Measuring Autocratic Regime Stability

Authors' identity not disclosed

Supplementary Information not intended for publication

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1 Appendix A: Verification and extensions

In the main text, we briefly summarized the main findings from our verification and extension exercise. In this section, we provide more detail about the procedure and results.

We verify and extend three studies linking non-tax revenue to autocratic instability. The first study uses *Durable* failure as the dependent variable to measure regime failure (Morrison 2009), while the second uses Archigos leader failure (Bueno de Mesquita and Smith 2010) and the third uses *DPI* failure (Ahmed 2012). In each study, the empirical analysis considers the stability of both dictatorships and democracies and we preserve this feature of the research design even though our main interest is in understanding how different measures of autocratic stability perform.

Non-tax revenue and Durable failure

Morrison (2009) argues that non-tax revenue reduces the risk of political instability in both democracies and dictatorships. In democracies, ample non-tax revenue enables leaders to decrease taxes on the rich and thus lower the incentive of the rich to stage a coup. In dictatorships, leaders can use non-tax income to increase social spending on the poor and thereby lower their incentive to stage a democratic revolution. The measure of non-tax revenue in Morrison's study is total government expenditure less total tax revenue, and is comprised of foreign aid grants, revenue from state-owned enterprises, and other sources. The dependent variable is a binary indicator of *Durable* failure, and the sample excludes all cases where *Durable* failure occurs as a result of civil war (or *interregnum* periods).

Table A-1 reports the verification and extension of Morrison's base model (column 2 of Table 3 in the original). The first column reports the verification; the coefficient estimate for non-tax revenue is -0.661 and statistically different from zero.[1] The second column examines democratic transitions, treating other types of instability events as right-censored. The estimate for non-tax revenue is larger in size than the original result and statistically significant. The next column looks at democratic failures and treats other instability events, including democratic transitions, as right-censored. Again the estimate for non-tax revenue is larger in size than the original result. This suggests that non-tax revenue reduces the risk of both transitions from autocracy to democracy and transitions from democracy to autocracy.[2]

The fourth column examines autocratic transition and consolidation events. The coefficient for non-tax revenue is now positive but not different from zero. This suggests that non-tax revenue does not reduce the risk of non-democratic instability events in this sample. The fifth column examines both democratic transitions and institutional liberalizations; the estimate for non-tax revenue is again negative and significant. The final column looks at

[1] We multiplied the main independent variable of interest by 1000 to reduce the number of reported zeros after the decimal point.

[2] Morrison also reports results that treat different sources of non-tax revenue as separate variables, and finds that aid grants significantly reduce the risk of *Durable* failures. In unreported tests, we find that the result for aid grants only holds for democratic failures and not for democratic transitions.

Table A-1: Verification and extension of Morrison (2009), Table 3

	Verification Model	Democratic Transition	Democratic Failure	Autocratic Transition/ Consolidation	Democratic Transition Inst. Liberal.	Autocratic Transition/Cons. Inst. De-liberal.
	(1)	(2)	(3)	(4)	(5)	(6)
Non-tax revenue	-0.661**	-0.683**	-0.804*	0.213	-0.764**	0.077
	(0.23)	(0.26)	(0.44)	(0.25)	(0.25)	(0.32)
Growth	-0.056**	-0.063*	-0.054	-0.095**	-0.040*	-0.083**
	(0.02)	(0.03)	(0.07)	(0.05)	(0.02)	(0.04)
GDP per capita	-0.192*	0.186	0.417**	-0.999**	-0.059	-0.859**
	(0.11)	(0.16)	(0.18)	(0.36)	(0.14)	(0.28)
Urban population	0.570**	0.941**	-0.793	0.864	0.716**	0.129
	(0.25)	(0.33)	(0.70)	(1.07)	(0.30)	(0.89)
Ethnolinguistic frac	-0.031	0.479	1.934	0.665	-0.437	0.932
	(0.54)	(0.86)	(1.41)	(1.75)	(0.71)	(1.61)
Population density	-0.016	0.187	-0.294	0.016	0.043	-0.186
	(0.09)	(0.13)	(0.28)	(0.26)	(0.11)	(0.22)
Past failures	-0.011	-0.061	0.173*	-0.217	0.021	-0.212
	(0.06)	(0.08)	(0.10)	(0.27)	(0.06)	(0.19)
Area under ROC curve	0.810	0.772	0.891	0.925	0.787	0.915
Instability events	102	43	6	19	70	26

* p<0.10; ** p<0.05. 1808 observations in 104 countries. All columns include the following control variables (not reported): duration, duration knot1, duration knot2, and a constant. Clustered standard errors in parentheses.

both autocratic transition and consolidation events as well as institutional de-liberalization events. Again, there is no relationship between non-tax revenue and these forms of autocratic instability.

Figure A-1 illustrates the substantive findings. The dashed line shows the result from the verification model (column 1): moving across almost the full range of the revenue variable decrease the risk of all failures from roughly 4 percent to under 1 percent. However, this estimate is stronger for the risk of democratic transition (column 2), which drops from roughly 2.5 percent to less 0.5 percent across this range of revenue values. Finally, the estimate for autocratic transitions and consolidation (column 4) is slightly positive but substantively small.

These findings suggest that the main empirical result in Morrison's analysis pertains to democratic transition and democratic failure events but not to autocratic transition and consolidation events.[3] That is, non-tax revenue may reduce the risk of transitions to and from democracy but has little influence on the risk of transitions from one autocratic regime to another. These results fit the theoretical expectations in Morrison's (2007) model, which

[3]Two issues we do not address in this exercise are: (1) the time duration controls (splines in this case) are incorrect because they are not calculated specifically for each type of instability event; and (2) we follow Morrison's approach in modeling multi-year transitions as multiple positive values for the dependent variable. This latter approach allows many transition events to be double- or triple-'counted', so that each regime at risk can 'fail' multiple times. Using a BTSCS model as a stand-in for a survival model would strictly mean allowing each regime at risk to fail only once.

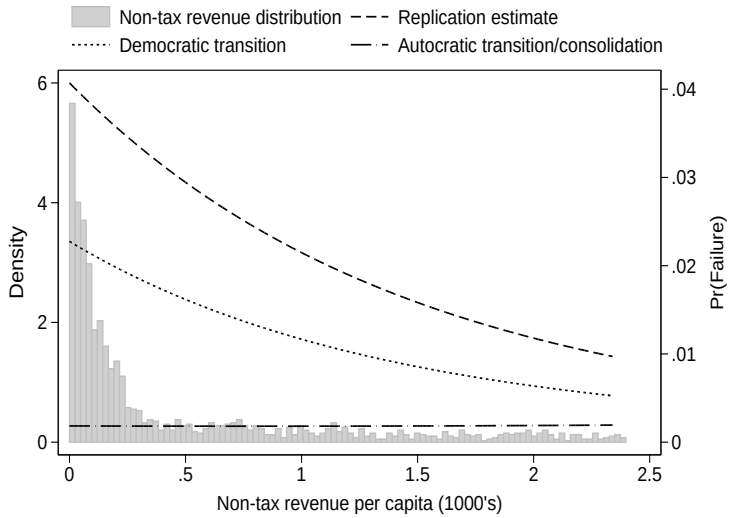

Figure A-1: ***Non-tax revenue and Durable failure.*** The horizontal axis depicts the measure of non-tax revenue (rescaled) from the 5th to the 95th percentile of the revenue distribution, while the right vertical axis depicts the predicted probability of different types of Durable failure. Estimates from models in columns 1, 2, and 4 in Table A-1.

follow from the threat of democratic revolution in autocracies and the threat of coups that topple democracies. Indeed, there is no outcome associated with autocracy-to-autocracy transitions in either Morrison's game or the Acemoglu and Robinson (2006) model upon which his analysis builds. In this class of theoretical models, the only risk to an autocratic regime arises from would-be democrats not from rebels or revolutionaries who would topple a dictatorship and replace it with another. So while *Durable* codes a number of distinct types of autocratic instability, only some of them are theoretically relevant in this study. Consistent with theoretical expectations, these *Durable* failures are the instability events that drive the empirical finding. Using *Durable* failure as a proxy for autocratic instability in this application only adds noise to the model but does not alter the main result, which rests on the correlation between non-tax revenue and democratic transitions.

Non-tax revenue and Leader failure

Next we examine two studies that use different measures of the same concept: leadership survival. The first, Bueno de Mesquita and Smith (2010), uses leader data from Archigos; while the second, Ahmed (2012) employs a binary indicator of government failure from the DPI. Both studies find that free resources, such as non-tax revenue, oil exports, foreign aid, or worker remittances, reduce the risk leadership ouster and that this effect is stronger for leaders in small coalition regimes and autocratic polities. Therefore, both studies examine "free resources" or "unearned income" by interacting these variables with a measure of either coalition size (W) or level of autocracy (A).

The first study looks at three sources of government revenue: non-tax revenue (from Morrison (2009)), oil exports (share of GDP), and foreign aid (share of GDP). We focus on the non-tax revenue model (Model 2, Table 1 in the original) because this model yields the strongest evidence "that if small-coalition leaders gain access to additional free resources then their risk of deposition is reduced" (Bueno de Mesquita and Smith, 2010, 8): the verification estimate for non-tax revenue is negative while the coefficient for the interaction between non-tax revenue and coalition size (W) is positive.[4] This study employs a Weibull survival model where the unit of analysis is the leader's time in power.

We categorize leadership failures into two bins: (1) those that coincide with a regime collapse; and (2) those that do not.[5] The former group of leader failures, which occur when the regime loses power, includes: military coups ousting democratically elected civilian leaders (e.g. Chile 1973, Thailand 1991); leader ousters occurring when autocratic regime collapse is followed by a new democracy (e.g. Argentina 1983, South Africa 1994); and leader ousters occurring when one autocratic regime is replaced by another (e.g. Liberia 1980, Pakistan 1977). The sample includes 335 leadership failures but only 45 of these occur during regime collapses.

The second group of leader failures, which occur when the regime remains in power, include: most leader transitions in democracies; regular leader changes in autocratic regimes (e.g. Mexican elections every six years from 1976-1994); and some irregular leader transitions in autocratic regimes that do not entail regime collapse (e.g. the Argentine military's non-violent rotation of junta leaders in the early 1980s).

Table A-2 reports the results. The first column is the verification model (Table 1, column 2 in the original): the estimate for $Non-tax$ is negative and statistically different from zero, indicating non-tax revenue is correlated with a lower hazard. In the second column, which examines only leader failures where the regime loses power, this estimate is negative but substantially smaller in size. Column 3 examines leader failures when the regime remains in power and the estimate of interest is again negative and large.

Figure A-2 shows how the substantive result varies across these three models.[6] We call readers' attention to the relative change in the hazard resulting from an increase in non-tax revenue, not the absolute size of the hazard because the latter is influenced by the number of events in each category of leader transitions. The left panel depicts the change in the hazard for all leader failures. An increase in non-tax revenue of 10 percent of GDP is associated with a decrease in the hazard of roughly one-half. The middle panel depicts the result

[4] In the other models, for example in column 4 of the original, the coefficient for interaction term is negative. This means that aid and oil have stronger influence on leadership stability in large coalition polities than in small coalition polities, the opposite of the expected relationship.

