ONLINE APPENDIX

1. The participatory budgeting census

The dataset I use in this study is the combination of two data collection efforts (spring of 2008 and spring of 2012) and builds upon pre-existing data collection efforts conducted by Ribeiro and De Grazia (1997-2002), Avritzer and Wampler (2005).

Differently from the previous efforts, which were based solely on city level surveys, the main explanatory variable — implementation of participatory budgeting — was constructed on the basis of a two-step procedure. First, with the help of research assistants, I investigated secondary sources[1], such as news, city websites, blogs and private web pages to identify potential candidates cities that could have implemented participatory budgeting during the period 2005 to 2008 (Census of 2008), and during the period 2009 to 2012 (Census of 2012).

I used the five criteria identified by Sintomer (2007) to isolate the potential candidates. Then each candidate city was contacted by phone to confirm that the process had effectively happened and that it fit the criteria described by Sintomer. Regarding frequency (due to the existence of processes that occur every other year) I coded a city as implementing PB if it had organized at least two cycles within the four-year electoral period.

The sample of cities investigated is composed of all the cities with a population of more than 50,000 inhabitants. The initial sample generated in 2008 cross-checked the previous data collection efforts conducted during the period 1989 to 2004. The second census conducted in 2012 instead focused only on the period 2009 to 2012 and on new cities that had achieved 50,000 inhabitants and had not been investigated before. In 2008 568 cities were investigated, in 2012 the sample was expanded to 595.

This essay employs in its main statistical analysis only the subset of 468 cities that achieved 50,000 inhabitants in 1992 because this set of cities is stable, there are no cities created or merged within the time

[1] A typical topic for a master thesis in political science, sociology or public policy is a case study on participatory budgeting. While the quality of these studies varies, they are invaluable secondary sources for mapping efforts.

period analyzed. The total number of Brazilian cities is approximately 5,500; but more than 65% of the total population lives in the cities I analyze.

Brazilian elections at the municipal level are held every four years, with the first municipal elections after a 20 year long dictatorship taking place in 1989. The qualitative literature shows that participatory budgeting is a fairly stable process within each electoral period; there are no case studies describing adoption that does not occur in the first year of the mandate, and it is rare that the process is abandoned before four years of implementation. In two of the case studies (Hortolandia (SP) and Itaúna (MG)) I visited in 2009 during my preparatory field work the process had lasted three years (2004-2007) then was simplified (2008) and subsequently was abandoned at the beginning of the new electoral term. This seems to be a fairly common pattern for citywide PB processes, confirmed also by the literature of PB processes outside of Brazil (Lopes-Alves and Allegretti 2012). It might be different for district level participatory budgetings that employ discretionary funding of city council members such as the process in New York City and Chicago, but it is too early to tell. Therefore the time unit employed by the census is the four year electoral term. The dataset contains six time periods: 1989 to 1992, 1993 to 1996, 1997 to 2000, 2001 to 2004, 2005 to 2008 and 2009 to 2012.

2. Explanatory variables

The dataset employed by this essay integrates the participatory budgeting census with information gathered from Instituto de Pesquisa Econômica Aplicada (IPEA) integrated with information from various state level electoral tribunals (Tribunal Regional Electoral — TRE) that possess information on executive elections held before 1996.

Using the latitude and longitude provided by Ipeadata I geocoded the participatory budgeting census and I created a measure of geographical proximity. This measure captures the minimal distance from one city to another city adopting participatory budgeting in the previous time period. The measures of peer proximity and weighted peer proximity were instead created on the basis of the party of the mayor. The first measure captures whether there is a city controlled by the same party that adopts PB in the previous time period. The second measure of peer proximity multiplies the previous dummy by the total number of cities adopting PB controlled by each party. I built these variable using the entire sample.

