From Open to Secret Ballot:
Vote Buying and Modernization

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April 2012

CWPE 1221

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April 19, 2012

Abstract

The secret ballot is one of the cornerstones of democracy. We contend that the historical process of modernization caused the switch from open to secret ballot with the underlying mechanism being that income growth, urbanization, and rising education standards undermined vote markets and made electoral corruption uneconomical. We undertake event history studies of ballot reform in Western Europe and the Americas during the 19th and 20th centuries to establish that modernization was systematically related to ballot reform. We study electoral turnout before and after ballot reform amongst the US states and British parliamentary constituencies to substantiate the hypothesis that modernization made vote buying uneconomical.

Key words: Secret ballot, modernization, electoral turnout, democratization.
JEL classification: D7, P16.

*Acknowledgements: We would like to thank Jac Heckelman, Julia Shvets, Miriam Golden, Jo Andrews, James Robinson, Thomas Barnebeck Andersen, Christian Bjørnskov, Carl-Johan Dalgaard, Casper Worm Hansen, Ingrid Henriksen, Lars Lønstrup, Martin Paldam, Paul Sharp, Linda Veiga, Jacob Gerner Hariri, and Philipp Schröder for helpful comments and useful suggestions on preliminary drafts of this paper. We also thank Samuel Berlinski, Torun Dewan, James Fearon, and Adam Przeworski for sharing data with us. This paper was partly written while Toke Aidt was visiting the Institute for Quantitative Social Science at Harvard University and, subsequently, the CESifo in Munich. The hospitality of these institutes is much appreciated. The paper was presented at the 2nd World Congress of the Public Choice Society and European Public Choice Society in Miami in March 2012. The usual qualifier applies.

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1 Introduction

One of the most striking facts in comparative political economy is the positive correlation between income and democracy. Since the first statistical evidence was unearthed in the late 1950s by Seymour M. Lipset in his influential paper "Social Requisites of Democracy: Economic Development and Political Legitimacy" (Lipset, 1959), a lively debate amongst political scientists, sociologists, and economists regarding the correct interpretation of this correlation has raged. Lipset (1959, p. 86) himself interprets, in what has subsequently become known as modernization theory, the correlation as a unidirectional causal relationship from economic development to democracy or as he puts it "economic development involving industrialization, urbanization, higher educational standards and a steady increase in the overall wealth of the society is a basic condition sustaining democracy". This interpretation has been questioned by many subsequent scholars.

In one corner, we find among many others Moore (1966), Przeworski and Limongi (1997), and Acemoglu et al. (2008). Przeworski and Limongi (1997, p. 167) declare that "there are no grounds to believe that economic development breeds democracies" and instead attribute the correlation to the fact that democracy is more likely to survive in rich than in poor countries. Acemoglu et al. (2008, p. 810) conclude that "there is no relationship between changes in income per capita and changes in democracy"[1] and instead suggest that the correlation can be explained by the fact that countries at critical junctures in the past were pushed on to divergent development paths, some of which led to economic prosperity and democracy and some of which did not.

In the opposite corner, we, besides Lipset (1959), find Barro (1999, p. 160), who argues that "increases in various measures of the standard of living forecast a gradual rise in democracy", and Gundlach and Paldam (2009, p. 34), who conclude that "the long-run causality appears to be running exclusively from income to democracy, with critical junctures playing no role in the long run." Yet other scholars endorse parts of modernization theory, but tend to stress different mechanisms than those envisaged by Lipset (1959). Rueschemeyer et al. (1993, pp. 74-75), for example, suggest that

[1] Boix (2009) and Benhabib et al. (2011) challenge the econometric evidence presented by Acemoglu et al. (2008) and claim that there is a statistically significant relationship between income growth and democratization in a larger sample.

"capitalist development is related to democracy because it shifts the balance of class power, because it weakens the power of the landlord class and strengthens subordinate classes."