[5] We have taken care to code leader failures that occur at an inauguration date in the calendar year after an election event that ends an autocratic regime. For example, even though regime collapse event that ends Noriega's dictatorship in Panama occurs in 1989, the leader failure is dated to 1990 when his successor is inaugurated. We count this event and equivalent scenarios as leader failures that coincide with regime collapse.

[6] Non-tax revenue is set at 3 percent and 13 percent of GDP respectively; W is set at zero; and W $\times$ Non-tax is set at zero. The mean value of non-tax revenue is 8.3, the median is 6.5, and the standard deviation is 7.6.

Table A-2: Verification and extension of Bueno de Mesquita and Smith (2010), Table 1 column 2

Leader failure	All	Regime loses power	Regime remains in power
	(1)	(2)	(3)
Non-tax revenue	-0.060**	-0.020	-0.073**
	(0.02)	(0.04)	(0.03)
Non-tax × W	0.081**	0.019	0.095**
	(0.04)	(0.08)	(0.04)
W	0.737	4.032	1.427
	(1.17)	(2.94)	(1.78)
ln(p) W	0.475**	-0.205	0.691**
	(0.16)	(0.42)	(0.18)
Log likelihood	-558.4	-126.8	-519.5
Failure events	335	45	290
$\beta_{Non-tax} + \beta_{Non-tax \times W}$	0.021	-0.001	0.023
	(0.027)	(0.068)	(0.021)

* p<0.10; ** p<0.05. All columns include the following control variables (not reported): S, Age, W × age, Threat, W × Threat, Ln(GDPpc), W × Ln(GDPpc), Growth, W × Growth, and a constant. Clustered standard errors in parentheses. 2105 observations in 103 countries, from 1972-2000.

from the model that examines only leader failures that occur during regime transitions: the substantive result is substantially smaller, lowering the hazard at two years from roughly 0.0011 to 0.0009. Finally, the right panel depicts the result from the third column: again the increase in non-tax revenue cuts the hazard by more than one-half.

A second study, Ahmed (2012), tests whether 'unearned' income from foreign aid and remittances influences government stability using data on leader failure from the DPI. The expectation is that unearned income lowers the risk of government failure and that this effect is stronger in autocratic countries than in democratic ones. The variables of interest are: (1) aid and remittances as a share of GDP; (2) the autocracy score, derived from the Polity index; and (3) the interaction of these two variables.

Table A-3 reports the results that verify and extend the results from Table 3 of Ahmed (2012). We concentrate on the model in column 2 that tests the interaction between *Aid* + *Remit* and *Autocracy*, and leave our verification and correction of the two-stage model for readers to assess with our replication files. Second, we address a concern that arises in the original analysis: the key interactive variable, *Autocracy*, is not properly lagged.[7] In the

[7]The autocracy score in Ahmed's study incorrectly uses the current observation year of the Polity index, which is coded for December 31 of each calendar year. When used as an explanatory variable in the analysis, this means that changes in the independent variable often capture the same political event that is measured by the dependent variable. For example, the DPI records a government failure in Chile in 1989 when an opposition candidate from the Christian Democrat party, Patricio Aylwin, won a fair and free election. The

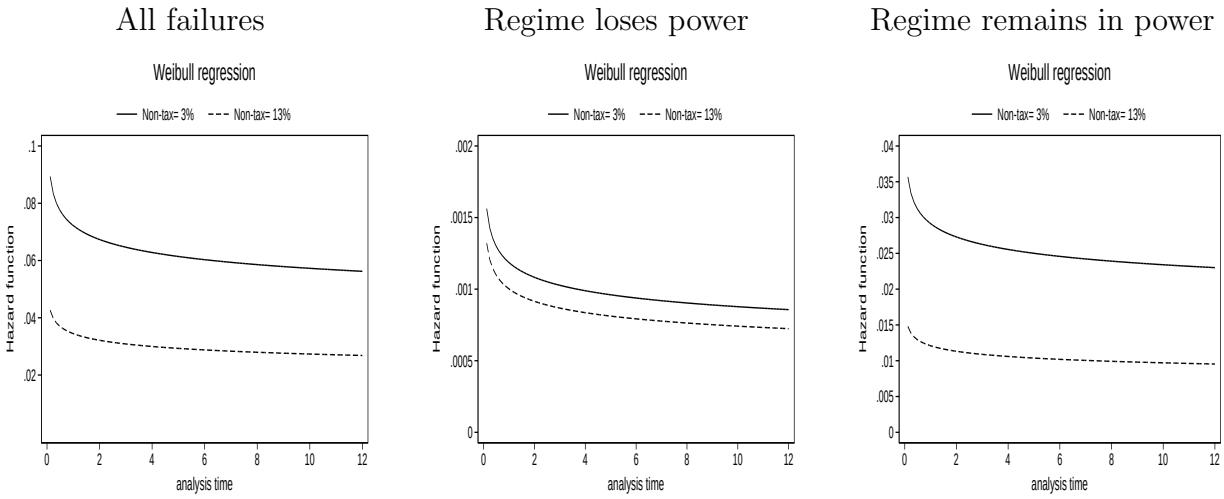

Figure A-2: ***Non-tax revenue and leadership failure, by regime remaining in power.*** Hazard rates calculated from models reported in Table A-2. Horizontal axes depicts the leader time in power (in years). The vertical axes shows the estimated hazard rates for associated with a 10 percent (of GDP) increase in non-tax revenue, from 3 percent o 13 percent.

models presented here, we therefore present the results both before (columns 1-3) and after (columns 4-6) correcting this error.

The bottom panel of Table A-3 reports the linear combination of the main coefficient of interest – $\beta_{Aid+Remit} + \beta_{Autocracy \times (Aid+Remit)}$ – at the 5th percentile and the 95th percentile of the in-sample distribution of the autocracy score. The first column is the verification of the original reported in column 2 of Table 3. The coefficient for the interaction between *Autocracy* and *Aid+Remit* is negative and statistically different from zero. This estimate for *Aid+Remit* at low levels of the autocracy is 0.009, while this estimate is -0.066 at high levels of autocracy.[8] Thus, consistent with theoretical expectations, the combination of aid and remittances lowers the risk of government failure, but only at high levels of institutionalized autocracy.

Columns 2 and 3 report results from splitting the DPI government failures into: those when the regime *loses* power and those when the regime *remains* in power. This analysis mixes autocracies and democracies; and we preserve this research design by coding all auto-

Polity score jumps from -1 on December 31 1988 to +8 on December 31 1989, marking this democratic transition. The autocracy score used by Ahmed as an explanatory variable for the level of institutionalized autocracy falls from 0.1 to 0.05, which corresponds to a 9 point increase (from -1 to +8) in the Polity scale. Therefore, the same event – in this case the 1989 election of Aylwin – is captured in both the dependent variable and the independent variable for the observation year 1989. To correctly use information from the the Polity scale as an explanatory variable to examine when the government is likely to fail, this variable needs to be lagged one year to reflect this concept as coded for December 31 *of the prior calendar year*.

[8]The 5th percentile of the distribution is 0.048, which corresponds to 9 on the Polity scale. The 95th percentile of the distribution is 0.500, which corresponds to -9 on the Polity scale.

cratic regime failures in the GWF data set as incumbent regime *losing* power as well as all democracies that fail and transition back to autocracy. Government failures where the autocratic regime *remains* in power and where democracy continues uninterrupted are coded as the incumbent regime *remaining* in power.[9] The estimate for the interaction term in column 2 – for government failures where the incumbent regime loses power – is positive. The linear combination estimates in the bottom panel show that the coefficient for $Aid + Remit$ is positive both at low levels of autocracy (0.036) and high levels of autocracy (0.056). Contrary to the theoretical expectations, this model suggests that aid and remittances *increase* the chances of government failures that coincide with regime transitions – for both democracy and autocracies.

The third column examines government failures when the incumbent regime remains in power, and the results parallel those reported in column 1 for all government failures. The results in columns 2 and 3 therefore suggest that the main finding in the original pertains to government failures when the incumbent group retains power. The final three columns repeat the analysis with the corrected autocracy score. This correction yields two further results. In column 4, which models all government failures, the interaction term is substantially smaller and not statistically different from zero. In column 5, the interaction term is strongly positive, and the estimated marginal effect of $Aid + Remit$ in countries with a high autocracy score is now positive and statistically different from zero – the opposite of the theoretical prediction.

Figure A-3 shows the main results from both the original and corrected models, for countries with a high level of autocracy (0.5 on the transformed autocracy score). In the left panel, the estimate from the verification model suggests that increasing unearned income across the range lowers the risk of failure from roughly 10 percent to less than 1 percent. However, this estimate masks the strongly negative association between unearned income and failure risk when there is no regime collapse and the positive (but weak) association for government failure when the regime collapses. The short dashed line depicting this latter estimate shows that moving across this range of unearned income is associated with an increase in the risk of regime failure from 4.3 percent to 5.7 percent. The corrected model in the right panel illustrates the same patterns. The risk of government failures that coincides with regime collapse rises from under 3 percent to 5 percent – the opposite of the theoretical expectation.

The results from the verification and extension in Tables A-2 and A-3 indicate that the stabilizing effect of non-tax revenue in the models of all leader failures does not extend to leader failures that occur when autocratic regimes lose power. Rather, the evidence that non-tax revenue stabilizes autocracies only pertains to leader transitions that occur when the incumbent regime retains power. Further, there are many fewer leader failures that occur during regime changes than those that do not. This means that much of our *confidence* in models of leader failure, stems from the large number of leader transitions that occur when the incumbent ruling group rotates leaders but does not lose power.

While Bermeo (2015) points out a number of empirical issues with the analysis in Bueno

[9]See Tables in Appendix C for a list of events for each type of government failure in the sample.

Table A-3: Verification and extension of Ahmed (2012), Table 3 column 2

				Correctly Lagged Autocracy Score (4-6)		
Government failure	All	Regime loses power	Regime remains in power	All	Regime loses power	Regime remains in power
	(1)	(2)	(3)	(4)	(5)	(6)
Aid + Remit	0.017	0.034*	-0.006	0.005	0.032	-0.015
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Autocracy score	-2.172	-6.021**	-1.221	-2.454	-7.857**	-0.980
	(1.48)	(1.99)	(1.37)	(1.57)	(2.12)	(1.37)
Autocracy × (Aid + Remit)	-0.166*	0.045	-0.223*	-0.044	0.095	-0.138
	(0.09)	(0.09)	(0.12)	(0.08)	(0.10)	(0.11)
Observations	1639	891	1400	1638	858	1399
Countries	97	51	84	97	51	84
Area under ROC curve	0.831	0.900	0.824	0.826	0.903	0.819
Failure events	291	69	222	290	68	222
$\beta_{Aid+Remit} + \beta_{Autocracy \times (Aid+Remit)}$	0.009	0.036**	-0.017	0.003	0.037*	-0.021
(5th pctile)	(0.012)	(0.017)	(0.014)	(0.014)	(0.020)	(0.016)
$\beta_{Aid+Remit} + \beta_{Autocracy \times (Aid+Remit)}$	-0.066*	0.056	-0.117**	-0.017	0.080**	-0.083**
(95th pctile)	(0.036)	(0.039)	(0.048)	(0.027)	(0.037)	(0.041)

* p<0.10; ** p<0.05. All columns include the following control variables (not reported): Finite term, Log GDP per capita, Growth, Log Population, War, Low political discontent, High political discontent, duration time dummies, country dummies, year dummies, and a constant. Clustered standard errors in parentheses.