Using information gathered by city websites, by IPEA, and by TRE, I constructed the variable identifying the party of the mayor. This variable goes back to 1989. In order to analyze the continuity of the party of the mayor I had to standardize the name of a number of parties that merged over time. An Excel file with the details of the coding is contained in the replication material.

Using data provided by IPEA on city council elections I constructed the variable identifying the number of seats of the party of the mayor in the council, and the dummy that identifies if the party of the mayor holds the majority of seats in the city council.

The final variables, tax share of revenues and the ratio of expenditures over revenues were constructed using information contained in the data of IPEA. Additional variables (e.g., city level GDP) employed in a variety of robustness checks available upon request are contained in the dataset of IPEA or were found in TRE websites.

Online appendix: System GMM

Following the method employed by Acemoglou et al. (2008) I compare a pooled linear probability model (LPM), a fixed effect linear probability model (FE), a pooled logit (LOGIT), a Chamberlain random effect logit (CHAMBERLAIN), and a linear system GMM model (GMM). These are autoregressive models that employ a system of interactions to estimate adoption and abandonment in one equation. Another set of interactions is included to isolate pre- and post-2002 effects.[2]

All models maintain the assumption that the mechanisms that drive the adoption and survival of PB are affected directly only by the previous time period. Thus the models do not consider the age of the process, nor do they differentiate between first adoption and re-adoption of a failed process. All models assume that the effect of time on adoption and continuation is identical.[3] All models include time dummies and estimate the errors adjusting for clustering at the city level.[4]

LPM and FE models are included because they overestimate and underestimate the linear effect of the lagged dependent variable and thus they offer an important metric to gauge the specification of the GMM model (Bond 2002). If the GMM estimate of the lagged dependent variable is outside the boundaries of the OLS and FE models, the GMM model is misspecified. The non-linear models are included as robustness checks.

The only model that takes into account reverse causation and endogeneity effects is the system GMM model. Thus if participatory budgeting is effective in securing the vulnerability of the mayor only the GMM model is correctly specified. The GMM model assumes that all the explanatory variables in the continuation model are endogenous. The other models do not. Thus when investigating the effect of explanatory variables on continuation of the process the other models might capture the effects of PB on the explanatory variables in the previous time period.

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[2] I apply these interactions only to those explanatory variables that capture the victory of the Workers' Party in the mayoral elections and to those that measure proximity. There are no theoretical reasons to assume the presence of structural breaks in the other variables and testing for the presence of a structural break in 2002 in the other explanatory variables does not detect any. These results are available upon request.

[3] Estimating two separate models, one focusing on adoption and one focusing on survival does not change the results. See online appendix.

[4] Introducing clustering at the state level, due to the low number of states (27), makes the Jensen statistics of the GMM estimations unreliable. However the results for the OLS, FE and Logit model are unchanged. Results are available in the replication material.

In the Participatory Budgeting Census there are a total of six time periods (1989-1992, 1993-1996, 1997-2000, 2001-2004, 2005-2008, 2009-2012), however due to the lack of data on city council elections in 1988 and 1992 the statistical analysis does not include the first time period. Brazilian municipal elections occur in the last year of each period. Each model investigates the probability of adoption and abandonment of PB in period T as a function of variables in period T-1. The following is the linear fixed effect specification:

$$E(PB_{i;t}) = \alpha_i + \beta PB_{i;t-1} + PBN_{i;t-1}\left[POL_{i;t-1}\boldsymbol{\gamma} + ECON_{i;t-1}\boldsymbol{\delta} + \varepsilon PROX_{i;t-1}\right]$$
$$+ PB_{i;t-1}\left[POL_{i;t-1}\boldsymbol{\zeta} + ECON_{i;t-1}\boldsymbol{\eta} + \theta PROX_{i;t-1}\right] + \boldsymbol{\iota} PERIOD_t$$