We propose a new perspective on the modernization debate. We hope that it will help explore the boundaries of the theory in a more nuanced way and that it will defuse some of the tension in the debate. We begin by observing that democracy is a package of institutions. This observation is neither new nor novel and most writers make a distinction between different aspects of democracy.[2] Yet, the modernization debate centers on the causal relationship between GDP per capita and *composite* indices of democracy. It is, therefore, either assumed that democratization is an all or nothing choice–a view that is contradicted by the historical record–or that all the sub-components of the overall package are equally likely (or unlikely) to be causally driven by modernization. The alternative view we propose is that modernization may be causally linked to specific sub-components of the overall package of democratic institutions without necessarily governing, in a causal sense, the evolution of the overall package or all of its parts.[3]

In this paper, we zoom in on the secret ballot and ask if its adoption was caused by economic development.[4] We focus on the secret ballot for three related reasons. First, the secret ballot is regarded as one of the cornerstones of free and fair elections (e.g., Rokkan, 1961; Elklit, 2000; Alvarez et al., 1996). In fact, Baland and Robinson (2007, p. 140) note that "the introduction of political institutions that stop corruption and vote buying, such as the Australian ballot, appear to be as significant a step in the process of political development as the construction of electoral democracy itself." Against this background, gaining a better understanding of how and why the secret ballot came about is important in itself.[5] Second, during the second and third waves

[2]Dahl (1971), for example, defines democracy by three attributes, "public contestation", "right to participate," and "civil liberties".

[3]Ziblatt (2006) makes a similar argument.

[4]Other aspects of the package of democratic institutions have already received substantial attention. See, for example, Boix (1999), Blais et al. (2004), and Andrews and Jackman (2005) for studies of the factors behind the adoption of proportional representation and Przeworski (2009), Aidt and Jensen (2011) for studies of the causes of suffrage reform in general and Braun and Kvanicka (2011) for a study of women's suffrage in particular.

[5]The secret ballot has not received much attention in the empirical literature on the causes and consequences of democratization but there are some exceptions, most notably Anderson and Tollison (1990), Heckelman (1995), Stokes (2005), Ziblatt (2009), Aidt and Jensen (2009), and Przeworski (2010).

of democratization democracy, typically, came as a complete package of *de jure* institutions including the secret ballot and universal suffrage. The Eastern European countries are prime examples of this as are Spain, Portugal, and Greece but examples also abound in post-colonial Africa. Historically, however, the process of democratization was a more gradual process where restrictions on participation, on contestation, and on civil liberties were relaxed step by step to eventually reach what we today recognize as democracy.[6] The gradual pattern in itself does not prove that modernization played a causal role during the first wave of democratization. However, it does suggest the possibility that modernization could have played a different role for each of these steps towards full-fledged democracy and that it will be fruitful to study aspects of democracy individually. Third, there is a straightforward causal mechanism that links modernization to the secret ballot. The mechanism operates through the vote market. Effective vote markets thrive under open or semi-open voting because this allows the buyer of a vote to verify that the seller kept his part of the bargain and their effectiveness is enhanced through social control and resort to effective economic sanctions if promises are not kept (Baland and Robinson, 2008).[7] Modernization tends to erode social control and the scope for economic sanction, to improve outside options for ordinary voters, or to undermine old norms of social deference. Income growth also tends to increase the price of a vote. All of these forces combine to make vote buying uneconomical. The defenders of the open ballot then become less stout defenders and ballot reform becomes more likely.

We begin the analysis by formalizing the logic behind our reasoning in a rational choice model of ballot reform. The model demonstrates amongst other things how and why modernization undermines the vote market and how this can trigger the secret ballot. To support these predictions empirically, we marshal two types of evidence. The first type of evidence is based on event history studies of the adoption of the secret ballot. This research design enables us to ask whether modernization–higher income levels, urbanization, and higher education standards–can predict the timing of these adoptions in three different historical samples: Western Europe plus (English-

[6] This is documented, for example, in Rueschemeyer et al. (1993), Collier (1999), Przeworski (2008), and Congleton (2011).

