$ indicates the presence of succession rules; Survival is the measurement for survival probability; **Controls** is a vector of control variables; and ε is the error term. The random intercept is distributed normally with mean μ_α and variance ε_a^2. I expect that survival has a positive effect in contrast to existing arguments, which expect a negative effect.

I test the model with four different sets of control variables. The first is a baseline specification that only includes survival probability and the lagged dependent variable. The second is the set of variables used to fit the random forest model. Including the random forest predictors helps ensure that if any predictors are correlated with succession rules, they do not contaminate the survival probability measure and create a false correlation. The third includes the set of substantive control variables to check for confounding. The fourth and final specification includes the full set of controls.

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[7]Regimes that meet the first three criteria but not the fourth are potential type II errors. They might be genuinely democratic, but the same party countries to win elections. Notable examples include Botswana, Mexico before 2000, and South Africa since the end of apartheid in 1994. The results are robust to excluding type II cases.

3.1 Survival Probability

The primary empirical challenge is measuring the latent variable survival probability. To calculate the probability that an autocrat survives a particular year, I use random forests for classification, a machine learning model.[8] The random forest predicts the probability that at least one autocrat loses power in a particular year for a reason other than their natural death, coded according to Archigos (Goemans, Gleditsch, and Chiozza 2009). The random forest combines predictions from 1,000 decision trees. The large number of decision trees makes the predictions stable across different runs of the random forest. In each decision tree, three variables are randomly chosen[9] and a random sample is drawn with replacement.[10] Based on the randomly-chosen variables and sample, the decision tree creates predictions by minimizing the root mean squared error. The decision tree splits the data into subsets to produce predicted values. The final random forest predicted probabilities are the predicted probabilities averaged across the decision trees. Combining random sampling and averaging the predictions reduces the risk of overfitting and the variances of the predictions (Breiman 2001).

My measurement approach is similar to Wright (2008) except that Wright uses probabilities from a survival analysis. Political scientists have also used item response theory (IRT) models to create latent variables for related concepts, including personalism (Frantz et al. 2020; Wright 2021) and power consolidation (Gandhi and Sumner 2020). In comparison to regression and IRT models, random forests are more flexible and accurate. Random forests do not impose functional forms on the predictors, allowing for much larger and more complex sets of patterns than a researcher could identify. Unlike IRT models, random forests can take both continuous and categorical variables. Each variable is dichotomized in decision nodes, but the cutoff is chosen from model criteria rather than *a prior* by the researcher. While the inferential value of machine learning is a developing topic, machine learning models dominate other methods for pure prediction (Athey and Imbens 2019; Grimmer, Roberts, and Stewart 2021).

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[8]The results are similar with a random forest regression. A random forest regression treats the probabilities as a continuous variable, akin to the linear probability model.

[9]I choose the number of variables as the rounded-down square root of the number of variables, or $\sqrt{15}$.

[10]In machine learning parlance, sampling with replacement is called "bagging." Political scientists will likely recognize bagging as non-parametric bootstrapping. In the bagging process, I do not account for the correlation between observations. Each spell year is sampled. Stratifying the sampling by countries or spells provides similar results.

I include 15 predictors in the model. I avoid variables that could be affected by succession rules. If succession rules reduce instability, they could affect predictors of survival like leader tenure, previous coups, and how predecessors lost power. Including them in the model risks biasing the survival probabilities to have a positive correlation with succession rules. Similarly, I omit institutional factors. Institutions should affect autocratic survival, but nominally-democratic institutions might cluster. An autocrat with a legislature or presidential could be more likely to have a successor from the institutional structure, again risking biasing the probabilities.

The predictors fall into four sets. First, the initial leader of a country and regime is more secure than their successors (Bienen and van de Walle 1989). I code the *national* founder as the first leader listed by Archigos after a country achieves independence. The *spell founder* is the first leader listed by Archigos after a new autocratic spell starts. The national and spell founder variables are coded 1 if one of the leaders in a spell year is the national founder or spell founder.[11] Second, wealth from natural resources makes autocrats more secure (Ross 2015). I include per capita income from *oil*, *coal*, *natural gas*, and *metals and minerals* (Haber and Menaldo 2011) as separate variables. Third, I account for potential and realized internal conflict. I include *ethnic fractionalization*, *religious fractionalization*, and *percent mountainous terrain* as potential facilitators of civil war (Fearon and Laitin 2003).[12] For domestic unrest, I include the number of *general strikes*, *terrorism events*, *riots*, and *anti-government demonstrations* (Banks and Wilson 2021). Finally, I include two economic variables, *economic growth* and *GDP per capita* (Bolt and Luiten van Zanden 2020).

An added challenge of the random forest is that the data are unbalanced. Around 10% of spell years experience at least one leader turnover. To address the imbalance, I use a weighted random forest. The weighted random forest more heavily penalizes misclassification of the rarer event, losing power, improving the predictions (Chen, Liaw, and Breiman 2004). I give

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[11] I match the dates of autocratic regimes with leaders from Archigos (Goemans, Gleditsch, and Chiozza 2009), the standard dataset for leaders and their tenures. Most causes are clear. Their tenures either fell within an autocratic spell, or the country is autocratic for its entire existence. I looked for specific events in determining which leaders began and ended autocratic spells like autocrats who led coups or autocrats who freely transitioned power after an election. I also used data from Gandhi and Sumner (2020) and Svolik (2012) as reference points for matching autocrats to autocratic spells.

[12] All three variables are time invariant (or nearly time invariant). Missing values after 1946 are filled with Fearon and Laitin's (2003) estimates.

the observations where the autocrat loses power three times as much weight. The results are similar when using an unweighted random forest or a 2 to 1 ratio, but the results are more stable using a 3 to 1 ratio.

I complement the random forest predictions with a measure used in previous work (Li 2009; Przeworski et al. 2000, chap. 4). Within a single autocratic spell, I divide the cumulative number of autocrats by the number of years that the autocracy has existed. Where possible, I extend the measurement back to the 1870s using Democracy-Dictatorship and Archigos. While these observations are not included in the final analysis, they reduce measurement error. A lower rate of leader turnover should indicate that an autocrat is more likely to survive the current year. I rescale the turnover rate variable from 0 to 1 where 1 indicates the least turnover per year and should indicate greater survival probability.