where PB and PBN are dummy variables that assume value 1 if the city is implementing participatory budgeting, or not implementing it respectively. POL is a matrix containing the four political variables described in section 5 of the paper measuring vulnerability, ECON a matrix containing the two economic variables measuring availability of resources, PROX is a vector measuring geographic proximity and PERIOD is a matrix containing period dummies that capture the effect of time and α_i are city level fixed effects. The LPM model has an identical specification, but without different intercepts for each city. The logit model applies a logistic link function to the LPM specification. The Chamberlain logit model introduces random effects, and averages of all explanatory variables as additional controls. These averages constitute a subset of all potential fixed effects. Introducing general fixed effects in non-linear dynamic panel data models results in the incidental parameter problem. For a discussion see Acemoglou et al. (2008) and Wooldridge (2010).

Following the first two hypotheses described in the paper each model also introduces a structural break that distinguishes the effects of the victory of the Partidos dos Trabalhadores and geographic proximity in the periods before and after 2002.

To facilitate the exposition of the results I begin by presenting the estimates that investigate H1 and H2 (Table 4a and 4b),[5] then present the estimates that investigate H3 and H4 (table 5),[6] and then present the remaining estimates and diagnostics (table 6). Note that table 4, 5 and 6 are all part of a single estimation procedure that includes all the explanatory variables described in the three tables.

The results shown in table 4a are very similar to the ones shown by the separate estimation methods in table 3 and support hypothesis 1. The large effect of the victory of the Workers' Party on adoption of PB declines after 2002. The amount of the decline is larger in linear specifications.

Less clear are the effect on survival, the GMM model that assumes that the adoption of PB might affect the victory of the Workers' Party shows a negative non significant effect, while all the other models show large and positive effects. Similarly the results regarding the change in the effect on continuation are unclear.

Table 4b investigates the effect of geographical proximity (**H2**). The table shows negative effects of geographical proximity on adoption, both pre- and post-2002, while a positive effect on survival that becomes negative after 2002. Note that the sign of the effect has a

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[5] H1: The probability that a city government controlled by the Partidos dos Trabalhadores adopts PB should decline after the victory of the party in the presidential elections (2002). H2: After 2004 the effect of proximity on the probability of adoption of PB decreases, and the effect of proximity on the probability of abandonment of PB increases.

[6] H3: The availability of resources and the city's wealth are positively correlated with the adoption and survival of PB. H4: The Political vulnerability of the city government is positively correlated with the adoption and survival of PB.

counterintuitive meaning as explained in the paper. A negative coefficient implies that the smaller the distance from a city adopting PB — what the proximity variable measures — the higher the change of adopting, a positive coefficient the opposite. The effect on adoption is significant in the linear specifications, but not significant in the non linear ones. Almost all effect on continuation are not significant.

To get a sense of the magnitude of these effect consider that the unit of measure is approximately 100 kilometers. Thus if the distance from city A and the closest city that implemented PB declines by 500 kms, the probability that city A adopts PB increases by 3% before 2002, while after 2002 it increases by 15%[7]. This might be a uniqueness of the Brazilian case, but certainly shows how important it is to analyze separately adoption and survival to fully understand what drives phenomena that look like policy bubbles. With regard peer-proximity no effect is detected[8].

Table 6 investigates H3, the effect of availability of resources and H4, the effect of political vulnerability. With respect the effect of vulnerability and resources the table shows results that are not robust to model specification. While the estimates of the effects on adoption correspond to the hypotheses we postulated, the estimates of the effect on the probability of survival have ambiguous results.

With regard the effect of a change in the city government the table shows that continuity (i.e. no change in government) has a negative effect on adoption (-5%). Note that the continuity of a city government partially captures its vulnerability. Incumbent governments on average might be less vulnerable than challengers. With regard the effect of continuity on survival of PB the table

[7] The magnitude of the effect increases by 2% after 2002, thus the total effect becomes 5% per each 100 km.
[8] Using peer-proximity (dummy=1 if a city controlled by the same party adopted PB in the previous time period) or weighted peer-proximity (dummy=number of cities controlled by the same party implementing PB in the previous time period) instead of geographic proximity does not find any significant results. Results available upon request.

identifies a positive effect that is significant in all models apart the GMM. Note that the latter model is the only one that accounts for reverse causation and isolates only the effect of continuity on PB.