[7] Stokes (2005) and Collier and Vicente (2012) show how vote markets can operate under secret ballot, but with more difficulty than under open ballot.

speaking) off-shoots (1820-1913), Latin America (1820-1958), and US states (1840-1950). In all cases, we find strong evidence, which is robust to instrumental variable estimations, that modernization affected the timing of the secret ballot. In contrast, the same (modernization) variables cannot predict the timing of reforms that extended the suffrage to broader segments of the male population.[8] The second type of evidence delves deeper into the underlying causal mechanism. Heckelman (1995) conjectures that electoral turnout falls as a consequence of the secret ballot. The reason is that the vote as a tradable commodity loses (much of) its value and voters have one less reason to show up and cast their largely inconsequential vote. The drop in turnout after the secret ballot is introduced can, therefore, be taken as an indicator of the importance of the vote market under open ballot. We can, then, ask whether the fall in turnout is smaller in places where modernization has progressed more, as one would expect if the mechanism through which modernization encourages ballot reform is the vote market. We investigate this in two contexts. The first is, building on Heckelman (1995), the US states from 1870 to 1950. The second is the parliamentary constituencies of the Great Britain in the election before and after the Ballot Act of 1872. In both cases, we find evidence consistent with the proposed causal mechanism.

The rest of the paper is organized as follows. Section 2 presents the theoretical framework. Section 3 presents the results of the three event history studies. Section 4 examines the effects of the secret ballot on turnout. Section 5 concludes. Appendices A and B contain mathematical proofs and a list of definitions of all the variables used in the empirical investigation, respectively. Supplementary appendices S1, S2 and S3 contain detailed information on the timing of ballot reforms and on empirical robustness checks as well as a discussion of the assumptions of the model.

2 A Theory of Ballot Reform

In this section, we propose a theory of ballot reform.[9] In contrast to existing theories, such as Heckelman and Yates (2002) or Baland and Robinson (2008), we emphasize

[8] Przeworski (2009) shows for a large cross-national sample of countries after World War I that the threat of revolution, to a greater extent than income growth or urbanization, drove the franchise extension. Aidt and Jensen (2011) draw the same conclusion from a historical sample of European countries.

[9] For theoretical models of vote buying in general elections, in legislatures, and in committees, see Dekel et al. (2008), Snyder (1991), and Dal Bo (2007), respectively.

ways in which modernization–higher income levels, industrialization, education, and urbanization–makes vote buying uneconomical and paves the way for reform. Specifically, the model formalizes the logic behind the three particular hypotheses that we test empirically.

2.1 Assumptions

We consider a society with regular elections in which not only the old elite but also broader social classes can vote. The suffrage is not universal and voting is, initially, open. While we take the suffrage as given, the choice of ballot system is endogenous. In each period, two parties–party E and party R–compete in an election. Party E represents the old elite, while party R represents the (enfranchised) middle or working classes, which, for concreteness, we refer to as the radicals.[10] The number of core supporters of party E is N_E. While all supporters of party E can vote, only a subset of party R's core supporters have the franchise. We denote the number of party R supporters who can vote by N_R and interpret an (exogenous) increase in N_R as a franchise extension. The old elite is outnumbered $N_R > N_E$. Voting is costly and some enfranchised voters may decide not to exercise their right. The party allegiance of a voter is observable and the parties share policy preferences with their core voters.[11] The party that gains the support of the majority of those who turn out to vote implements the policy that is optimal for its voters. As in Acemoglu and Robinson (2006) and Boix (2003), we focus on the distributive conflict between the old elite and the majority of the electorate and assume that the policy with party R in power is better for voters of type R than the policy associated with party E and vice versa. We refer to these policies as policy R and policy E, respectively. With this in mind, we can write the

[10] The parties should be interpreted as broad social groupings rather than as particular historical political parties. Party E represents the old social elites whose claim to power is threatened by liberal democracy. Party R represents groups who stand to gain from liberal democracy. In the context of 19th century Britain, they can be exemplified by Radical Members of Parliament, the Chartists, or the Westminster Committee and in the context of 19th and early 20th century USA as the Mugwumps or Liberal Societies.