The survival probabilities prove extremely accurate at predicting whether an autocrat loses power. To validate the measure, I estimate a Cox proportional hazards model with survival as the dependent variable. I assess model performance with concordance. Concordance compares every pair of observations where one observation survived and the other failed. A pair is concordant if the observation that survived had a higher predicted probability to survive. Concordance is the proportion of concordant pairs (Harrell, Lee, and Mark 1996).

The random forest predictions perform much better than other measurements. The turnover rate variable has a concordance of 56%. A concordance of 56% is better than randomly, but only marginally. Next, I use the 15 predictors in the random forest model as independent variables. The concordance increases substantially to just under 65%. When the survival probabilities are used, the concordance exceeds 90%, an extremely accurate model that outperforms a more-specified model with the predictors.

The survival probabilities are also stable. Using machine learning models as covariates can underestimate uncertainty by not incorporating uncertainty in the prediction models themselves (Knox, Lucas, and Cho 2022). To assess the uncertainty in the predictions, I rerun the random forest an additional 1,000 times. The average standard deviation for an observation's predictions is less than one percentage point. The survival probabilities are both accurate and consistent.

3.2 Succession Rules

I use two different measurements for succession rules. The first, used by Iqbal and Zorn (2008) and Frantz and Stein (2017), is Polity's measurement of executive regulation variable (Marshall, Gurr, and Jaggers 2014). I code succession rules as existing if Polity codes executive regulation as being designational or regulated. The Polity variable has extensive coverage but is less precise theoretically. The variable captures whether any rules, either informal or formal, influence succession. A country can be coded as having succession rules in the absence of any formal institutions or named successor.

For the second variable, I follow Meng (2021b) and focus on autocracies with vice presidents.[13] Vice presidents are designated successors. They are specified in the constitution as the next leader if the executive leaves office early. I base the coding of vice presidents on the WhoGov dataset (Nryup and Bramwell 2020). WhoGov covers national cabinets starting in 1966. I code a country as having a vice president if WhoGov codes the chief executive, based on Archigos, as being a president and codes another individual as being a vice president. For the other two main classifications that chief executives have, prime ministers and chiefs of state, I always code them as not having vice presidents. Prime ministers rarely have lines of succession, and chiefs of state hold offices outside the constitutional order, like general secretary of a ruling party. Neither can have their successor specified in the constitution. Vice presidents present a stricter, more theoretically precise operationalization. While 81% of spell years have succession rules using Polity, just 21% have vice presidents.

3.3 Controls

I include control variables that could plausibly influence appointing a successor and could correlate with survival probability. Monarchies usually have lines of succession and tend to be more stable than other types of autocracies. Whether a country is a *monarchy* comes from Cheibub, Gandhi, and Vreeland (2010). Nominally-democratic institutions can protect an autocrat's rules. Institutions likely bundle, so autocracies with nominally-democratic institutions

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[13]Meng (2021b) includes prime ministers as a form of vice presidents, but she restricts this claim to the African cases that she studies. I do not include prime ministers because my sample is global.

may incidentally create succession rules. I include whether an autocracy has a *legislature* from Cheibub, Gandhi, and Vreeland (2010) and whether it has a *ruling party* from Miller (2020).

Many autocracies model their constitutions on presidential democracies, which are more likely to include successors than other constitutional designs. I classify constitutions using the Comparative Constitutions Project (Elkins, Ginsburg, and Melton 2014). A country has a *presidential constitution* if the legislature cannot remove the head of state for political reasons and the head of state is popularly elected (Cheibub, Elkins, and Ginsburg 2014).

Colonial history may also affect institutional choice. Colonizers may export their institutions, and former colonies can experience similar shocks. For example, former Spanish colonies in Latin America achieved independence in the early 1800s. Newly-independent Latin American countries modeled their constitutions on the United States, including vice presidents (Marsteintredet and Uggla 2019). I code colonial history based on the country from which former colonies received independence. I code 29 *English colonies*, 24 *French colonies*, and 19 *Spanish colonies*. An additional 15 countries fall into *other colonies*, composed of six Portuguese, three Belgian, two American, two Dutch, one shared between England and Italy, and one shared between England and France. The remaining 44 are not coded as former colonies and serve as the reference category.

Finally, I include population size. Gerring and Knutsen (2019) argue that larger polities are more likely to have succession rules. According to their argument, larger polities have more elites competing for power. Autocrats struggle to consolidate power and are more likely to regulate succession. *Population* comes from the Maddison Project (Bolt and Luiten van Zanden 2020). Table A1, in the appendix, provides summary statistics for all variables used in the analyses.

4   Results

Table 1 shows the results using survival probabilities as the key explanatory variable and succession rules as the dependent variable. Across all four specifications, my hypothesis is supported. Survival probability has a positive and statistically significant effect on having suc-

Figure 1. Predicted Probabilities of Succession Rules and Vice Presidents Based on Survival Probability
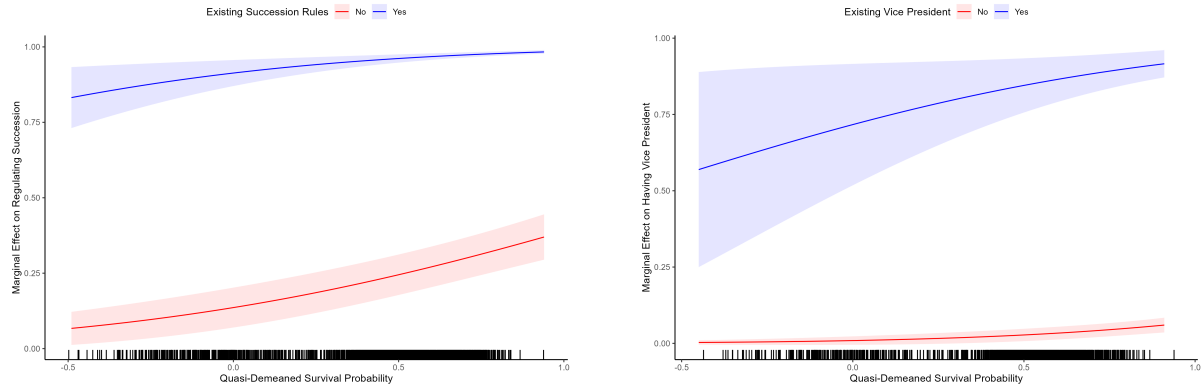
Notes: The left panel shows the predicted probability of having succession rules. The right panel shows the predicted probability of having a vice president. Shaded areas are 95% confidence intervals. Rug lines represent observations at each value.

cession rules. Taking the average marginal effects (AMEs), a ten percentage point increase in survival probability is associated with a 0.04 to 0.08 percentage point increase in the probability of having succession rules.