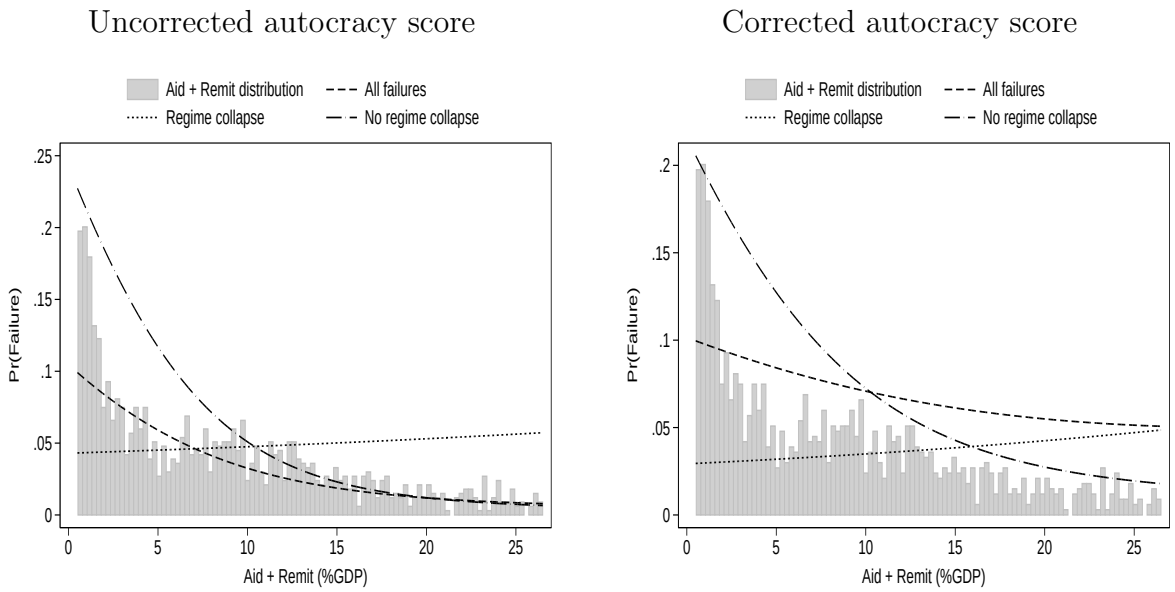

Figure A-3: ***Unearned income and government failure, by regime remaining in power.*** The horizontal axis depicts the measure of unearned income from the 5th to the 95th percentile of the distribution; the vertical axis depicts the estimated risk of different types of government failure. Estimates in left panel from columns 1-3 in Table A-3. Estimates in right panel from columns 4-6 in Table A-3.

de Mesquita and Smith (2010) and Ahmed (2012) that make it difficult to interpret empirical findings using their data and modeling approaches, we offer one explanation that might account for a negative correlation between non-tax revenue and leader exit when the ruling regime or coalition remains in power: non-tax revenue or free resources may allow incumbents to pay regime supporters with resources to forestall attempts by regime *insiders* to oust the incumbent leader. Leader ouster by regime insiders (including many leadership reshuffling coups), we believe, is conceptually distinct from attempts by regime *outsiders* to replace the ruling regime or coalition. Regime insiders ousting a leader can be interpreted as accountability to the regime elite or regime supporters. In contrast, regime outsiders ousting a regime (in addition to its leader) from power can be interpreted as an attempt to replace the ruling coalition with another one, thus changing the composition of the group with access to power and the resources that come with it. Aksoy, Carter and Wright (2015, 423), for example, "pinpoint the accountability of dictators to elites with an interest in preserving the regime" by introducing "a new distinction between coups that *reshuffle* the leadership but leave the regime intact, and *regime change* coups that replace the group of elites atop the regime." The former, they argue, "better capture whether elite supporters hold the dictator accountable because while reshuffling coups replace the leader, the core regime supporters still retain power."

2 Appendix B: Coding rules for different types of political change events

The following table describes the usage of four measures of political instability: Polity *Durable* failure, DPI government failure, Archigos leadership failure, and GWF regime failure.

Measure	Coding Rule	Usage
Polity *Durable* Failure (1800-2012)	Researchers use Polity's *Durable* variable to operationalize regime failure or instability. A country-year is coded as failure whenever the *Durable* variable is zero, indicating the breakdown of regime stability. According to the Polity IV user manual, The *Durable* variable measures "The number of years since the most recent regime change (defined by a three point change in the POLITY score over a period of three years or less) or the end of transition period defined by the lack of stable political institutions (denoted by a standardized authority score)."	Treating all zeros in the *Durable* variable as regime failures should be theoretically justified, particularly for the following cases. *Durable* is coded as zero for multiple transitional years (i.e., -88 in the combined Polity scores) and the subsequent year of new regime. For years when a state experienced foreign interruption (i.e., -66 in the combined Polity scores) and the subsequent year, *Durable* is also coded as zero. Country-years of government discontinuity or interregnum (i.e., -77 in the combined Polity scores) and the subsequent year are also coded as zeros in the *Durable* variable. How to treat all these multiple years of regime instability depends on users' discretion based on the research question and the theoretical concept of regime instability.
DPI Government Failure (1975-2010)	This measure uses DPI's *YRSOFFC* variable that records the number of years that the executive stayed in power: according to the DPI2012 codebook "years are counted in which the executive was in power as of January 1 or was elected but hadn't taken office as of January 1. Thus, a "1" is recorded in the year following his/her election." The end year of the executive tenure is often treated as government failure.	This measure largely corresponds to leadership failure, but the concept of "the executive" could be different from "the effective leader": "The executive who formally (de jure) holds power is counted."
Archigos Leadership Failure (1875-2004)	The *Archigos* data set records when a leader, "the actual effective ruler" lost power. The *EXIT* variable shows whether and how a leader lost power: "It can take on the following values: -888 Leader still in power; 1 Leader lost power through regular means; 2 Leader died of natural causes while in power; 2.1 Leader retired due to ill health; 2.2 Leader lost office as a result of suicide; 3 Leader lost power through irregular means; 4 Leader deposed by another state."	Researchers often use this measure as a dichotomous variable indicating whether a leader stayed in office in a country-year. The information about the mode of exit is also used to distinguish between regular or irregular leadership failure: "Removal from office is coded as Regular when the leader is removed in accordance with explicit rules or established conventions of his or her particular country." "Removal from office is coded as Irregular when the leader was removed in contravention of explicit rules and established conventions."
GWF Regime Failure (1946-2010)	An autocratic regime-year is coded as failure when the executive or the governing body is replaced by a person or a group of people from other factions significantly different from the former: the means of replacement could be a competitive election, a coup, mass uprising, civil war, or some peaceful institutional changes that ensure significant changes in the composition of the ruling group.	For researchers who are interested in whether the ruler or the ruling elites actually lost power followed by changes in domestic institutions or political environments, this measure is useful because it distinguishes between institutional changes and regime instability.

This appendix details the coding rules used to delineate different types of political change events for each of the three variables (Polity Durable, Archigos leader failure, and DPI

government turnover). The coding rules for the autocratic regime collapse events in the GWF data are available in the codebook: `http://dictators.la.psu.edu/`. The code book also contains brief narratives describing each regime collapse event in the data set.

Polity Durable

(1) **Democratic transitions**

- *Durable* failures that occur the same year as the following GWF transitions: autocracy-to-provisional; provisional-to-democracy; autocracy-to-democracy
- *Durable* failures that occur just prior to a democratic transition (i.e. *Durable* failures that precede the GWF transition event by 1 or 2 consecutive years and entail a change in the Polity score)

(2) **Institutional liberalization** Regime remains in power

- *Durable* failures that entail an increase in the Polity2 score but do not happen around GWF transitions

(3) **Autocratic transitions and consolidation**

- *Durable* failures that occur the same year as the following GWF transitions: autocracy-to-autocracy; warlord-to-autocracy; foreign-occupied-to-autocracy; or not independent-to-autocracy
- *Durable* failures that occur just prior to or after an autocratic transition (i.e. *Durable* failures that precede or follow the autocratic transition event by 1 or 2 consecutive years and entail a change in the Polity score)

(4) **Institutional de-liberalization** Regime remains in power

- *Durable* failures that entail a decrease in the Polity score but do not happen around GWF transitions

(5) **Democratic failure**

- *Durable* failures that occur the same year as the following GWF transitions: democracy-to-autocracy; or provisional-to-autocracy
- *Durable* failures that occur prior to (or after) democratic failures (i.e., *Durable* failures that precede or follow GWF democratic failure events by 1 or 2 years and entail a change in the Polity score)

(-88)

- *Durable* failures that occur in countries not included in the GWF data set
- *Durable* failures that result when a regime remains in power but merges with another country (e.g. Germany West 1990)

- *Durable* failures that occur during a transition from interruption or interregnum but the GWF regime does not change

Archigos leader failure

(1) **Democratic survival** Democratic regime remains in power, but leadership fails.

- *Archigos* leadership failures that occur in country-years in which GWF regime type is democracy or provisional, and the subsequent year is also coded as the same.

(2) **Democratic failure** Democratic regime collapses and leadership also fails.

- *Archigos* leadership failures that occur in country-years in which GWF regime type is democracy or provisional, and the subsequent year is coded as autocracy. (Not included in this type of Archigos failure are cases in which events of GWF democratic failure do not entail Archigos leadership failure: e.g., Peru 1992 when Fujimori closed the Congress)

(3) **Democratic Transition** Autocratic regime collapses and leadership fails too.

- *Archigos* leadership failures that occur in country-years in which GWF regime type is autocracy, but the subsequent year is coded as democracy or provisional.

(4) **Autocratic failure** One form of autocracy transforms into another.

- *Archigos* leadership failures that occur in country-years in which GWF regime type is autocracy, but the subsequent country-year is neither democracy nor provisional (e.g., transition from personalist to party regime in Nicaragua 1979).

(5) **Autocratic survival** Autocratic regime remains in power, but leadership fails.

- *Archigos* leadership failures that occur in country-years in which a particular type of GWF autocracy remains in the subsequent year.

(-88)

- *Archigos* leadership failures that occur in country-years not included in the GWF data set (e.g. Belize)
- *Archigos* leadership failures that occur in the years of civil war, foreign occupation, or provisional government (e.g. Afghanistan 1996)

DPI government turnover

(1) **Democratic survival** Democracy survives, but the executive fails.

- *DPI* government turnovers that occur in country-years in which GWF regime type is democracy or provisional, and the subsequent year is also coded as the same.

(2) **Democratic failure** Both democracy and the executive fail.

- *DPI* government turnovers that occur in country-years in which GWF regime type is democracy or provisional, and the subsequent year is coded as autocracy. (Not included in this category of DPI failures are cases in which events of GWF democratic failure do not entail DPI government turnover: e.g., Zambia 1996 when the President prohibited the participation of the most influential opposition candidate)

(3) **Democratic Transition** Both autocratic regime and the executive fail.

- *DPI* government turnovers that occur in country-years in which GWF regime type is autocracy, but the subsequent year is coded as democracy or provisional.

(4) **Autocratic failure** One form of autocracy transforms into another.

- *DPI* government turnovers that occur in country-years in which GWF regime type is autocracy, but the subsequent country-year is neither democracy nor provisional (e.g., transition from personalist to military regime in Haiti 1986).