[11] The assumption implies that parties can offer a type-specific price in exchange for votes. An alternative is to assume that parties cannot distinguish voters at all and must bribe at random or, if voters have different reservation prices, try to get them to self-select. If all voters have the same reservation price, Heckelman and Yates (2002) show that the minority party has a natural advantage and that this gives the majority party a reason for supporting the secret ballot. This "minority effect" is reinforced if the supporters of the majority party has the lowest reservation price. We maintain that the allegiance of a voter can be observed for simplicity, but note that our results are not driven by this assumption.

utility gain for a voter of type R or E of having "their" party in power as

$$\Delta_R \equiv u_R(R) - u_R(E) > 0 \quad (1)$$

$$\Delta_E \equiv u_E(E) - u_E(R) > 0, \quad (2)$$

where $u_i(j)$ is the utility that a voter of type $i \in \{E, R\}$ derives from policy $j \in \{E, R\}$. Depending on the precise nature of the underlying policies, it is possible that the utility loss per capita to the elite associated with the switch in power from party E to party R is larger than the gain per capita to the radicals and vice versa. A neutral assumption is that gains and loses are of equal size and, as nothing of substance depends on it, we let $\Delta \equiv \Delta_R = \Delta_E$.

The society has an infinitely long time horizon. We index time by t and assume a common discount factor $\beta \in (0, 1)$. There are two possible ballot regimes: open or secret ballot. Under secret ballot (SB), voters vote their preference and there is no electoral corruption; under open ballot (OB), votes can be bought and sold in a vote market.[12] The initial ballot regime is open ballot, but it may be reformed to secret ballot if the majority party proposes such a reform and the opposition party is unwilling to pay the veto cost of preventing the reform. We assume that once secret ballot is introduced, it is not possible to go back to open ballot again.[13]

Within a given period, we can distinguish between five stages that evolve sequentially. What happens within each stage depends on the ballot regime. Since calender time plays no important role, we omit time index t when it is not strictly needed. The five stages are:

A. Planning. Under open ballot, the two parties (simultaneously) decide on how many opposition voters to target with a bribe in the upcoming election. We denote these targets by n^b_{-jj} for $j \in \{E, R\}$.[14] The associated cost is $p_j \upsilon_{-j} n^b_{-jj}$ where p_j is the money offered to a voter of type j in exchange for his vote (to be determined below) and υ_{-j} is the marginal cost of raising funds for party $-j$. The parties care about

[12] Stokes (2005) shows how party machines even in the presence of the secret ballot can use social networks to buy votes. Accordingly, vote markets can exist even with secret voting, but they are clearly less effective. We make, for simplicity, the extreme assumption that the vote market shuts down with the arrival of the secret ballot, but it would be sufficient to assume that it is harder to buy votes under secret than under open ballot.

[13] Acemoglu and Robinson (2006) make a similar assumption about franchise extensions.

[14] The notation $-j$ means "not j", so if $j = E$, then $-j = R$ and vice versa.

policy, the cost of electoral bribery, and being in power and their per-period expected payoffs are

$$V_E = f_E(u_E(E) + M) + (1 - f_E)u_E(R) - p_R \upsilon_E n^b_{ER} \quad (3)$$

$$V_R = (1 - f_E)\left(u_R(R) + M\right) + f_E u_R(E) - p_E \upsilon_R n^b_{RE}, \quad (4)$$

where f_E is the probability that party E wins the election and M is the utility value of political office. Under secret ballot, the parties do not buy votes.