To clarify the effects, the left panel of figure 1 graphs the predicted probability of having succession rules based on survival probability from the baseline model. The *x* axis shows survival probabilities quasi-demeaned by the spell-level random effects (Jordan and Philips 2023). When succession rules are the dependent variable, the quasi-demeaned survival probability ranges from -0.55 to 0.88 with a mean of 0.33 and a standard deviation of 0.17. I separate the predictions by whether the spell already had succession rules in the previous year. (The AMEs are statically significant in both cases.) Across both scenarios, survival probability substantially increases the probability of having succession rules. Survive probability influences both the introduction and retention of succession rules.

The dependent variable changes to having a vice president in table 2. Survival probability has a significant and positive effect in all four models. A 10 percentage point increase in survival probability is associated with increasing the probability of having a vice president by approximately 0.05 to 0.08 percentage points. The right panel of figure 1 graphs the predicted probabilities of having a vice president based on survival probability and the one-year lag. Now, the quasi-demeaned survival probabilities range from -0.49 to 0.94 with a mean of 0.45 and a standard deviation of 0.19. Survival probability has a weaker effect on having a vice

Table 1. Effect of Survival Probability on Succession Rules

	(1)	(2)	(3)	(4)
Survival Probability	0.81***	0.47***	1.38***	0.96***
	(0.15)	(0.16)	(0.23)	(0.25)
Lagged Succession Rules	2.46***	2.49***	2.41***	2.47***
	(0.09)	(0.09)	(0.12)	(0.12)
Ethnic Fractionalization		−0.19		−0.20
		(0.24)		(0.34)
Religious Fractionalization		−0.37		−0.36
		(0.32)		(0.47)
Logged Mountainous Terrain		−0.05		−0.12*
		(0.04)		(0.07)
Logged Oil Income per Capita		0.01		−0.04
		(0.03)		(0.05)
Logged Coal Income per Capita		0.12**		−0.07
		(0.06)		(0.08)
Logged Natual Gas Income per Capita		0.04		0.15*
		(0.05)		(0.08)
Logged Metals & Minerals Income per Capita		−0.01		0.02
		(0.03)		(0.05)
National Founder		0.80***		0.63**
		(0.18)		(0.27)
Spell Founder		−0.60***		−0.25
		(0.12)		(0.17)
Logged GDP per Capita		0.24**		0.27*
		(0.10)		(0.15)
GDP Growth		1.34***		1.53**
		(0.45)		(0.64)
Logged Strikes		−0.18		0.17
		(0.16)		(0.22)
Logged Terror Events		−0.29***		−0.18
		(0.11)		(0.15)
Logged Riots		−0.48***		−0.58***
		(0.10)		(0.13)
Logged Demonstrations		0.04		0.01
		(0.10)		(0.13)
Monarchy			1.44***	1.60***
			(0.33)	(0.39)
Legislature			1.15***	1.13***
			(0.13)	(0.14)
Presidential Constitution			0.17	0.26*
			(0.15)	(0.15)
Ruling Party			0.68***	0.75***
			(0.14)	(0.15)
Logged Population			0.05	0.18**
			(0.07)	(0.08)
English Colony			0.13	0.23
			(0.26)	(0.29)
French Colony			−0.40	−0.38
			(0.26)	(0.30)
Spanish Colony			0.07	0.12
			(0.26)	(0.31)
Other Colony			−0.38	−0.26
			(0.28)	(0.31)
Log-Likelihood	−750.85	−687.72	−434.05	−399.95
N	3704	3704	3288	3288
Autocratic Spells	145	145	140	140
Random Intercept Variance	0.26	0.22	0.36	0.32

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

Table 2. Effect of Survival Probability on Vice Presidents

	(1)	(2)	(3)	(4)
Survival Probability	0.89***	0.81***	1.35***	1.26***
	(0.28)	(0.30)	(0.38)	(0.40)
Lagged Vice President	2.93***	2.89***	3.01***	3.04***
	(0.12)	(0.12)	(0.14)	(0.14)
Ethnic Fractionalization		0.43		0.16
		(0.36)		(0.37)
Religious Fractionalization		0.55		0.65
		(0.48)		(0.51)
Logged Mountainous Terrain		−0.05		−0.10
		(0.06)		(0.07)
Logged Oil Income per Capita		−0.07		−0.04
		(0.05)		(0.05)
Logged Coal Income per Capita		−0.09		−0.18**
		(0.07)		(0.08)
Logged Natual Gas Income per Capita		0.03		0.02
		(0.07)		(0.07)
Logged Metals & Minerals Income per Capita		−0.00		−0.01
		(0.04)		(0.04)
National Founder		0.37		0.36
		(0.27)		(0.32)
Spell Founder		−0.37*		−0.47*
		(0.22)		(0.25)
Logged GDP per Capita		0.05		0.09
		(0.12)		(0.14)
GDP Growth		0.79		0.56
		(0.62)		(0.71)
Logged Strikes		−0.42		−0.37
		(0.29)		(0.33)
Logged Terror Events		0.10		0.08
		(0.17)		(0.20)
Logged Riots		−0.00		0.03
		(0.16)		(0.19)
Logged Demonstrations		0.09		−0.07
		(0.15)		(0.18)
Monarchy			−0.89**	−0.85*
			(0.45)	(0.45)
Legislature			−0.03	−0.10
			(0.17)	(0.17)
Presidential Constitution			−0.02	−0.03
			(0.16)	(0.16)
Ruling Party			0.26	0.25
			(0.20)	(0.20)
Logged Population			−0.01	0.06
			(0.07)	(0.08)
English Colony			0.58**	0.16
			(0.27)	(0.28)
French Colony			−0.41	−0.83**
			(0.30)	(0.33)
Spanish Colony			0.15	0.05
			(0.33)	(0.35)
Other Colony			0.45	0.03
			(0.31)	(0.31)
Log-Likelihood	−454.87	−445.73	−350.32	−341.05
N	2926	2926	2534	2534
Autocratic Spells	127	127	123	123
Random Intercept Variance	0.39	0.45	0.45	0.33

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

president, but having a vice president is much rarer in general. The AME of survival probability is significant regardless of whether there is already a vice president. Again, survival probability is associated with both introduction and retention.