(5) **Autocratic survival** Autocratic regime remains in power, but the executive fails.

- *DPI* government turnovers that occur in country-years in which a particular type of GWF autocracy remains in the subsequent year.

(-88)

- *DPI* government turnovers that occur in country-years not included in the GWF data set (e.g. Jamaica)
- *DPI* government turnovers that occur in country-years of civil war, foreign occupation, or provisional government (e.g. Liberia 1994)

3 Appendix C: Political change events in verification samples

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Table C-1: Instability events in Morrison (2009) verification

Country	Year	Failure	Country	Year	Failure	Country	Year	Failure	Country	Year	Failure
Argentina	1983	Dem tr	Guatemala	1974	Inst de-lib	Mexico	1977	Inst lib	Senegal	1978	Inst lib
Belarus	1995	Aut tr	Guyana	1978	Inst de-lib	Mexico	1988	Inst lib	South Africa	1992	Dem tr
Belarus	1996	Aut tr	Guyana	1979	Inst de-lib	Mexico	1994	Inst lib	South Africa	1993	Dem tr
Brazil	1985	Dem tr	Guyana	1980	Inst de-lib	Mexico	1995	Inst lib	South Africa	1994	Dem tr
Bulgaria	1990	Dem tr	Haiti	1986	Aut tr	Mexico	1996	Inst lib	Spain	1975	Dem tr
Burkina Faso	1977	Inst lib	Haiti	1987	Aut tr	Mexico	1997	Inst lib	Spain	1976	Dem tr
Burkina Faso	1978	Inst lib	Haiti	1988	Aut tr	Nepal	1981	Inst lib	Spain	1977	Dem tr
Burkina Faso	1980	Aut tr	Honduras	1980	Dem tr	Nepal	1990	Dem tr	Spain	1978	Dem tr
Burundi	1992	Dem tr	Hungary	1988	Dem tr	Nicaragua	1984	Inst lib	Thailand	1973	Dem tr
Burundi	1997	Inst lib	Hungary	1989	Dem tr	Nicaragua	1990	Dem tr	Thailand	1974	Dem tr
Burundi	1998	Inst lib	Hungary	1990	Dem tr	Pakistan	1977	Aut tr	Thailand	1976	Dem fail
Cameroon	1992	Inst lib	Indonesia	1998	Dem tr	Panama	1989	Dem tr	Thailand	1977	Inst lib
Chad	1991	Aut tr	Indonesia	1999	Dem tr	Paraguay	1989	Inst lib	Thailand	1978	Inst lib
Chad	1992	Aut tr	Iran	1979	Aut tr	Paraguay	1992	Dem tr	Thailand	1991	Dem fail
Chile	1973	Dem fail	Iran	1980	Aut tr	Peru	1978	Dem tr	Thailand	1992	Dem tr
Chile	1988	Dem tr	Iran	1981	Aut tr	Peru	1979	Dem tr	Tunisia	1987	Inst lib
Chile	1989	Dem tr	Iran	1982	Aut tr	Peru	1980	Dem tr	Uruguay	1973	Dem fail
Congo	1997	Dem fail	Iran	1997	Inst lib	Peru	1992	Dem fail	Uruguay	1985	Dem tr
Cote d'Ivoire	1999	Aut tr	S Korea	1987	Dem tr	Peru	1993	Inst lib	Yemen	1991	Inst lib
Dominican Rep	1978	Dem tr	S Korea	1988	Dem tr	Peru	2000	Dem tr	Yemen	1992	Inst lib
Dominican Rep	1996	Inst lib	Lesotho	1993	Dem tr	Portugal	1976	Dem tr	Yemen	1993	Inst lib
Gabon	1990	Inst lib	Madagascar	1973	Aut tr	Romania	1989	Dem tr	Zimbabwe	1979	Aut tr
Gabon	1991	Inst lib	Madagascar	1974	Aut tr	Romania	1990	Dem tr	Zimbabwe	1980	Aut tr
Germany	1990	Dem tr	Madagascar	1991	Dem tr	Romania	1996	Inst lib	Zimbabwe	1983	Inst de-lib
Greece	1974	Dem tr	Madagascar	1992	Dem tr	Rwanda	1993	Aut tr	Zimbabwe	1987	Inst de-lib
Greece	1975	Dem tr	Madagascar	1997	Inst de-lib						

Dem tr ≡ Democratic transition (autocracy-to-democracy); *Dem fail* ≡ Democratic failure (democracy-to-autocracy); *Inst lib* ≡ Institutional liberalization (non-transition increase in the Polity score); *Aut tr* ≡ Autocratic transition and consolidation (autocracy-to-autocracy); *Inst de-Lib* ≡ Institutional de-liberalization (non-transition decrease in the Polity score). For completeness, Germany 1990 and Uruguay 1985 are coded democratic transition even though these observation years occur one year after the transition. We code Guyana 1978-80, which is not coded in GWF, as institutional de-liberalization because the Polity score declines in 1980 when Burnham and the PNC, the incumbents, win a fraudulent election. Rwanda 1993 is coded autocratic transition even though the Habyarimana regime did not fall until the RPF rebels took control of Kigali in 1994. We code Madagascar 1973-74 as autocratic transition because the transition from one autocracy to another occurs in 1975 when Ratsiraka was named President by the incumbent military junta and started ruling with civilian parties.

Table C-2: Archigos leader failure, Yes Regime collapse

(Bueno de Mesquita & Smith 2010 verification sample)

Country	Year	Country	Year	Country	Year
Argentina	1983	Dominican Rep	1978	Peru	1980
Brazil	1985	Honduras	1972	Portugal	1976
Bulgaria	1990	Hungary	1990	Rwanda	1973
Bulgaria	1990	Indonesia	1998	South Africa	1994
Burkina Faso	1980	Korea South	1988	Sri Lanka	1994
Burkina Faso	1982	Lesotho	1993	Thailand	1975
Burkina Faso	1987	Liberia	1980	Thailand	1975
Burundi	1996	Madagascar	1972	Thailand	1976
CAR	1981	Madagascar	1993	Thailand	1976
Chad	1975	Mauritania	1978	Thailand	1988
Chad	1990	Nicaragua	1990	Thailand	1991
Chile	1973	Pakistan	1977	Thailand	1992
Chile	1990	Panama	1982	Thailand	1992
Congo	1992	Panama	1990	Thailand	1992
Congo	1997	Paraguay	1993	Uruguay	1985

Regime collapse is defined as Autocracy-to-Autocracy, Autocracy-to-Democracy, or Democracy-to-Autocracy. Non-missing observations only.

Table C-3: Archigos leader failure, No Regime collapse

(Bueno de Mesquita & Smith 2010 verification sample)

Country	Year	Country	Year	Country	Year	Country	Year	Country	Year	Country	Year
Argentina	1981	Colombia	1998	India	1984	Jamaica	1980	Norway	1998	Switz	1979
Argentina	1981	Costa Rica	1974	India	1989	Japan	1972	Pakistan	1990	Switz	1980
Argentina	1982	Costa Rica	1978	India	1990	Japan	1974	Pakistan	1990	Switz	1981
Argentina	1982	Costa Rica	1982	India	1991	Japan	1976	Pakistan	1993	Switz	1982
Argentina	1988	Costa Rica	1986	India	1996	Japan	1978	Pakistan	1993	Switz	1983
Australia	1972	Costa Rica	1990	India	1996	Japan	1980	Pakistan	1993	Switz	1984
Australia	1975	Costa Rica	1994	India	1997	Japan	1982	Pakistan	1996	Switz	1991
Australia	1983	Costa Rica	1998	India	1998	Japan	1987	Pakistan	1997	Switz	1992
Australia	1991	Czech Rep	1997	Iran	1989	Japan	1989	Panama	1983	Switz	1993
Australia	1996	Czech Rep	1998	Iran	1997	Japan	1989	Panama	1994	Switz	1994
Austria	1983	Denmark	1972	Ireland	1973	Japan	1991	Paraguay	1989	Switz	1995
Austria	1986	Denmark	1973	Ireland	1977	Japan	1993	Peru	1975	Switz	1996
Austria	1997	Denmark	1975	Ireland	1979	Korea South	1979	Peru	1985	Thailand	1980
Belgium	1973	Denmark	1982	Ireland	1981	Korea South	1980	Peru	1990	Thailand	1995
Belgium	1974	Denmark	1993	Ireland	1982	Korea South	1980	Poland	1995	Thailand	1996
Belgium	1978	DR	1982	Ireland	1982	Korea South	1993	Portugal	1986	Thailand	1997
Belgium	1979	DR	1982	Ireland	1987	Latvia	1995	Portugal	1996	Trinidad	1995
Belgium	1981	DR	1986	Ireland	1992	Latvia	1997	Romania	1991	Tunisia	1987
Belgium	1981	DR	1996	Ireland	1994	Latvia	1998	Romania	1992	Turkey	1989
Belgium	1992	Egypt	1981	Ireland	1997	Latvia	1999	Romania	1996	Turkey	1991
Bolivia	1989	El Salvador	1999	Israel	1974	Lesotho	1991	Senegal	1980	Turkey	1991
Bolivia	1993	Estonia	1995	Israel	1977	Lesotho	1994	Singapore	1990	Turkey	1993
Bolivia	1997	Estonia	1997	Israel	1977	Lesotho	1994	Slovak Rep	1998	Turkey	1993
Brazil	1990	Estonia	1999	Israel	1983	Madagascar	1996	South Africa	1978	Turkey	1996
Brazil	1992	Finland	1994	Israel	1984	Mauritania	1979	South Africa	1989	Turkey	1996
Brazil	1994	France	1974	Israel	1986	Mauritania	1979	South Africa	1989	Turkey	1997
Bulgaria	1989	France	1981	Israel	1992	Mauritius	1982	South Africa	1989	UK	1974
Bulgaria	1991	France	1995	Israel	1995	Mauritius	1995	Spain	1981	UK	1976
Bulgaria	1992	Germany W	1974	Israel	1996	Mexico	1976	Spain	1982	UK	1979
Bulgaria	1994	Germany W	1982	Israel	1999	Mexico	1982	Spain	1996	UK	1990
Bulgaria	1995	Greece	1973	Italy	1973	Mexico	1988	Sri Lanka	1977	UK	1997
Bulgaria	1997	Greece	1980	Italy	1974	Mexico	1994	Sri Lanka	1989	US	1974
Bulgaria	1997	Greece	1981	Italy	1976	Moldova	1997	Sri Lanka	1993	US	1977
BFO	1974	Greece	1989	Italy	1979	Mongolia	1997	Sweden	1976	US	1981
BFO	1983	Greece	1989	Italy	1980	Netherlands	1973	Sweden	1978	US	1989
Burundi	1976	Greece	1989	Italy	1981	Netherlands	1977	Sweden	1979	US	1993
Canada	1979	Greece	1990	Italy	1982	Netherlands	1982	Sweden	1982	Uruguay	1976
Canada	1980	Greece	1993	Italy	1983	Netherlands	1994	Sweden	1986	Uruguay	1976
Canada	1984	Guatemala	1974	Italy	1987	Norway	1972	Sweden	1991	Uruguay	1981
Canada	1984	Guatemala	1978	Italy	1987	Norway	1973	Sweden	1994	Uruguay	1990
Canada	1993	Guatemala	1982	Italy	1988	Norway	1976	Sweden	1996	Uruguay	1995
Canada	1993	Honduras	1975	Italy	1989	Norway	1981	Switz	1972	Venezuela	1974
Chile	1994	Honduras	1978	Italy	1992	Norway	1986	Switz	1973	Venezuela	1979
Colombia	1974	Hungary	1988	Italy	1993	Norway	1989	Switz	1974	Venezuela	1984
Colombia	1978	Hungary	1994	Italy	1994	Norway	1990	Switz	1975	Venezuela	1989
Colombia	1982	Hungary	1998	Italy	1995	Norway	1996	Switz	1976	Venezuela	1993
Colombia	1986	India	1977	Italy	1996	Norway	1997	Switz	1977	Venezuela	1994
Colombia	1990	India	1979	Italy	1998	Norway	1998	Switz	1978	Venezuela	1999
Colombia	1994	India	1980								

Regime collapse is defined as Autocracy-to-Autocracy, Autocracy-to-Democracy, or Democracy-to-Autocracy. Non-missing observations only.