B. Electoral turnout. The enfranchised voters decide if they want to exercise their right to vote. Under open ballot, each voter compares the sum of his expressive benefit of voting (θ) and the expected utility value of the bribe (v^e_j) to the utility cost of voting ($c \in (0,1)$) and votes if $\theta + v^e_j \geq c$ for $j \in \{E, R\}$.[15] We assume that each voter believes that the probability he will be offered a bribe (if he shows up at the polling station) is equal to the ratio of the number of bribes offered to voters of his type (n^b_{-jj}) and the number of voters of his type (N_j).[16] The expected utility value of the bribe, therefore, is

$$v^e_j = \frac{n^b_{-jj}}{N_j} p_j \lambda_j, \quad (5)$$

where λ_j is the marginal utility of income. If we let the expressive benefit θ be uniformly distributed on $[0, 1]$ for each type of voter, then the number of voters of type j turning out to vote can be written as

$$n^{OB}_j(n^b_{-jj}, N_j) = N_j\left(1 - c\right) + n^b_{-jj} p_j \lambda_j. \quad (6)$$

Turnout amongst voters of type j increases in the number of enfranchised voters of this type. More importantly, by offering bribes a party gives *opposition* voters an extra reason to turn out to vote. Under secret ballot, no bribes are offered. This reduces the benefit of voting, and turnout is given by

$$n^{SB}_j(0, N_j) = N_j(1 - c). \quad (7)$$

[15] Instrumentally rational voters have little reason to vote because the likelihood that an individual voter is pivotal in a large election is effectively zero and it takes time and effort to get to the polling station. Voting is, therefore, to a large extent an expressive act (Hamlin and Jennings, 2011).

[16] This implies that voters underestimate the likelihood that they will be paid a bribe (because not all of them show up to vote). We could, alternatively, assume that voters rationally anticipate turnout and estimate the probability of getting a bribe accordingly. Doing so adds unnecessary complications without yielding any additional insights, and we therefore decided to adopt the simpler formulation.

C. Vote buying. The voters who decided to vote show up at the polling station. Under open ballot, a vote market can operate. A voter of type j is willing to shift his allegiance to party $-j$ if offered at least his reservation price (p_j). The reservation price for a voter of type R is the monetary sum needed to compensate him for the economic loss of having policy E instead of policy R, and similarly for a voter of type E. Formally, $p_j = \Delta\lambda_j^{-1}$ for $j \in \{E, R\}$, where we use the marginal utility of income (λ_j) to convert the utility differential (Δ) into a monetary amount. We expect the radicals to be poorer than the elite. Since the marginal utility of income falls with income ($\lambda_E < \lambda_R$), the reservation price is, typically, higher for voters of type E than for voters of type R. Under secret ballot, the vote market is not operative.

D. Polling. The election outcome depends on the relative electoral support of the two parties and on random events that might induce some voters to shift their allegiances (after bribes, if any, are paid). This induces an aggregate preference shock (η) in favor of one party at the expense of the other.[17] The shock can, in principle, be positive (a shift to the radicals) or negative (a shift to the elite) and is introduced to capture the unpredictability of elections. Under open ballot, party E wins a majority amongst those who turn out to vote if

$$\frac{n_E^{OB} - \eta + g(v)}{n_E^{OB} + n_R^{OB}} \geq \frac{1}{2}, \tag{8}$$

where $v = \alpha_E n_{ER}^b - \alpha_R n_{RE}^b$ is the (productivity adjusted) difference between the number of votes bought by party E and party R. The function g, which is increasing and strictly concave and with $g(0) = 0$, describes the vote buying technology. Its concavity captures that it is relatively easy to control a few corrupted voters but much harder to control many. We interpret the two parameters (α_E and α_R) as exogenous measures of vote buying productivity.