In table 3, the key independent variable is turnover rate. The dependent variable is succession rules. As with survival probability, turnover rate has a positive and statistically significant effect regardless of the model. A 0.10 increase in the turnover rate variable, which indicates greater security, ranges from 0.07 to 1.5 percentage points.

Table 4 uses turnover rate as the main independent variable and having a vice president as the dependent variable. Now, the coefficient is insignificant in all four models. While the results with turnover rates and vice presidents do not provide evidence for my hypothesis, they do not provide evidence against it. Only coefficient, in model (4), is negative. Additionally, turnover rate is the weaker independent variable and vice presidents the more restrictive dependent variable. The evidence still weighs toward the hypothesis that an autocrat more likely to survive is more likely to have succession rules or successors. No evidence supports the argument that autocrats less likely to survive are more likely to have successors.

I re-estimate the models on subsets of the data to check two potential concerns. Results are shown in the appendix. First, autocrats who lose power quickly could never have the chance to create succession rules. One standard is to only include autocrats who only survive at least three years in office. Tables A2 to A5 only includes spell years if a leader in that spell year has survived to a third year. Second, type II cases could drive the results. Type II cases meet the first three conditions for democracy—elected executive, popularly-elected legislature, and multiparty elections—but fail to meet the fourth. They have never experienced a transition of power between parties under the same rules that brought the party to power. Type II cases could genuinely be democracies where the ruling party has continued winning. Tables A6 to A9 exclude any type II cases.

Both checks provide the same substantive conclusions as the main results. In every specification, survival probability has a positive and significant on both succession rules and vice presidents. Turnover rates also have a significant and positive in all the models for succession rules, but the estimates for vice presidents are insignificant. The coefficient is negative only in

Table 3. Effect of Turnover Rate on Succession Rules

	(1)	(2)	(3)	(4)
Turnover Rate	1.54***	1.70***	1.12***	1.15***
	(0.14)	(0.22)	(0.24)	(0.31)
Lagged Succession Rules	2.62***	2.40***	2.31***	2.45***
	(0.07)	(0.09)	(0.10)	(0.12)
Ethnic Fractionalization		−0.23		−0.22
		(0.26)		(0.36)
Religious Fractionalization		−0.37		−0.32
		(0.34)		(0.50)
Logged Mountainous Terrain		−0.04		−0.11
		(0.05)		(0.07)
Logged Oil Income per Capita		0.00		−0.05
		(0.03)		(0.05)
Logged Coal Income per Capita		0.09		−0.07
		(0.06)		(0.09)
Logged Natual Gas Income per Capita		0.02		0.15*
		(0.05)		(0.08)
Logged Metals & Minerals Income per Capita		−0.01		0.02
		(0.03)		(0.05)
National Founder		0.43**		0.46
		(0.18)		(0.28)
Spell Founder		−0.10		0.09
		(0.14)		(0.19)
Logged GDP per Capita		0.25**		0.32**
		(0.10)		(0.15)
GDP Growth		1.34***		1.77***
		(0.43)		(0.66)
Logged Strikes		−0.19		0.11
		(0.16)		(0.22)
Logged Terror Events		−0.28**		−0.25*
		(0.11)		(0.15)
Logged Riots		−0.46***		−0.61***
		(0.10)		(0.13)
Logged Demonstrations		−0.02		−0.11
		(0.10)		(0.13)
Monarchy			1.37***	1.64***
			(0.31)	(0.41)
Legislature			1.10***	1.12***
			(0.12)	(0.14)
Presidential Constitution			0.02	0.21
			(0.13)	(0.16)
Ruling Party			0.75***	0.80***
			(0.14)	(0.16)
Logged Population			0.02	0.19**
			(0.06)	(0.08)
English Colony			0.01	0.25
			(0.26)	(0.31)
French Colony			−0.49*	−0.32
			(0.27)	(0.32)
Spanish Colony			−0.19	0.12
			(0.27)	(0.33)
Other Colony			−0.62**	−0.28
			(0.30)	(0.33)
Log-Likelihood	−1053.99	−659.58	−541.46	−399.24
N	5606	3704	3906	3288
Autocratic Spells	171	145	153	140
Random Intercept Variance	0.23	0.28	0.50	0.40

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 4. Effect of Turnover Rate on Vice Presidents

	(1)	(2)	(3)	(4)
Turnover Rate	0.28	0.12	0.21	−0.25
	(0.32)	(0.43)	(0.41)	(0.52)
Ethnic Fractionalization		0.38		0.15
		(0.34)		(0.35)
Religious Fractionalization		0.60		0.60
		(0.46)		(0.49)
Logged Mountainous Terrain		−0.05		−0.08
		(0.06)		(0.07)
Logged Oil Income per Capita		−0.06		−0.04
		(0.04)		(0.05)
Logged Coal Income per Capita		−0.08		−0.17**
		(0.07)		(0.08)
Logged Natual Gas Income per Capita		0.05		0.02
		(0.07)		(0.07)
Logged Metals & Minerals Income per Capita		0.01		−0.01
		(0.04)		(0.04)
National Founder		0.35		0.34
		(0.27)		(0.32)
Spell Founder		−0.35		−0.46*
		(0.23)		(0.26)
Logged GDP per Capita		0.04		0.14
		(0.12)		(0.13)
GDP Growth		0.95		0.71
		(0.59)		(0.66)
Logged Strikes		−0.44		−0.50
		(0.29)		(0.34)
Logged Terror Events		0.07		−0.03
		(0.17)		(0.19)
Logged Riots		−0.01		−0.04
		(0.16)		(0.18)
Logged Demonstrations		0.00		−0.11
		(0.15)		(0.17)
Monarchy			−0.90**	−0.73*
			(0.40)	(0.43)
Legislature			−0.09	−0.08
			(0.15)	(0.17)
Presidential Constitution			−0.07	−0.05
			(0.14)	(0.16)
Ruling Party			0.29*	0.35*
			(0.17)	(0.20)
Logged Population			−0.03	0.06
			(0.06)	(0.07)
English Colony			0.51**	0.20
			(0.24)	(0.27)
French Colony			−0.36	−0.72**
			(0.25)	(0.31)
Spanish Colony			0.03	−0.04
			(0.29)	(0.33)
Other Colony			0.28	0.10
			(0.27)	(0.30)
Log-Likelihood	−579.09	−449.70	−432.30	−346.34
N	3637	2926	2949	2534
Autocratic Spells	149	127	135	123
Random Intercept Variance	0.37	0.41	0.35	0.27

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

the full model with turnover rates and vice presidents. The negative coefficient is never significant. The support for my hypothesis is robust to excluding short-serving autocrats and type II cases.