Table C-4: DPI government turnover, Yes Regime collapse

(Ahmed 2012 verification sample)

Country	Year	Country	Year	Country	Year
Albania	1992	El Salvador	1982	Nicaragua	1990
Argentina	1976	El Salvador	1994	Niger	1993
Armenia	1998	Ethiopia	1991	Nigeria	1979
Bangladesh	1990	Gambia	1994	Nigeria	1983
Belarus	1994	Georgia	2003	Nigeria	1993
Benin	1991	Ghana	1981	Nigeria	1999
Brazil	1985	Ghana	2000	Pakistan	1977
BFO	1980	Guatemala	1995	Pakistan	1988
BFO	1982	GNB	2003	Panama	1982
BFO	1987	Haiti	1986	Paraguay	1993
Burundi	1987	Haiti	1994	Peru	1980
Burundi	1993	Honduras	1981	Peru	2001
Burundi	1996	Kenya	2002	Philippines	1986
CAR	1979	S. Korea	1987	Senegal	2000
CAR	1981	Lesotho	1986	SLE	1992
Chad	1979	Liberia	1980	Sudan	1985
Chad	1982	Madagascar	1993	Sudan	1989
Chad	1990	Malawi	1994	Thailand	1988
Chile	1989	Mali	1991	Thailand	1991
Congo	1992	Mauritania	1978	Turkey	1983
Congo	1997	Mexico	2000	Uganda	1985
Dom. Rep.	1978	Nepal	1991	Uruguay	1984
Ecuador	1979	Nicaragua	1979	Zambia	1991

Regime collapse is defined as Autocracy-to-Autocracy, Autocracy-to-Democracy, or Democracy-to-Autocracy. Non-missing observations only.

Table C-5: DPI government turnover No Regime Failure

(Ahmed 2012 verification sample)

Country	Year	Country	Year	Country	Year	Country	Year
Albania	1997	Dom. Rep.	2000	S. Korea	1979	Paraguay	2003
Albania	1999	Ecuador	1976	S. Korea	1992	Peru	1985
Albania	2001	Ecuador	1981	S. Korea	1997	Peru	1990
Algeria	1978	Ecuador	1984	S. Korea	2002	Philippines	1992
Argentina	1981	Ecuador	1988	Kuwait	1977	Philippines	1998
Argentina	1989	Ecuador	1992	Lao PDR	1991	Philippines	2000
Argentina	1999	Ecuador	1996	Latvia	1997	Poland	1995
Argentina	2001	Ecuador	2002	Latvia	2002	Romania	1991
Azerbaijan	2003	Egypt	1981	Lesotho	1998	Romania	1996
Bangladesh	1981	El Salv.	1977	Lesotho	2002	Romania	1998
Bangladesh	1996	El Salv.	1979	Lithuania	1997	Romania	2000
Bangladesh	2001	El Salv.	1984	Lithuania	2003	Russia	2000
Benin	1996	El Salv.	1989	Macedon.	1998	S. Arabia	1982
Bolivia	1978	El Salv.	1999	Macedon.	2002	Senegal	1980
Bolivia	1985	Estonia	2001	Madag.	1996	SLE	1985
Bolivia	1989	Ethiopia	1995	Malaysia	1976	SLE	1995
Bolivia	1993	Fiji	1987	Malaysia	1981	Slovenia	2002
Bolivia	1997	Ghana	1978	Malaysia	2003	Sol. Isl	1981
Bolivia	2001	Guate.	1978	Mali	2002	Sol. Isl	1984
Botswana	1980	Guate.	1982	Mauritania	1984	Sol. Isl	1986
Botswana	1998	Guate.	1991	Mauritius	1982	Sol. Isl	1989
Brazil	1979	Guate.	1993	Mauritius	1995	Sol. Isl	1993
Brazil	1989	Guate.	1999	Mauritius	2000	Sol. Isl	1997
Brazil	1992	Guate.	2003	Mauritius	2003	Sri Lanka	1977
Brazil	1994	Guyana	1985	Mexico	1982	Sri Lanka	1988
Brazil	2002	Guyana	1997	Mexico	1994	Sri Lanka	1993
Burkina Faso	1991	Guyana	1999	Moldova	1996	Swazil.	1982
Cameroon	1982	Haiti	1989	Moldova	2001	Swazil.	1986
CAR	1991	Haiti	2000	Mongolia	1997	Syria	2000
Chile	1993	Honduras	1978	Mozamb.	1986	Thailand	1980
China	1989	Honduras	1985	Nepal	1983	Togo	1991
China	2003	Honduras	1989	Nepal	1986	Togo	1993
Colombia	1978	Honduras	1993	Nepal	1994	TTO	1981
Colombia	1982	Honduras	1997	Nepal	1997	TTO	1986
Colombia	1986	Honduras	2001	Nepal	1999	TTO	1991
Colombia	1990	Hungary	1994	Nepal	2001	TTO	1995
Colombia	1994	Hungary	1998	Nicaragua	1996	TTO	2001
Colombia	1998	Hungary	2002	Nicaragua	2001	Tunisia	1987
Colombia	2002	India	1977	Niger	1987	Turkey	1978
Comoros	1990	India	1980	Pakistan	1990	Turkey	1989
Congo	1979	India	1984	Pakistan	1993	Turkey	1991
Costa Rica	1978	India	1989	Pakistan	1996	Turkey	1993
Costa Rica	1982	India	1996	Panama	1978	Turkey	1995
Costa Rica	1986	India	1998	Panama	1984	Turkey	1999
Costa Rica	1990	Indonesia	1998	Panama	1988	Turkey	2002
Costa Rica	1994	Indonesia	2001	Panama	1994	Uruguay	1981
Costa Rica	1998	Iran	1989	Panama	1999	Uruguay	1989
Costa Rica	2002	Iran	1997	PNG	1980	Uruguay	1994
Cote d'Ivoire *	1984	Iran	2001	PNG	1982	Venezuela, RB	1978
Cote d'Ivoire	1993	Israel	1977	PNG	1985	Venezuela, RB	1983
Croatia	2000	Israel	1983	PNG	1988	Venezuela, RB	1988
Cyprus	1988	Israel	1986	PNG	1992	Venezuela, RB	1993
Cyprus	1993	Jamaica	1980	PNG	1994	Venezuela, RB	1998
Dom. Rep.	1982	Jamaica	1989	Paraguay	1989	Zimbabwe	1979
Dom. Rep.	1986	Jamaica	1992	Paraguay	1998	Zimbabwe	1987
Dom. Rep.	1996	Kenya	1978				

Regime collapse is defined as Autocracy-to-Autocracy, Autocracy-to-Democracy, or Democracy-to-Autocracy. * This year is marked as failure in the verification sample but we cannot find an original DPI data set that records this year as government turnover. Non-missing observations only.

4 Appendix D: Autocratic instability in Iraq and Nepal

In this section, we examine the political changes in two countries, Iraq and Nepal, to illustrate when these three measures capture the same events and when they do not. Figure D-1 presents graphically the regime and leadership changes in these two countries between 1946 and 2010.

Iraq became independent under the rule of King Faisal in 1932. Since then, the combined Polity score indicates that Iraq became more autocratic in 1958 (-1 point), 1968 (-2 points), and 1979 (-2 points).[10] The political events captured by these changes are important for measuring autocratic instability but they do not constitute *Durable* failures because they do not entail a change of 3 points or more on the combined index. The only *Durable* failure occurs in 2003, the result of foreign invasion and not changes in domestic politics.

In contrast, the GWF measure of autocratic regime collapse captures the 1958 coup which ends the monarchy and results in the death of the royal family. This coup and political transition constitutes regime change, according to their coding rules, because a new group of elites – based in the military – rules Iraq. Similarly, GWF mark the 1968 coup as autocratic regime failure because the Ba'thists regained power that year, and excluded non-Ba'thists associated with the Aref regime. The post-1968 al-Bakr regime is distinct from the previous one because the group from which top leaders could be chosen and who could influence policy was limited to Ba'thists, who had been excluded from the earlier regime not long after the seizure of power Haddad (1971, 143-144, 157-64). Finally, GWF code the formal transfer of power from Field Marshal al-Bakr to Hussein in 1979 as autocratic regime change because it completed a gradual shift from a regime based mostly on Ba'thist military officers and the Ba'th party to one in which the group of leaders included few outside of Hussein's family and home region (Farouk-Sluglett and Sluglett 1987, 208-13; Brooker 1997, 115-16).

While Polity captures changes in political institutions and GWF changes in the ruling group, DPI focuses on leadership turnover. Thus, 1979 is coded as a year of government turnover due to leadership changes from al-Bakr to Hussein. This event also constitutes autocratic regime failure, but the leadership change itself is not a sufficient reason to code regime failure while it is sufficient for the DPI's government turnover variable.

Nepal's history illustrates further differences among Polity, GWF, and DPI. GWF code Nepal as two separate autocratic regimes during the post-war period. For over a century (1846-1951), the Rana family dominated Nepal as hereditary prime ministers. They marginalized the monarchy and controlled all branches of government. In 1951, however, they were forced to return executive power to the king by an insurgency and demonstrations (Levi 1952, 185-91; Heitzman 1991). In 1990, the monarchy agreed to constitutional changes and multi-party election, which was won by the opposition in 1991, marking the end of the regime.

Polity *Durable* records five instability years prior to the 1990-91 democratic transition. The first four (1957-1960) involve changes in the Polity score that capture a series of democ-

[10] Polity codes foreign interruption in Iraq from 2003 to 2009, which means the combined Polity score is missing and *Durable* is 0.