Overall it is quite surprising that measures of vulnerability in the city council have no significant influence on adoption or survival of the process. While there is no evidence that city governments adopt PB to bypass the city council, there is evidence that significant opposition to the process within the city council was present in some municipalities that abandoned the process (e.g. São Paulo, Wampler 2008). There is also evidence that city council members react to the presence of PB in Porto Alegre proposing more amendements to the budget in an attempt to regain control over the resources spent in PB (Dias 2002). It is also surprising that the presence of slack resources has unclear effects on adoption or continuation.

Concluding this section table 6 presents the estimation of the intercept, lagged dependent variable, time effects and diagnostics. The Arellano-Bond test rejects the hypothesis of no first order serial correlation in the residuals of the GMM model, and accepts the hypothesis of no second order serial correlation. The Sargan and Hansen tests accept the null hypotheses. The estimate of the coefficient of the lagged dependent variable of the GMM model lies in between the estimate of the LPM and the FE models. Thus the GMM model is correctly specified. Varying the lag structure generates different results most of which fail the Sargan and Hansen tests or present an estimate of the lagged dependent variable that is outside the bounds of the LPM and the FE models estimates.

As expected, the time effect on the period 2001-2004 is positive and strongly significant in all specifications. The other time effects are smaller and not significant. The intercept is positive in the linear models, but not significant.

All models have a low fit that suggests caution in interpreting the results in a causal manner. The larger fit of the Chamberlain model should be judged cautiously because this model has twice the number of regressors of the other specifications by construction.

Overall these robustness check confirm H1 and show that the results on vulnerability of the mayor, on Mayor's share of council seats and the result on tax share of revenues displayed by table 3 are potentially affected by endogenous relations and thus should be evaluated with extra care.

Table 4A: Testing the influence of the Workers' Party (H1)

Period 1997 to 2012					
	Pooled OLS	FE	Pooled Logit	Chamberlein Logit, RE	System GMM
Probability of Adoption					
Victory of the PT before 2002	0.73*** (0.04)	0.62*** (0.05)	0.66*** (0.05)	0.62*** (0.07)	0.72*** (0.05)
Change in effect after 2002	-0.29*** (0.07)	-0.10 (0.07)	-0.12*** (0.03)	-0.03 (0.05)	-0.23** (0.07)
Probability of Survival					
Victory of the PT	0.49*** (0.07)	0.54 (0.08)	0.52*** (0.14)	0.58*** (0.15)	-0.04 (0.25)
Change in effect after 2002	-0.21** (0.08)	-0.16 (0.11)	-0.13*** (0.04)	-0.12*** (0.04)	0.08 (0.22)

Table 4B: Testing the influence of geographical proximity (H2)

	Pooled OLS	FE	Pooled Logit	Chamberlein Logit, RE	System GMM
Probability of Adoption					
Proximity before 2002	-0.01* (0.004)	-0.02*** (0.01)	-0.02 (0.01)	-0.02 (0.01)	-0.01** (0.004)
Change in effect after 2002	-0.03** (0.01)	-0.03*** (0.01)	-0.02 (0.02)	-0.001 (0.02)	-0.02* (0.01)
Probability of Survival					
Minimum Distance	0.04 (0.04)	0.07 (0.05)	0.02 (0.03)	0.05 (0.03)	0.01 (0.12)
Change in effect after 2002	-0.06 (0.05)	-0.08 (0.05)	-0.03 (0.03)	-0.07** (0.03)	-0.01 (0.12)