5   Conclusion

A recent wave of research on autocratic succession has reached a seeming consensus. Autocrats who expect to lose power introduce succession rules and successors to stabilize their rule and prolong their tenure. Previous work has only tested the effects of succession rules and assumed that autocrats are endangered before succession rules. In contrast, I argue that autocrats who are more likely to survive should designate successors. They can more easily overcome the core costs of successors—the creation of potential rivals. The benefits of appointing a successor, further, are insufficient to stabilize a truly endangered ruler.

I conduct the first test of whether survival probability actually affects having succession rules. I also introduce a new measurement of survival probabilities using random forests, a machine learning model. The results support my argument and contradict the current consensus. When autocrats are more likely to stay in power, they are more likely to have succession rules and vice presidents, regardless of whether they already exist.

My results and argument have a clear implication for autocratic succession. If autocrats are more likely to have successors when they are *ex ante* more likely to survive, results identifying a connection between autocratic survival and succession rules are potentially spurious. The relationship should be retested with better accounting for selection effects. Even if the relationship still exists, the logic for why autocrats have succession rules needs to change. It is unlikely that secure autocrats introduce succession rules purely for a potential increase in security. Ultimately, succession rules and successors are tools of the stable and secure, not the threatened.

This paper, further, speaks to the broader challenges of studying institutions, especially in autocracies. Scholars primarily try to identify the effects that institutions have on outcomes. But if institutions affect outcomes, actors' preferences over outcomes make institutions endoge-

24

nous to the outcomes that they are meant to explain. This endogeneity is frequently neglected or treated as a nuisance. The fact that institutions are political outcomes, however, makes them important and interesting outcomes to study in and of themselves.

Future research should directly study why autocrats adopt nominally-democratic institutions, not merely their effects. The comparative literature on autocracy and institutions rarely studies institutions as outcomes.[14] Scholars who account for potential endogeneity typically treat the reasons for institutions as a statistical nuisance or a design problem. Neither method is likely to address endogeneity sufficiently. Institutions have complex causes that are difficult to address as objects of secondary interest, especially in a cross-national context. Rather than treat endogeneity as a mere problem, scholars should study institutions as outcomes themselves and then evaluate their effects. To understand the effects of institutions, we need to understand their causes.

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[14]For partial counterexamples, Meng (2021a) challenges the argument that ruling parties constrain autocrats. She shows that most ruling parties cannot outlive the autocrat, but she does not directly study which autocrats create ruling parties. Wright (2008) argues and shows that autocrats who expect to survive longer create legislatures. The argument about legislatures is secondary to testing whether autocratic legislatures increase investment accounting for their causes. His result, interpreted more broadly, aligns with my finding that an institution emerges after an autocrat is already secure.

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Appendix

Table A1. Summary Statistics

Variable	N	Mean	SD	Min	Q1	Median	Q3	Max
Survival Probability	3753	0.91	0.2	0.02	0.94	0.98	0.99	1
Turnover Rate	6000	0.89	0.19	0	0.89	0.95	0.98	1
Succession Rules	5678	0.82	0.38	0	1	1	1	1
Vice President	3746	0.21	0.41	0	0	0	0	1
Ethnic Fractionalization	4643	0.44	0.29	0	0.17	0.48	0.7	0.93
Religious Fractionalization	4643	0.37	0.21	0	0.18	0.39	0.55	0.78
Logged Mountainous Terrain	4643	2.16	1.4	0	0.99	2.3	3.34	4.56
Logged Oil Income per Capita	5392	1.77	2.77	0	0	0	3.33	11.27
Logged Coal Income per Capita	5378	0.76	1.52	0	0	0	0.61	6.98
Logged Natual Gas Income per Capita	5347	0.95	1.87	0	0	0	0.93	9.56
Logged Metals & Minerals Income per Capita	5285	1.77	2.01	0	0	0.86	3.3	7.27
National Founder	6000	0.15	0.36	0	0	0	0	1
Spell Founder	6000	0.34	0.47	0	0	0	1	1
Logged GDP per Capita	4795	8	0.93	5.93	7.28	7.84	8.63	11.58
GDP Growth	4752	0.02	0.08	-0.61	-0.01	0.02	0.05	1.74
Logged Strikes	4811	0.04	0.2	0	0	0	0	2.64
Logged Terror Events	4811	0.13	0.32	0	0	0	0	3.56
Logged Riots	4811	0.17	0.43	0	0	0	0	3.5
Logged Demonstrations	4811	0.17	0.45	0	0	0	0	3.3
Monarchy	5026	0.14	0.34	0	0	0	0	1
Legislature	4993	0.71	0.45	0	0	1	1	1
Presidential Constitution	5303	0.23	0.42	0	0	0	0	1
Ruling Party	5051	0.67	0.47	0	0	1	1	1
Logged Population	4970	8.92	1.54	4.82	7.9	8.98	9.9	14.09
English Colony	6000	0.21	0.41	0	0	0	0	1
French Colony	6000	0.18	0.38	0	0	0	0	1
Spanish Colony	6000	0.13	0.34	0	0	0	0	1
Other Colony	6000	0.1	0.3	0	0	0	0	1

Table A2. Effect of Survival Probability on Succession Rules where Autocrat Served at Least Three Years