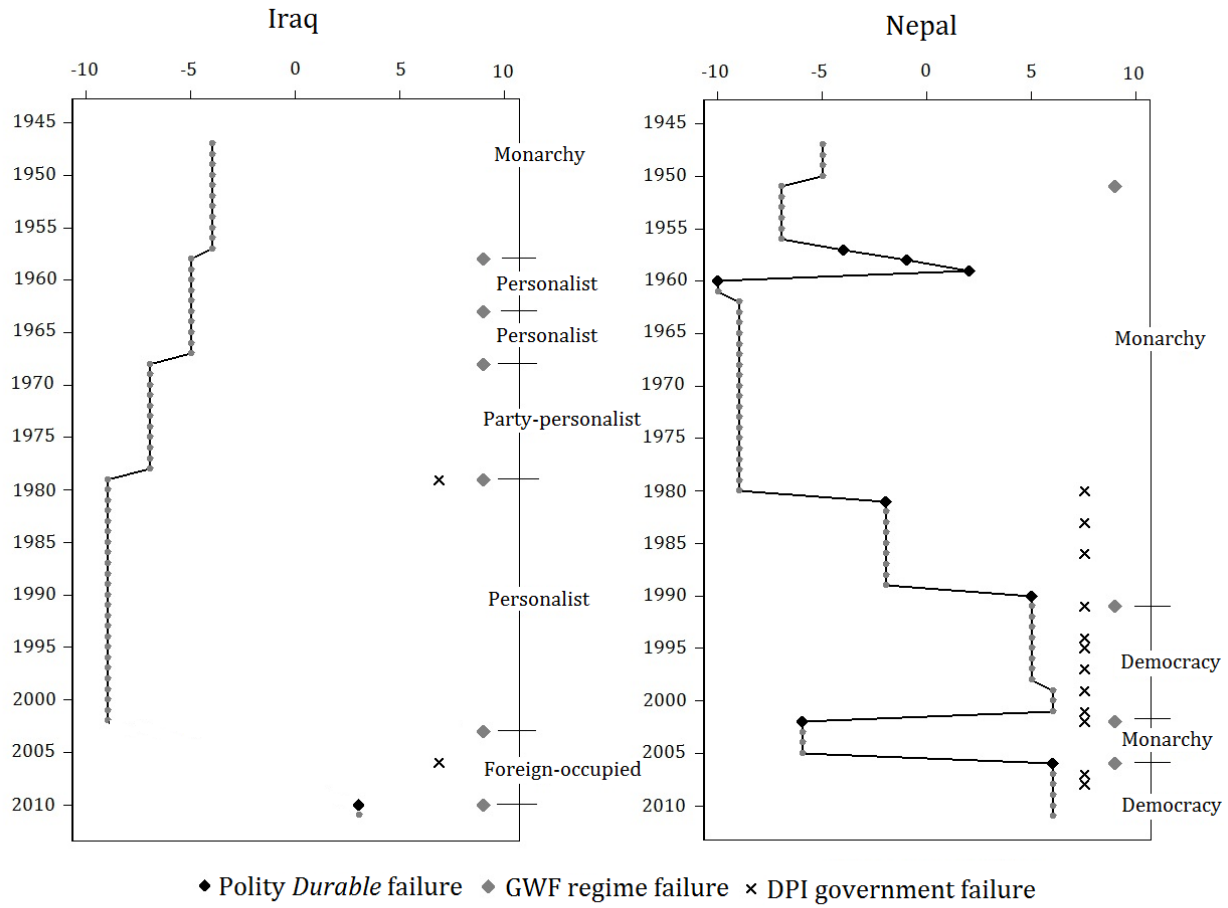

Figure D-1: ***Leadership and regime changes in Iraq and Nepal, 1946-2010.*** This figure illustrates how the Polity score changes in Iraq and Nepal between 1946 and 2010, and compares three different indicators of regime instability: Polity *Durable* failure, GWF regime failure, and DPI government failure. In the left graph, years between 2003 and 2009 are coded as *Durable* failures due to foreign interruption.

ratization efforts, including the first national elections in 1959. Mass anti-government protest and civil disobedience in 1957-58 precipitated the King's announcement of these elections, and Polity codes these years as transitional (-88). In 1960, however, the regime destroyed these democratizing efforts. As Heitzman (1991) describes, "with the army's support and with little warning, the king used his emergency powers to dismiss the cabinet and arrest its leaders." Even though the regime made initial efforts to appease discontent, the King never lost power. Thus, these instances of *Durable* failure are not coded as autocratic regime failures by GWF. The final *Durable* failure prior to democratic transition entailed a limited liberalization process culminating in national elections in 1981. The monarchy remained in power, however. Finally, Polity *Durable* and GWF agree on coding democratic transition in 1991 (though Polity marks this in 1990, not 1991), democratic failure in 2002, and democratic transition again in 2006.

Between 1975 and 1990, however, there are three DPI failures, all involving changes in the leadership of Prime Minister rather than any other changes in political institutions or the ruling monarchy. For the same reason, during the period of democratic rule between 1991 and 2002, there are five DPI failures. In sum, a monarchy ruled Nepal until the democratic transition of 1990-91 democratization – an event captured in all the data sets. In addition, Polity *Durable* codes several failed democratization attempts, while the DPI codes eight leadership changes that do not entail regime change.

5 Appendix E: Extended discussion of Ahmed (2012)

This appendix first discusses the measure of the level of autocracy (Autocracy Score) in Ahmed's (2012) analysis, focusing on two points: (1) the Autocracy Score is a transformation of the quasi-continuous, equal interval Polity scale; and (2) the Autocracy Score is not correctly lagged. Changes to correct either of these yields null results for the main empirical test in Table 3 of the original article.

This appendix then extends the two-stage models in Table 4 of the original manuscript. In attempting to verify these models, we note that the original specification did not include the constituent terms of the key interaction variable.

The Autocracy Score

The autocracy score in this analysis is defined as the "inverse of a country's adjusted POLITY score."[11] In addition to inverting the conventional 21-point scale and constraining the values to fall between 0 and 1, Ahmed transforms the quasi-continuous variable to give more weight to changes in the Polity index at the autocratic end of the index. For example, a 1-point increase in the Polity index from -10 to -9 translates into a decrease in the adjusted autocracy score from 1 to 0.5, but a 10-point increase in the Polity scale from 0 to 10 translates into a decrease from 0.091 to 0.047 in the adjusted autocracy score. Figure E-1 plots the adjusted autocracy score against the standard Polity index, showing the data transformation. Though there is no mention of this adjustment in Ahmed (2012), in unreported results we find that this transformation accounts for the main results in Tables 3 and 4 of the original analysis. However, there are well-known problems associated with assuming that each one-point change in the Polity index is equivalent, and this particular issue is not germane to our discussion of measures of autocratic instability. Therefore, following Ahmed, we use the transformed index (i.e. the vertical axis in Figure 1) throughout.

Two-stage models

Next we turn to the two-stage instrumental variable models in Table 4 of the original analysis. We concentrate on the model reported in column 3, which uses an instrumental variable – $Muslim \times Oil$ – to predict values for the interaction between *Autocracy* and $Aid + Remit$. To obtain maximum likelihood convergence using a two-stage approach, Ahmed changes the model specification by substituting duration time polynomials for duration time dummies and substituting geographic region dummies for country dummies. The first column of Table E-1 reports the verification of column 3, Table 4 in Ahmed's analysis. The coefficient estimate for the interaction term is negative and statistically different from zero. Ahmed interprets this estimate as "captur[ing] the heterogeneous effect of unearned foreign income in autocracies (at varying degrees) on government turnover" (159). However, this model does

[11] Ahmed further writes that the "adjusted score rescales the Polity index (-10 to +10) by adding +11, so that the adjusted scale lies on a 1-to-21 scale, where a value less than 18 falls under the conventional cutoff for classification as an authoritarian regime."

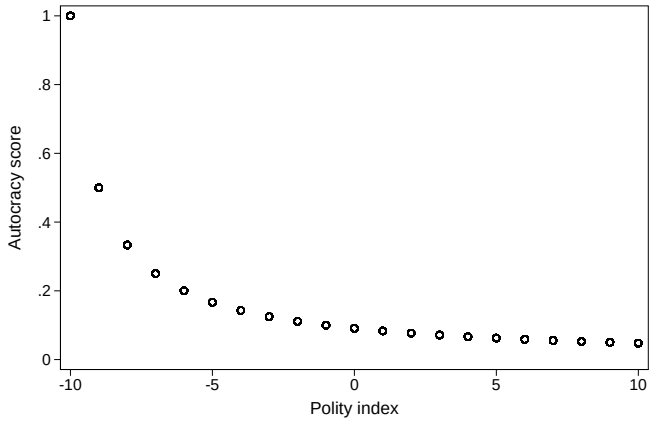

Figure E-1: ***Polity index and the Autocracy score***. *Horizontal axis depicts the 21-point scale of the Polity 2 index. The vertical axis shows the Autocracy score used in Ahmed (2012).*

not include the constituent terms of the interaction ($Autocracy$ and $Aid + Remit$). Importantly, the interaction term and the autocracy score are positively correlated by construction, and the autocracy score is negatively correlated with government failure. This means that a large negative effect of the interaction term may be picking up the independent (negative) influence of the autocracy score when the latter is not included as a control variable.

Thus, to estimate the influence of $Aid + Remit$ on the risk of government failure conditional on $Autocracy$, we need to test a model that includes the interaction term and both constituent terms. To do this requires including two endogenous variables, $Aid + Remit$ and $Autocracy \times (Aid + Remit)$, in the outcome equation. To identify the two-stage equations, we therefore need an additional excluded instrument. We use the interaction between the autocracy score and the excluded instrument: $Autocracy \times (Muslim \times Oil)$.

Before estimating the two-stage model with two endogenous variables, however, we first test the verification model in the first column using the corrected autocracy score to calculate the interaction term. This result is reported in column (2), and the coefficient estimate is nearly identical to that in the first column. Next, we change the model specification to make it more parsimonious so that we can obtain maximum likelihood convergence in a model with two endogenous regressors.[12] Column 3 reports the estimate from this more parsimonious model, with little change to the estimate for the interaction term. Thus, correcting the autocracy score and testing a more parsimonious model preserves the two-stage result reported by Ahmed for the interaction.

Using this more parsimonious specification, column 4 reports the instrumental variables result while controlling for the autocracy score and including two endogenous regressors. The coefficient estimate for the interaction term in this model is still negative but much

[12]We drop the following control variables from the model specification: finite term, low discontent, high discontent, duration time cubed, year dummies, and dummies for Asia and North America.

Table E-1: Verification and extension of Ahmed (2012), Table 4

	Verification Model	Corrected Autocracy score (2-5)				
Government turnover	All	All	All	All	Regime Loses Power	Regime Remains in Power
	(1)	(2)	(3)	(4)	(5)	(6)
Uncorrected Autocracy × (Aid + Remit)	-0.294**					
	(0.13)					
Corrected Autocracy × (Aid + Remit)		-0.285**	-0.312**	-0.060	0.305**	-0.063
		(0.12)	(0.09)	(0.08)	(0.11)	(0.14)
Aid + Remit				-0.043*	-0.130**	-0.029
				(0.02)	(0.02)	(0.06)
Corrected Autocracy				-1.124**	-3.795**	-0.955
				(0.54)	(1.07)	(0.71)
First stage F-statistic	4.2	4.2	7.7		6.6, 11.1	
Failure events	291	290	290	290	226	64
Parsimonious specification	No	No	Yes	Yes	Yes	Yes
$\beta_{Aid+Remit} + \beta_{Autocracy \times (Aid+Remit)}$				-0.046**	-0.115**	-0.032
(5th pctile)				(0.021)	(0.015)	(0.063)
$\beta_{Aid+Remit} + \beta_{Autocracy \times (Aid+Remit)}$				-0.073**	0.022	-0.061
(95th pctile)				(0.033)	(0.041)	(0.098)

* p<0.10; ** p<0.05. Columns 1-2 include the following control variables (not reported): Finite term, Log GDP per capita, Growth, Log Population, War, Low political discontent, High political discontent, duration time polynomials, region dummies, year dummies, and a constant. Columns 3-6 drop: War, Low political discontent, High political discontent, duration time cubed, year dummies, and Asia and North America dummies. Clustered standard errors in parentheses. 1638 observations in 97 countries.

closer to zero and not statistically significant. This suggests that model mis-specification – i.e. not including the constituent terms when testing an interaction – accounts for the main two-stage result.