Notes: the sample spans 5 time periods 1993-1996, 1997-2000, 2001-2004, 2005-2008, 2009-2012 and is comprised by 468 cities with a population larger than 50000 (base year 1992). This table presents a subset of the estimates, see table 6 and 7 for the rest. Brasilia is excluded. The table shows only a subset of coefficient estimates All the explanatory variables are lagged. Each model included time effects for periods 4, 5 and 6. The logit coefficients represent average marginal effects. In the Chamberlain Logit model the marginal effect of the coefficients are estimated assuming that the intercept is equal to zero. In the GMM model all adoption variables are considered as predetermined, all continuation variables as endogenous, time effects as exogenous. The GMM model employs a two-step procedure and an orthogonal transformation. All models present robust standard errors that are clustered at the city level. The GMM models utilizes Windmeijer (2005) finite sample correction for standard errors. Standard errors are in parentheses. *, ** and *** denote significance at the 10%-, 5%- and 1%-levels, respectively.

Table 5: Testing the effect of availability of resources (H3) and political vulnerability (H4)

Period 1996 to 2012					
Probability of Adoption	Pooled OLS	FE	Logit	Chamberlein Logit, RE	System GMM
Tax share of revenues	0.52*** (0.11)	0.08 (0.31)	0.49*** (0.10)	0.12 (0.23)	0.78** (0.20)
Financial viability index	-0.14 (0.09)	-0.16 (0.10)	-0.13 (0.10)	-0.05 (0.08)	-0.14 (0.16)
City government continuity	-0.05*** (0.02)	-0.07*** (0.02)	-0.05** (0.02)	-0.06*** (0.02)	-0.05** (0.02)
Mayor's vulnerability	0.05 (0.04)	0.11** (0.05)	0.05 (0.05)	0.09** (0.04)	0.06 (0.06)
Mayor controls the council	-0.01 (0.02)	-0.004 (0.02)	-0.01 (0.02)	-0.01 (0.02)	-0.02 (0.03)
Mayor's share of council seats	-0.12 (0.07)	-0.01 (0.09)	-0.15 (0.09)	-0.002 (0.10)	-0.12 (0.13)
Probability of Survival					
Tax share of revenues	0.52 (0.32)	0.47 (0.45)	0.30 (0.19)	0.34 (0.31)	1.90*** (0.64)
Financial viability index	-0.31 (0.23)	-0.16 (0.24)	-0.16 (0.15)	0.04 (0.16)	-0.15 (0.41)
City government continuity	0.19*** (0.06)	0.14*** (0.07)	0.12** (0.05)	0.09* (0.05)	0.27 (0.17)
Mayor's vulnerability	-0.27** (0.12)	0.03 (0.13)	-0.15** (0.07)	-0.05 (0.08)	0.44 (0.34)
Mayor controls the city council	-0.01 (0.06)	-0.06 (0.06)	-0.002 (0.03)	-0.01 (0.04)	-0.29 (0.21)
Mayor's share of council seats	-0.31 (0.31)	-0.05 (0.34)	-0.18 (0.17)	-0.24 (0.21)	0.45 (0.96)

Notes: the sample spans 5 time periods 1993-1996, 1997-2000, 2001-2004, 2005-2008, 2009-2012 and is comprised by 468 cities with a population larger than 50000 (base year 1992). This table presents a subset of the estimates, see table 5 and 7 for the rest. Brasilia is excluded. The table shows only a subset of coefficient estimates All the explanatory variables are lagged. Each model included time effects for periods 4, 5 and 6. The logit coefficients represent average marginal effects. In the Chamberlain Logit model the marginal effect of the coefficients are estimated assuming that the intercept is equal to zero. In the GMM model all adoption variables are considered as predetermined, all continuation variables as endogenous, time effects as exogenous. The GMM model employs a two-step procedure and an orthogonal transformation. All models present robust standard errors that are clustered at the city level. The GMM models utilizes Windmeijer (2005) finite sample correction for standard errors. Standard errors are in parentheses. *, ** and *** denote significance at the 10%-, 5%- and 1%-levels, respectively.