	(1)	(2)	(3)	(4)
Survival Probability	1.52***	1.11***	2.35***	1.49***
	(0.22)	(0.25)	(0.35)	(0.40)
Lagged Succession Rules	3.16***	3.21***	3.10***	3.35***
	(0.11)	(0.13)	(0.16)	(0.18)
Ethnic Fractionalization		−0.06		0.05
		(0.26)		(0.32)
Religious Fractionalization		−0.64*		−0.64
		(0.34)		(0.42)
Logged Mountainous Terrain		−0.00		−0.07
		(0.05)		(0.06)
Logged Oil Income per Capita		−0.00		−0.10**
		(0.04)		(0.05)
Logged Coal Income per Capita		0.06		−0.09
		(0.06)		(0.08)
Logged Natual Gas Income per Capita		0.02		0.30***
		(0.06)		(0.09)
Logged Metals & Minerals Income per Capita		−0.02		0.01
		(0.04)		(0.05)
National Founder		0.02		−0.31
		(0.23)		(0.39)
Spell Founder		−0.04		0.56**
		(0.17)		(0.24)
Logged GDP per Capita		0.15		0.06
		(0.12)		(0.16)
GDP Growth		1.63**		1.87*
		(0.72)		(1.06)
Logged Strikes		−0.55**		−0.26
		(0.21)		(0.27)
Logged Terror Events		−0.22		−0.32*
		(0.15)		(0.19)
Logged Riots		−0.45***		−0.62***
		(0.14)		(0.18)
Logged Demonstrations		0.12		0.06
		(0.13)		(0.17)
Monarchy			2.01***	2.12***
			(0.65)	(0.72)
Legislature			1.05***	1.03***
			(0.19)	(0.17)
Presidential Constitution			0.32*	0.41**
			(0.18)	(0.19)
Ruling Party			0.57***	0.73***
			(0.21)	(0.21)
Logged Population			0.09	0.23***
			(0.07)	(0.08)
English Colony			0.01	0.32
			(0.29)	(0.30)
French Colony			−0.22	0.10
			(0.28)	(0.27)
Spanish Colony			−0.01	0.05
			(0.33)	(0.35)
Other Colony			−0.49*	−0.34
			(0.29)	(0.26)
Log-Likelihood	−371.57	−344.03	−203.97	−178.27
N	2845	2845	2570	2570
Autocratic Spells	132	132	123	123
Random Intercept Variance	0.07	0.10	0.16	0.00

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table A3. Effect of Survival Probability on Vice Presidents where Autocrat Served at Least Three Years

	(1)	(2)	(3)	(4)
Survival Probability	1.06***	0.94**	2.42***	2.30***
	(0.39)	(0.42)	(0.58)	(0.62)
Ethnic Fractionalization		0.39		0.17
		(0.32)		(0.37)
Religious Fractionalization		0.53		0.57
		(0.42)		(0.49)
Logged Mountainous Terrain		−0.05		−0.07
		(0.06)		(0.07)
Logged Oil Income per Capita		−0.02		0.02
		(0.04)		(0.05)
Logged Coal Income per Capita		−0.09		−0.11
		(0.06)		(0.08)
Logged Natual Gas Income per Capita		−0.03		−0.04
		(0.07)		(0.08)
Logged Metals & Minerals Income per Capita		−0.01		−0.01
		(0.04)		(0.05)
National Founder		0.19		0.60
		(0.27)		(0.37)
Spell Founder		−0.31		−0.76**
		(0.23)		(0.31)
Logged GDP per Capita		0.04		0.04
		(0.12)		(0.14)
GDP Growth		1.34		0.96
		(0.82)		(0.96)
Logged Strikes		−0.53		−0.21
		(0.45)		(0.50)
Logged Terror Events		0.10		0.10
		(0.21)		(0.24)
Logged Riots		0.03		0.06
		(0.19)		(0.22)
Logged Demonstrations		0.13		−0.02
		(0.18)		(0.22)
Monarchy			−0.71	−0.63
			(0.46)	(0.44)
Legislature			0.11	0.00
			(0.20)	(0.20)
Presidential Constitution			−0.06	−0.06
			(0.19)	(0.18)
Ruling Party			0.07	0.01
			(0.25)	(0.25)
Logged Population			0.01	0.03
			(0.07)	(0.08)
English Colony			0.62**	0.28
			(0.26)	(0.27)
French Colony			−0.31	−0.61*
			(0.30)	(0.32)
Spanish Colony			0.16	0.18
			(0.38)	(0.39)
Other Colony			0.48	0.12
			(0.30)	(0.30)
Log-Likelihood	−308.25	−299.33	−233.72	−225.59
N	2360	2360	2082	2082
Autocratic Spells	122	122	115	115
Random Intercept Variance	0.26	0.18	0.31	0.15

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

Table A4. Effect of Turnover Rates on Succession Rules where Autocrat Served at Least Three Years

	(1)	(2)	(3)	(4)
Turnover Rate	1.88***	1.58*	1.24	1.15***
	(0.68)	(0.94)	(1.07)	(0.31)
Lagged Succession Rules	3.09***	3.19***	2.89***	2.45***
	(0.10)	(0.13)	(0.15)	(0.12)
Ethnic Fractionalization		−0.10		−0.22
		(0.26)		(0.36)
Religious Fractionalization		−0.60*		−0.32
		(0.34)		(0.50)
Logged Mountainous Terrain		−0.02		−0.11
		(0.05)		(0.07)
Logged Oil Income per Capita		−0.02		−0.05
		(0.04)		(0.05)
Logged Coal Income per Capita		0.07		−0.07
		(0.06)		(0.09)
Logged Natual Gas Income per Capita		0.04		0.15*
		(0.06)		(0.08)
Logged Metals & Minerals Income per Capita		−0.02		0.02
		(0.04)		(0.05)
National Founder		0.03		0.46
		(0.23)		(0.28)
Spell Founder		−0.05		0.09
		(0.17)		(0.19)
Logged GDP per Capita		0.12		0.32**
		(0.11)		(0.15)
GDP Growth		2.33***		1.77***
		(0.69)		(0.66)
Logged Strikes		−0.60***		0.11
		(0.21)		(0.22)
Logged Terror Events		−0.24*		−0.25*
		(0.14)		(0.15)
Logged Riots		−0.50***		−0.61***
		(0.13)		(0.13)
Logged Demonstrations		0.03		−0.11
		(0.13)		(0.13)
Monarchy			1.95***	1.64***
			(0.45)	(0.41)
Legislature			1.05***	1.12***
			(0.17)	(0.14)
Presidential Constitution			0.17	0.21
			(0.17)	(0.16)
Ruling Party			1.02***	0.80***
			(0.23)	(0.16)
Logged Population			0.02	0.19**
			(0.08)	(0.08)
English Colony			0.09	0.25
			(0.29)	(0.31)
French Colony			−0.30	−0.32
			(0.30)	(0.32)
Spanish Colony			−0.39	0.12
			(0.33)	(0.33)
Other Colony			−0.59*	−0.28
			(0.32)	(0.33)
Log-Likelihood	−570.77	−352.50	−282.47	−399.24
N	4103	2845	2999	3288
Autocratic Spells	152	132	130	140
Random Intercept Variance	0.06	0.11	0.40	0.40