The final two columns report results for the corrected interaction specification with two endogenous variables, but separately examine government failure when the incumbent regime *loses* power and when it *remains* in power. The estimate for the interaction in column 5 (lose power) is positive and significant – the opposite of the theoretical prediction. The estimate for the marginal effect of unearned income in highly autocratic regimes, shown in the bottom panel, is positive but small (0.022). The estimate in democratic regimes is negative and statistically significant. This suggests that if we have the proper model specification, unearned income may only stabilize democracies. The final column estimates a model of government turnover when the incumbent regime remains in power; the estimate of interaction term is in the expected direction (negative) but much smaller than estimate in columns (1) to (3). These results confirm findings from the naive verification models in the main text: the main empirical finding for unearned income and government turnover pertains to the category of turnover events where the incumbent regime remains in power.

6 Appendix F: Uncertainty around the estimates

This section presents 95% confidence intervals around the point estimates for models extending Morrison (2009) and Ahmed (2012).

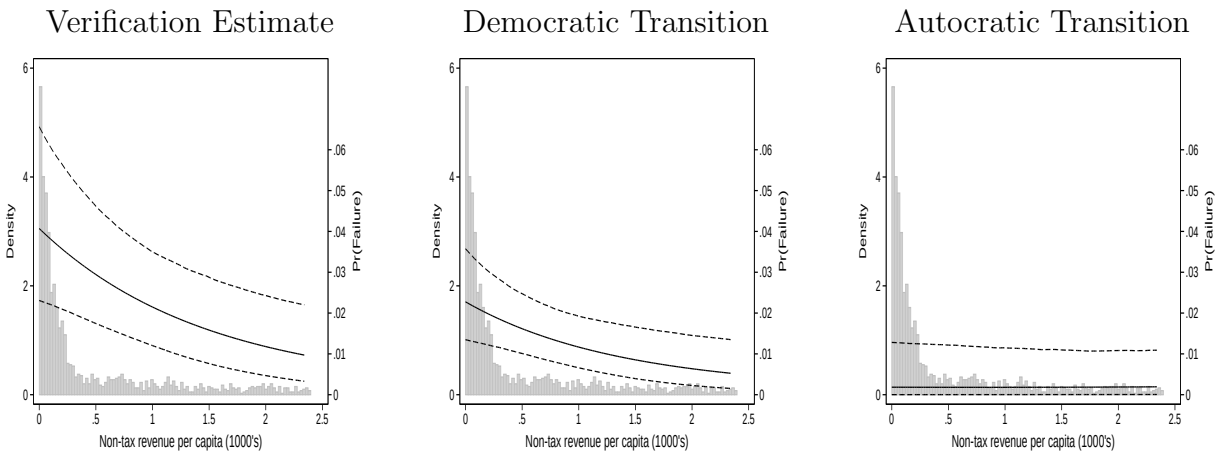

Figure F-1: ***Non-tax revenue and Durable failure.*** The confidence intervals are calculated using the estimates from models in columns 1, 2, and 4 in Table A-1. The horizontal axis depicts the measure of non-tax revenue (rescaled) from the 5th to the 95th percentile of the revenue distribution, while the right vertical axis depicts the predicted probability of different types of Durable failure.

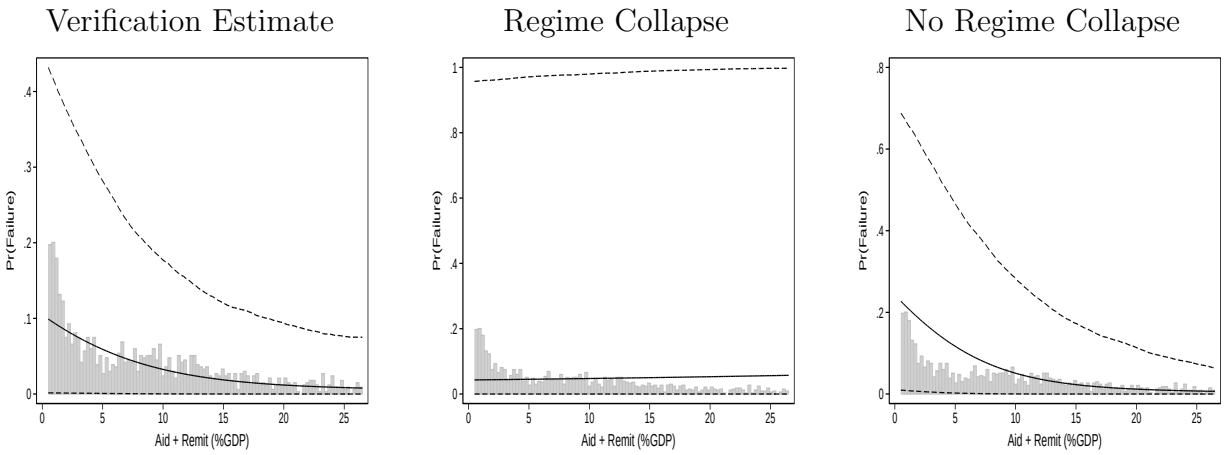

Figure F-2: ***Unearned income and government failure, using uncorrected autocracy score.*** The confidence intervals are calculated using the estimates from columns 1-3 in Table A-3. The horizontal axis depicts the measure of unearned income from the 5th to the 95th percentile of the distribution; the vertical axis depicts the estimated risk of different types of government failure.

7 Appendix G: Extension using Svolik's Ruling Coalition Data

In this section, we extend the three studies (Morrison 2009; Bueno de Mesquita and Smith 2010; Ahmed 2012) linking non-tax revenue to regime/leadership breakdown using Svolik's ruling coalition data. We maintain the research designs of these studies, but examine how the results change incorporating the information about autocratic ruling coalition status into the coding of dependent variables.[13] Since Svolik's data do not provide information about non-autocratic regime years, we can neither determine regime types nor identify cases of ruling coalition failure during non-autocratic regime spells. Thus we follow the GWF coding rule for regime failure during non-autocratic spells, while splitting regime/leadership failures during autocratic regime spells into those when the incumbent ruling coalition loses power and those when the ruling coalition remains in power.

To juxtapose the extension results in this section with those using the GWF data in Appendix A, we first show that autocratic regime failure events in the GWF data set closely match cases of ruling coalition failure in the Svolik data set, thus expecting similar results from our extension analysis. We find that 97 percent of GWF regime collapse country-years entail ruling coalition transition, while 86 percent of country-years with ruling-coalition changes also entail GWF autocratic regime collapse. Table G-1 lists cases where the GWF and Svolik data disagree. There are 5 cases of GWF regime failure where ruling coalition transition does not occur according to the Svolik data, and 24 cases of Svolik ruling coalition transition where an autocratic regime in the GWF data does not collapse.

Non-tax revenue and Durable failure

Table G-2 reports the verification and extension of Morrison's base model (column 2 of Table 3 in the original). The first column replicates Morrison's base model. The second column examines durable failures accompanied with ruling coalition failure,[14] and the third column examines durable failures when the incumbent ruling coalition remains in power. In all three models, non-tax revenue appears to decrease the chances of regime failures.[15] Substantively, however, Figure G-1 shows that the regime-stabilizing effect of non-tax revenue appears to be greater when the ruling coalition remains in power than when the coalition loses power, which is somewhat consistent with the results of other extension analysis.

[13] See Appendix A for details about theoretical arguments, research designs, and empirical findings of these studies.

[14] About 83 percent of democratic transitions in Svolik's data involve ruling coalition transition.

[15] To normalize the original non-tax revenue variable and minimize the influence of outliers, we log the non-tax revenue variable twice and rerun the models in columns 2 and 3. Then, we find results that are quite similar to those reported in Table A-1: i.e., non-tax revenue reduces the likelihood of durable failure that involves ruling coalition transition, such as most cases of democratization.

Table G-1: Disagreement between GWF regime failure and Svolik ruling coalition transition

Regime collapse & No ruling coalition transition		Ruling coalition transition & No regime collapse	
Country	Year	Country	Year
Cambodia	1970	Afghanistan	1986
Cameroon	1983	Algeria	1999
Niger	1991	Argentina	1962
Syria	1947	Argentina	1963
Syria	1951	Burkina Faso	1974
		Burundi	1976
		Cambodia	1985
		Cambodia	1991
		Congo/Zaire	1965
		Ecuador	1976
		El Salvador	1960
		El Salvador	1961
		El Salvador	1962
		El Salvador	1979
		Gabon	1964
		Ghana	1993
		Haiti	2001
		Hungary	1956
		Iran	1951
		Iran	1953
		Korea, South	1979
		Kuwait	1990
		South Africa	1948
		Sri Lanka	1989

Regime collapse is defined by the GWF coding rule, and ruling coalition transition is defined by Svolik's ruling coalition data set. Non-missing observations only.

Table G-2: Verification and extension of Morrison (2009), Table 3

	Verification Model	Coalition remain in power	Coalition lose power
	(1)	(2)	(3)
Non-tax revenue	-0.661**	-0.621**	-0.632**
	(0.23)	(0.27)	(0.25)
Growth	-0.056**	-0.076	-0.043**
	(0.02)	(0.05)	(0.02)
GDP per capita	-0.192*	0.012	-0.283*
	(0.11)	(0.18)	(0.15)
Urban population	0.570**	0.696	0.454
	(0.25)	(0.44)	(0.32)
Ethnolinguistic frac	-0.031	0.483	-0.192
	(0.54)	(1.04)	(0.59)
Population density	-0.016	0.173	-0.107
	(0.09)	(0.16)	(0.11)
Past failures	-0.011	0.071	-0.059
	(0.06)	(0.07)	(0.08)
Area under ROC curve	0.810	0.793	0.820
Instability events	102	30	72

* p<0.10; ** p<0.05. 1808 observations in 104 countries. All columns include the following control variables (not reported): duration, duration knot1, duration knot2, and a constant. Clustered standard errors in parentheses.

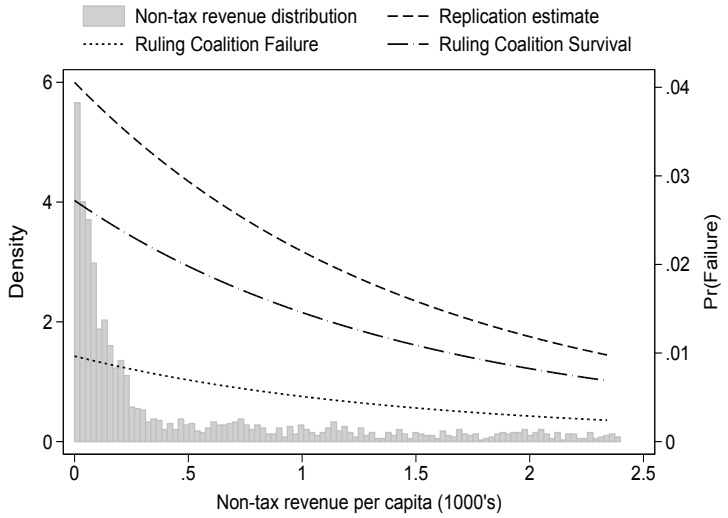

Figure G-1: ***Non-tax revenue and Durable failure.*** The horizontal axis depicts the measure of non-tax revenue (rescaled) from the 5th to the 95th percentile of the revenue distribution, while the right vertical axis depicts the predicted probability of different types of Durable failure. Estimates from models in columns 1, 2, and 3 in Table G-2.