Table 6: intercepts, lagged dependent variable, time effects and diagnostics

Period 1996-2012. Dep. var.: implementation of PB					
	Pooled OLS	FE	Logit	Chamberlain Logit, RE	System GMM
Intercept	0.17 (0.11)	0.24 (0.13)	NA	NA	0.12 (0.20)
lagged dependent variable	**0.55**** (0.24)	**-0.25** (0.25)	0.43* (0.24)	-0.12 (0.09)	**-0.13** (0.54)
Period 3 (1996-2000)	baseline	Baseline	baseline	Baseline	Baseline
Period4 (2001-2004)	0.07*** (0.02)	0.10*** (0.02)	0.09*** (0.03)	0.08** (0.03)	0.08*** (0.03)
Period5 (2005-2008)	0.03 (0.04)	0.09** (0.05)	0.04 (0.05)	0.09* (0.05)	0.04 (0.07)
Period 6 (2009-2012)	0.01 (0.03)	0.07** (0.03)	0.01 (0.04)	0.04 (0.04)	0.03 (0.04)
Number of observations	1834	1834	1834	1834	1834
Number of clusters	468	468	468	468	468
Missing values	38	38	38	38	38
R-squared	0.34	0.19			
Root MSE	0.34				
R-squared within		0.26			
R-squared between		0.11			
Pseudo R-squared			0.30		
Corr(observed;predicted)^2				0.52	0.26
Number of instruments					110
Arellano-Bond test for AR(1) in first differences *H0: There is no first-order serial correlation in residuals*					z = -8.81 Pr > z = 0.000
Arellano-Bond test for AR(2) in first differences *Ho: There is no second-order serial correlation in residuals*					z = 0.75 Pr > z = 0.455
Sargan test of overidintifying restrictions *H0: Model specification is correct and all overidentifying restrictions are exogenous*					chi2(85) = 101.96 Prob > chi2 = 0.101
Hansen test of overidintifying restrictions *H0: Model specification is correct and all overidentifying restrictions are exogenous*					chi2(85) = 82.90 Prob > chi2 = 0.544
Hansen test excluding SGMM instruments (i.e. the differenced instruments) *H0: GMM differenced- instruments are exogenous*					chi2(43) = 31.48 Prob > chi2 = 0.903
Difference-in-Hansen tests of exogeneity of GMM instrument subsets: *H0: system-GMM instruments are exogenous and they increase Hansen J-test*					chi2(42) = 51.42 Prob > chi2 = 0.151
Difference-in-Hansen tests of exogeneity of IV instrument subsets: *H0: GMM instruments without IV instruments are exogenous*					chi2(82) = 80.30 Prob > chi2 = 0.533
Difference-in-Hansen tests of exogeneity of standard IV instrument subsets: *H0: IV instruments are exogenous*					chi2(3) = 2.61 Prob > chi2 = 0.456

Notes: the sample spans 5 time periods 1993-1996, 1997-2000, 2001-2004, 2005-2008, 2009-2012 and is comprised by 468 cities with a population larger than 50000 (base year 1992). This table presents a subset of the estimates, see table 5 and 6 for the rest. Brasilia is excluded. The table shows only a subset of coefficient estimates All the explanatory variables are lagged. Each model included time effects for periods 4, 5 and 6. The logit coefficients represent average marginal effects. In the Chamberlain Logit model the marginal effect of the coefficients are estimated assuming that the intercept is equal to zero. In the GMM model all adoption variables are considered as predetermined, all continuation variables as endogenous, time effects as exogenous. The GMM model employs a two-step procedure and an orthogonal transformation. All models present robust standard errors that are clustered at the city level. The GMM models utilizes Windmeijer (2005) finite sample correction for standard errors. Standard errors are in parentheses. *, ** and *** denote significance at the 10%-, 5%- and 1%-levels, respectively.