Under the assumption that η is distributed uniformly on the interval $[-\frac{\widehat{\eta}}{2}, \frac{\widehat{\eta}}{2}]$, we

[17] This means that total turnout is not random; it is simply a matter of some of the voters who turn out to vote randomly changing their mind at the polling station.

can write the win probability of party E under open ballot as

$$f_E(n_E^b, n_R^b, n_E^{OB}, n_R^{OB}) = \left\{ \begin{array}{c} 0 \\ \frac{1}{\widehat{\eta}}\left(\frac{\widehat{\eta}}{2} + \frac{n_E^{OB}-n_R^{OB}}{2} + g(v)\right) \\ 1 \end{array} \right\} \text{for} \left\{ \begin{array}{c} \left(\frac{n_E^{OB}-n_R^{OB}}{2} + g(v)\right) < -\frac{\widehat{\eta}}{2} \\ \left(\frac{n_E^{OB}-n_R^{OB}}{2} + g(v)\right) \in [-\frac{\widehat{\eta}}{2}, \frac{\widehat{\eta}}{2}] \\ \left(\frac{n_E^{OB}-n_R^{OB}}{2} + g(v)\right) > \frac{\widehat{\eta}}{2} \end{array} \right\}. \tag{9}$$

The win probability of party R is $1 - f_E$. Under secret ballot, the vote market shuts down ($g(0) = 0$) and the win probability of party E is $f_E^{SB} \equiv f_E(0, 0, n_E^{SB}, n_R^{SB})$. Since the support base of party R is bigger than that of party E, party E is likely to lose under secret ballot ($f_E^{SB} < \frac{1}{2}$). After the election, the winner implements its most-preferred policy and earns the office rent (M).

E. Ballot reform. Under open ballot, the winning party may, after the policy has been implemented, propose that the secret ballot is adopted for future elections. While the majority party can implement its policy platform without the consent of the opposition, the opposition can, at a cost $\rho > 0$, veto such a proposal. The idea we want to capture with the veto is that reforming the ballot system is fundamentally different from day-to-day policy making and needs to pass a stricter test than the simple majority rule.[18] Of course, if $\rho \to \infty$, then the veto becomes irrelevant but we expect the normal case to be one with $\rho < \infty$. If a reform proposal is made and not vetoed, then the new ballot regime applies for all future periods. If the secret ballot has already been introduced in the past, no reform proposition can be made.

We analyze the model in two steps. First, we characterize the equilibrium in the vote market. Second, we study the reform process.

2.2 The vote market

If the secret ballot has been introduced in the past, party E wins with probability $f_E^{SB} < \frac{1}{2}$. If the secret ballot has not yet been adopted, the vote market can flourish and the two parties must, in stage A, decide how many opposition voters to target with

[18] Most of the ballot reforms that we study empirically were adopted under bicameral systems, which were widespread in Europe and in Latin America throughout the 19th century and remain a feature of most US state legislatures today. The franchise or other aspects of the voting rules often gave the old elites unchallenged control over the upper chamber even if their grip on power was challenged in elections to the lower chamber. A natural way to think of the veto, then, is that it represents the ease with which the upper chamber can block proposals from the lower chamber and at what cost.

bribes in the upcoming election, anticipating events as they unfold in the subsequent stages. Using equations (3) and (4) and recalling from equation (6) that $\frac{\partial n_j^{OB}}{\partial n_{-jj}^b} = \Delta$ and $p_j = \Delta\lambda_j^{-1}$ for $j \in \{E, R\}$, the two first order conditions governing these choices can be stated as follows:

$$n_{ER}^b \quad : \quad \frac{1}{\widehat{\eta}}\frac{\partial g}{\partial v}(v) \leq \frac{v_E\Delta}{\lambda_R\alpha_E(\Delta+M)} + \frac{\Delta}{2\widehat{\eta}\alpha_E} \quad \text{with} = \text{if } n_{ER}^b > 0 \tag{10}$$

$$n_{RE}^b \quad : \quad \frac{1}{\widehat{\eta}}\frac{\partial g}{\partial v}(v) \leq \frac{v_R\Delta}{\lambda_E\alpha_R(\Delta+M)} + \frac{\Delta}{2\widehat{\eta}\alpha_R} \quad \text{with} = \text{if } n_{RE}^b > 0. \tag{11}$$