Non-tax revenue and Leader failure

Next, we examine two studies (Bueno de Mesquita 2010; Ahmed 2012) that use Archigos leadership failure and DPI government turnover as the proxies of leadership failure. We extend these studies by decomposing the proxies into cases where the incumbent ruling coalition remains in power and those where the ruling coalition collapses.

We first replicate Model 2, Table 1 in Bueno de Mesquita and Smith (2010) that examines the effect of non-tax revenues on leadership duration. The original model in column 1, Table G-3 shows that the coefficient estimate for non-tax revenue is negative while the coefficient for the interaction between non-tax revenue and coalition size (W) is positive, indicating that non-tax revenue reduces the hazard of leadership failure, and much more so in small winning coalition systems. Then, we divide leadership failures into two categories: (1) those that coincide with a ruling coalition collapse in column 2; and (2) those that do not in column 3. The results show that leadership-stabilizing effect of non-tax revenue is insignificant for leader failures when the ruling coalition loses power. For leader failures when the ruling coalition remains in power, the estimate of non-tax revenue is negative and significant, and the interaction term is positive and significant, which is largely consistent with the results in column 1.

Table G-3: Verification and extension of Bueno de Mesquita and Smith (2010), Table 1 column 2

Leader failure	All	Coalition loses power	Coalition remains in power
	(1)	(2)	(3)
Non-tax revenue	-0.060**	-0.003	-0.078**
	(0.02)	(0.04)	(0.03)
Non-tax × W	0.081**	-0.001	0.103**
	(0.04)	(0.08)	(0.04)
W	0.737	4.576	0.590
	(1.17)	(3.55)	(1.63)
ln(p) W	0.475**	0.082	0.608**
	(0.16)	(0.35)	(0.19)
Log likelihood	-558.4	-127.8	-523.6
Failure events	335	42	291
$\beta_{Non-tax} + \beta_{Non-tax \times W}$	0.021	0.020	0.023
	(0.017)	(0.021)	(0.022)

* p<0.10; ** p<0.05. All columns include the following control variables (not reported): S, Age, W × age, Threat, W × Threat, Ln(GDPpc), W × Ln(GDPpc), Growth, W × Growth, and a constant. Clustered standard errors in parentheses. 2105 observations in 103 countries, from 1972-2000.

Figure G-2 shows how the substantive effect of non-tax revenue varies across these three models. Again, the results are quite similar to those using GWF regime failure in Figure A2.

The left panel shows the change in the hazard of all leader failures. A ten percent increase in non-tax revenue as a percentage of GDP (from 3 to 13 percent) decreases the hazard by about one-half. The middle panel shows the result from the model that examines only leader failures entailing ruling coalition failures: the substantive effect of non-tax revenue is almost negligible. Finally, the right panel shows the substantive result from the third column: the increase in non-tax revenue reduces the hazard by more than one-half.

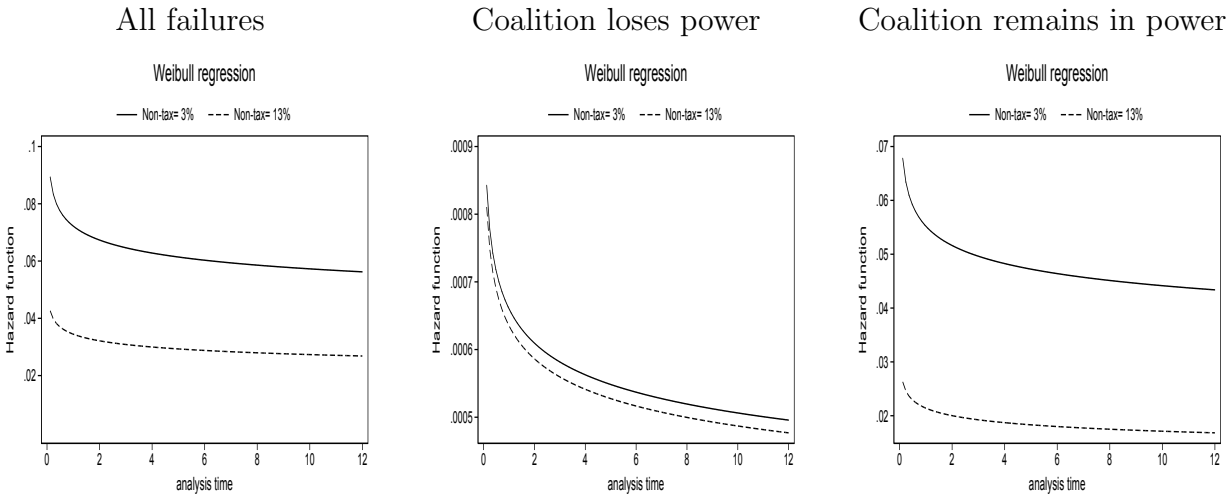

Figure G-2: ***Non-tax revenue and leadership failure, by regime remaining in power.*** Hazard rates calculated from models reported in Table G-3. Horizontal axes depicts the leader time in power (in years). The vertical axes shows the estimated hazard rates for associated with a 10 percent (of GDP) increase in non-tax revenue, from 3 percent o 13 percent.

Next, we replicate and extend Model 2, Table 3 of Ahmed (2012) that examines whether 'unearned' income from foreign aid and remittances, along with the interaction between *Aid+ Remit* and *Autocracy*, influences government stability using data on government turnover from the DPI. Table G-4 reports the results with (columns 1-3) and without (columns 4-6) correcting the *Autocracy* score.[16] The bottom panels of Table G-4 report the linear combination of the main coefficients of interest – $\beta_{Aid+Remit} + \beta_{Autocracy \times (Aid+Remit)}$ – at the 5th percentile and the 95th percentile of the in-sample distribution of the autocracy score.

The first column replicating the original study shows that the coefficient estimate for the interaction between *Autocracy* and $Aid + Remit$ is negative and statistically different from zero, indicating that $Aid + Remit$ has negative effect on the risk of government turnover in highly autocratic countries. In columns 2 and 3, we split the DPI government failures into: those when the autocratic ruling coalition collapses and those when the autocratic ruling coalition remains in power. The estimate for the interaction term in column 2 – for government failures where the incumbent coalition loses power – is negative and insignificant. The

[16]See Appendix E for detailed discussion on this correction.

linear combination estimates in the bottom panel show that the coefficient for $Aid + Remit$ is positive only at low levels of autocracy. This result suggests that aid and remittances do not *decrease* the chances of government failures that coincide with coalition failures. The third column examines government failures when the ruling coalition remains in power, and the results show that aid and remittances reduce the risk of government turnover when the ruling coalition remains in power only in autocracies. These results indicate that the leadership-stabilizing effect of non-tax revenues is significant when the ruling group retains power. Similarly, columns 4 to 6 using the corrected autocracy score show that aid and remittances decrease the chances of government failures only when autocratic ruling coalitions remain in power.

Table G-4: Verification and extension of Ahmed (2012), Table 3 column 2

				Correctly Lagged Autocracy Score (4-6)		
Government failure	All	Coalition loses power	Coalition remains in power	All	Coalition loses power	Coalition remains in power
	(1)	(2)	(3)	(4)	(5)	(6)
Aid + Remit	0.017	0.083**	-0.013	0.005	0.086**	-0.012
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
Autocracy score	-2.172	-3.550**	-1.254	-2.454	-3.312*	-1.414
	(1.48)	(1.73)	(1.43)	(1.57)	(1.73)	(1.48)
Autocracy × (Aid + Remit)	-0.166*	-0.246	-0.135	-0.044	-0.178	-0.156
	(0.09)	(0.17)	(0.11)	(0.08)	(0.15)	(0.11)
Observations	1639	576	1446	1638	551	1445
Countries	97	38	85	97	38	85
Area under ROC curve	0.831	0.908	0.821	0.826	0.902	0.821
Failure events	291	55	226	290	54	226
$\beta_{Aid+Remit} + \beta_{Autocracy \times (Aid+Remit)}$	0.009	0.070**	-0.020	0.003	0.076**	-0.020
(5th pctile)	(0.012)	(0.021)	(0.014)	(0.014)	(0.026)	(0.016)
$\beta_{Aid+Remit} + \beta_{Autocracy \times (Aid+Remit)}$	-0.066*	-0.040	-0.081*	-0.017	-0.003	-0.091*
(95th pctile)	(0.036)	(0.070)	(0.045)	(0.027)	(0.053)	(0.043)

* p<0.10; ** p<0.05. All columns include the following control variables (not reported): Finite term, Log GDP per capita, Growth, Log Population, War, Low political discontent, High political discontent, duration time dummies, country dummies, year dummies, and a constant. Clustered standard errors in parentheses.

The results from the verification and extension in Tables G-3 and G-4 indicate that the leadership-stabilizing effect of non-tax revenue is not significant when ruling coalitions lose power. Conversely, the findings in the original models appear to pertain to leadership failures when the ruling group remains in power. This finding is largely consistent with those using the GWF regime coding reported in Appendix A.

References

Acemoglu, Daron and James Robinson. 2006. *Economic Origins of Dictatorship and Democracy*. New York: Cambridge University Press.

Ahmed, Faisal Z. 2012. "The Perils of Unearned Foreign Income: Aid, Remittances, and Government Survival." *American Political Science Review* 106(1):146–165.

Aksoy, Deniz, David B Carter and Joseph Wright. 2015. "Terrorism and the Fate of Dictators." *World Politics* 67(3):423–68.

Brooker, Paul. 1997. *Defiant Dictatorships: Communist and Middle Eastern Dictatorships in a Democratic Age*. Basingstoke, Hampshire: Macmillan.

Bueno de Mesquita, Bruce and Alastair Smith. 2010. "Leader Survival, Revolutions, and the Nature of Government Finance." *American Journal of Political Science* 54(4):936–950.

Farouk-Sluglett, Marion and Peter Sluglett. 1987. *Iraq Since 1958: From Revolution to Dictatorship*. London: KPI Ltd.

Haddad, George. 1971. *Revolutions and Military Rule in the Middle East: The Arab States, Pt. I: Iraq, Syria, Lebanon and Jordon*. New York: Robert Speller and Sons.

Heitzman, James. 1991. Chapter 1 - Historical Setting. In *Nepal: A Country Study*, ed. Andrea Matles Savada. Washington, DC: Federal Research Division, Library of Congress. `http://lcweb2.loc.gov/frd/cs/nptoc.html` [Accessed: 27 September 2012].

Levi, Werner. 1952. "Government and Politics in Nepal: I." *Far Eastern Survey* 21(18):185–91.

Morrison, Kevin. 2007. "Natural resources, aid, and democratization: A best-case scenario." *Public Choice* 131(3-4):365–386.

Morrison, Kevin. 2009. "Oil, Non-Tax Revenue, and the Redistributional Foundations of Regime Stability." *International Organization* 63(1):107–138.