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table A5. Effect of Turnover Rates on Succession Rules where Autocrat Served at Least Three Years

	(1)	(2)	(3)	(4)
Turnover Rate	0.06	0.96	0.19	0.07
	(1.03)	(1.20)	(1.24)	(1.31)
Ethnic Fractionalization		0.40		0.20
		(0.31)		(0.36)
Religious Fractionalization		0.51		0.58
		(0.41)		(0.48)
Logged Mountainous Terrain		−0.05		−0.04
		(0.05)		(0.07)
Logged Oil Income per Capita		−0.01		0.03
		(0.04)		(0.05)
Logged Coal Income per Capita		−0.07		−0.09
		(0.06)		(0.08)
Logged Natual Gas Income per Capita		−0.02		−0.05
		(0.06)		(0.07)
Logged Metals & Minerals Income per Capita		−0.01		−0.01
		(0.04)		(0.04)
National Founder		0.16		0.47
		(0.27)		(0.35)
Spell Founder		−0.26		−0.63**
		(0.23)		(0.30)
Logged GDP per Capita		0.03		0.07
		(0.11)		(0.13)
GDP Growth		1.73**		1.88**
		(0.79)		(0.91)
Logged Strikes		−0.57		−0.37
		(0.45)		(0.49)
Logged Terror Events		0.13		0.02
		(0.21)		(0.24)
Logged Riots		−0.02		−0.05
		(0.19)		(0.22)
Logged Demonstrations		0.07		−0.09
		(0.18)		(0.21)
Monarchy			−0.61	−0.46
			(0.41)	(0.42)
Legislature			−0.00	−0.00
			(0.18)	(0.20)
Presidential Constitution			−0.08	−0.04
			(0.16)	(0.17)
Ruling Party			0.23	0.17
			(0.22)	(0.24)
Logged Population			0.01	0.02
			(0.06)	(0.07)
English Colony			0.59**	0.36
			(0.23)	(0.27)
French Colony			−0.35	−0.54*
			(0.27)	(0.31)
Spanish Colony			0.02	0.22
			(0.33)	(0.37)
Other Colony			0.34	0.17
			(0.27)	(0.29)
Log-Likelihood	−389.06	−301.82	−286.57	−232.70
N	2874	2360	2380	2082
Autocratic Spells	136	122	120	115
Random Intercept Variance	0.28	0.16	0.25	0.14

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

Table A6. Effect of Survival Probability on Succession Rules Excluding Type 2 Cases

	(1)	(2)	(3)	(4)
Survival Probability	0.74***	0.41**	1.34***	0.92***
	(0.15)	(0.17)	(0.24)	(0.27)
Lagged Succession Rules	2.38***	2.40***	2.36***	2.42***
	(0.10)	(0.10)	(0.12)	(0.13)
Ethnic Fractionalization		−0.33		−0.29
		(0.26)		(0.38)
Religious Fractionalization		−0.35		−0.60
		(0.34)		(0.52)
Logged Mountainous Terrain		−0.04		−0.12
		(0.05)		(0.07)
Logged Oil Income per Capita		0.01		−0.05
		(0.03)		(0.05)
Logged Coal Income per Capita		0.12*		−0.03
		(0.06)		(0.10)
Logged Natual Gas Income per Capita		0.03		0.13*
		(0.05)		(0.08)
Logged Metals & Minerals Income per Capita		−0.03		−0.02
		(0.03)		(0.05)
National Founder		0.92***		0.66**
		(0.19)		(0.29)
Spell Founder		−0.63***		−0.32*
		(0.13)		(0.18)
Logged GDP per Capita		0.24**		0.31*
		(0.10)		(0.16)
GDP Growth		1.25***		1.53**
		(0.46)		(0.67)
Logged Strikes		−0.13		0.26
		(0.17)		(0.23)
Logged Terror Events		−0.29**		−0.22
		(0.11)		(0.15)
Logged Riots		−0.51***		−0.63***
		(0.11)		(0.14)
Logged Demonstrations		0.07		0.07
		(0.11)		(0.14)
Monarchy			1.45***	1.60***
			(0.34)	(0.41)
Legislature			1.14***	1.14***
			(0.14)	(0.15)
Presidential Constitution			0.19	0.25
			(0.16)	(0.17)
Ruling Party			0.70***	0.79***
			(0.15)	(0.16)
Logged Population			0.03	0.16*
			(0.07)	(0.09)
English Colony			0.27	0.53
			(0.29)	(0.35)
French Colony			−0.49*	−0.32
			(0.29)	(0.34)
Spanish Colony			−0.02	0.14
			(0.29)	(0.36)
Other Colony			−0.36	−0.07
			(0.30)	(0.35)
Log-Likelihood	−699.68	−639.67	−404.81	−372.67
N	2980	2980	2666	2666
Autocratic Spells	138	138	132	132
Random Intercept Variance	0.26	0.24	0.40	0.41

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table A7. Effect of Survival Probability on Vice Presidents Excluding Type 2 Cases

	(1)	(2)	(3)	(4)
Survival Probability	0.78***	0.74**	1.33***	1.19***
	(0.29)	(0.31)	(0.40)	(0.42)
Lagged Vice President	2.91***	2.88***	2.95***	3.00***
	(0.13)	(0.14)	(0.15)	(0.16)
Ethnic Fractionalization		0.20		−0.03
		(0.36)		(0.36)
Religious Fractionalization		0.63		0.54
		(0.48)		(0.51)
Logged Mountainous Terrain		−0.01		−0.11
		(0.07)		(0.07)
Logged Oil Income per Capita		−0.07		−0.08
		(0.05)		(0.05)
Logged Coal Income per Capita		−0.13		−0.22**
		(0.08)		(0.09)
Logged Natual Gas Income per Capita		0.06		0.09
		(0.07)		(0.08)
Logged Metals & Minerals Income per Capita		−0.02		−0.06
		(0.05)		(0.05)
National Founder		0.37		0.27
		(0.30)		(0.34)
Spell Founder		−0.41*		−0.53**
		(0.24)		(0.27)
Logged GDP per Capita		0.06		0.20
		(0.13)		(0.15)
GDP Growth		0.90		0.81
		(0.64)		(0.72)
Logged Strikes		−0.51		−0.41
		(0.32)		(0.34)
Logged Terror Events		0.10		0.13
		(0.18)		(0.20)
Logged Riots		0.03		−0.07
		(0.18)		(0.21)
Logged Demonstrations		0.15		−0.06
		(0.17)		(0.19)
Monarchy			−0.91**	−1.06**
			(0.45)	(0.48)
Legislature			0.07	−0.00
			(0.18)	(0.18)
Presidential Constitution			−0.00	−0.03
			(0.19)	(0.18)
Ruling Party			0.32	0.36*
			(0.20)	(0.20)
Logged Population			0.04	0.13*
			(0.08)	(0.08)
English Colony			0.66**	0.47
			(0.29)	(0.30)
French Colony			−0.43	−0.68**
			(0.31)	(0.33)
Spanish Colony			0.34	0.34
			(0.36)	(0.38)
Other Colony			0.33	0.07
			(0.31)	(0.30)
Log-Likelihood	−379.16	−370.44	−299.57	−287.40
N	2291	2291	2011	2011
Autocratic Spells	118	118	114	114
Random Intercept Variance	0.31	0.39	0.40	0.23

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table A8. Effect of Turnover Rate on Succession Rules Excluding Type 2 Cases

	(1)	(2)	(3)	(4)
Turnover Rate	1.49***	1.70***	1.14***	1.15***
	(0.15)	(0.24)	(0.24)	(0.31)
Lagged Succession Rules	2.55***	2.41***	2.26***	2.45***
	(0.07)	(0.10)	(0.11)	(0.12)
Ethnic Fractionalization		−0.41		−0.22
		(0.30)		(0.36)
Religious Fractionalization		−0.39		−0.32
		(0.38)		(0.50)
Logged Mountainous Terrain		−0.05		−0.11
		(0.05)		(0.07)
Logged Oil Income per Capita		0.00		−0.05
		(0.04)		(0.05)
Logged Coal Income per Capita		0.09		−0.07
		(0.07)		(0.09)
Logged Natual Gas Income per Capita		0.02		0.15*
		(0.06)		(0.08)
Logged Metals & Minerals Income per Capita		−0.04		0.02
		(0.04)		(0.05)
National Founder		0.55***		0.46
		(0.20)		(0.28)
Spell Founder		−0.14		0.09
		(0.15)		(0.19)
Logged GDP per Capita		0.26**		0.32**
		(0.11)		(0.15)
GDP Growth		1.36***		1.77***
		(0.46)		(0.66)
Logged Strikes		−0.17		0.11
		(0.17)		(0.22)
Logged Terror Events		−0.29**		−0.25*
		(0.12)		(0.15)
Logged Riots		−0.52***		−0.61***
		(0.11)		(0.13)
Logged Demonstrations		0.01		−0.11
		(0.11)		(0.13)
Monarchy			1.37***	1.64***
			(0.32)	(0.41)
Legislature			1.12***	1.12***
			(0.13)	(0.14)
Presidential Constitution			0.00	0.21
			(0.14)	(0.16)
Ruling Party			0.75***	0.80***
			(0.14)	(0.16)
Logged Population			0.02	0.19**
			(0.07)	(0.08)
English Colony			0.18	0.25
			(0.28)	(0.31)
French Colony			−0.49*	−0.32
			(0.28)	(0.32)
Spanish Colony			−0.12	0.12
			(0.28)	(0.33)
Other Colony			−0.55*	−0.28
			(0.30)	(0.33)
Log-Likelihood	−975.61	−614.23	−500.19	−399.24
N	4567	2980	3162	3288
Autocratic Spells	164	138	146	140
Random Intercept Variance	0.26	0.34	0.49	0.40

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table A9. Effect of Turnover Rate on Vice Presidents Excluding Type 2 Cases

	(1)	(2)	(3)	(4)
Turnover Rate	0.43	0.18	0.20	−0.16
	(0.34)	(0.45)	(0.41)	(0.52)
Lagged Vice President	2.85***	2.85***	2.88***	2.98***
	(0.12)	(0.14)	(0.13)	(0.16)
Ethnic Fractionalization		0.19		−0.04
		(0.36)		(0.34)
Religious Fractionalization		0.64		0.49
		(0.48)		(0.48)
Logged Mountainous Terrain		−0.01		−0.09
		(0.07)		(0.07)
Logged Oil Income per Capita		−0.08		−0.08*
		(0.05)		(0.05)
Logged Coal Income per Capita		−0.12		−0.21**
		(0.08)		(0.09)
Logged Natual Gas Income per Capita		0.07		0.09
		(0.07)		(0.07)
Logged Metals & Minerals Income per Capita		−0.02		−0.05
		(0.05)		(0.05)
National Founder		0.34		0.26
		(0.32)		(0.35)
Spell Founder		−0.37		−0.50*
		(0.27)		(0.28)
Logged GDP per Capita		0.07		0.23
		(0.13)		(0.14)
GDP Growth		1.04*		1.02
		(0.61)		(0.67)
Logged Strikes		−0.58*		−0.50
		(0.32)		(0.34)
Logged Terror Events		0.07		0.03
		(0.18)		(0.20)
Logged Riots		0.02		−0.10
		(0.18)		(0.20)
Logged Demonstrations		0.05		−0.13
		(0.17)		(0.19)
Monarchy			−0.76**	−0.92**
			(0.37)	(0.45)
Legislature			−0.02	−0.01
			(0.15)	(0.18)
Presidential Constitution			−0.03	−0.04
			(0.15)	(0.18)
Ruling Party			0.36**	0.47**
			(0.17)	(0.20)
Logged Population			0.02	0.12*
			(0.06)	(0.07)
English Colony			0.48**	0.51*
			(0.24)	(0.28)
French Colony			−0.39	−0.58*
			(0.25)	(0.31)
Spanish Colony			0.19	0.22
			(0.30)	(0.36)
Other Colony			0.21	0.12
			(0.26)	(0.28)
Log-Likelihood	−470.91	−373.55	−369.71	−291.71
N	2810	2291	2315	2011
Autocratic Spells	140	118	128	114
Random Intercept Variance	0.31	0.39	0.27	0.17

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$