The right-hand side shows the cost of buying an extra vote. It consists of two terms. The first term is the direct (utility) cost per vote. The second term is the expected utility loss induced by the fact that bribery increases turnout amongst opposition voters and through that reduces the win probability of the party that offers the extra bribe. The left-hand side shows the benefit (in terms of a higher win probability) of allocating an extra dollar to buying opposition votes before adjusting for productivity differences (as captured by α_j) and is the *same* for the two parties. An implication, then, is that at most one of the parties will buy votes at equilibrium (see appendix A for a formal proof) and it is the party with the lowest productivity adjusted cost that will buy.[19] Under Assumption 1, this party is party E; the minority party representing the elite.

Assumption 1 $\frac{v_E}{\lambda_R\alpha_E(\Delta+M)} + \frac{1}{2\widehat{\eta}\alpha_E} < \frac{v_R}{\lambda_E\alpha_R(\Delta+M)} + \frac{1}{2\widehat{\eta}\alpha_R}$.

This assumption is likely to be satisfied because voters of type R are cheaper to buy than voters of type E, as we expect them to be poorer ($\lambda_R > \lambda_E$); because the elite is likely to be able to raise funds at lower cost than the radicals ($v_E < v_R$); and because the elite is likely to be more effective at buying votes than the radicals ($\alpha_E > \alpha_R$), as they can use social sanctions more effectively. The equilibrium win probability of party E can be written as

$$f_E^{OB} \equiv f_E(n_{ER}^{b^*}, 0, n_E^{OB}(0), n_R^{OB}(n_{ER}^{b^*})) > f_E^{SB}, \tag{12}$$

where $n_{ER}^{b^*}$ represents how many radical voters party E offers bribes to at equilibrium.

[19] Baland and Robinson (2008) show a similar result. They assume that one party cares more about being in power than the other and that competition in the vote market takes place in prices à la Bertrand. The implication is that only the party with the highest value of power buys votes. Our result is driven by differences in the cost of vote buying rather than by differences in the value of power, and we assume that competition takes place in "quantities" rather than in "prices".

The equilibrium in the vote market (n_{ER}^{b*}) and the win probability of the minority party, f_E^{OB}, are affected by three key parameters, α_E, λ_R, and N_R. The first of these parameters controls how bribes are transformed into actual votes, and we interpret a fall in α_E as an increase in the transaction cost of vote buying. This is likely to be systematically related to "modernization" through a number of complementary channels. First, a vote market operates most effectively in environments with a high degree of economic dependency and social control, as stressed by Baland and Robinson (2008). Industrialization and urbanization open up new economic possibilities for working and middle class voters and make them more mobile both in terms of occupation choices and in terms of place of residence. As pointed out by Hicken (2007), urbanization destroys traditional patron-client networks, which, once they are gone, are difficult to re-create. The transition from a static agrarian economy to a dynamic industrial economy with deeper markets and economic specialization, therefore, makes it harder for the old elite to enforce and monitor vote contracts, and the transaction cost of vote buying shoots up. Of course, political parties may respond to this challenge and reorganize to take advantage of the new opportunities that, for example, urbanization offers. This happened in some large US cities at the turn of the 19th century, where a culture of machine politics emerged and supported a system of direct vote buying. But the general tendency would be to increase the transaction cost of running a vote market. Moreover, as stressed by Rueschemeyer et al. (1993, p. 75), economic development "weakens the power of the landlord class and strengthens subordinate classes. The working and the middle classes [...] gain an unprecedented capacity for self-organization due to such developments as urbanization, factory production, and new forms of communication and transportation." This also serves to undermine the vote market. Second, modernization entails higher education standards and a rise in literacy in the general population. As pointed out by Lipset (1959, p. 79), "education presumably broadens men's outlooks, enables them to understand the need for norms of tolerance, restrains them from adhering to extremist and monistic doctrines, and increases their capacity to make rational electoral choices." This broader outlook is likely to make it harder to enforce vote contracts and contributes to decreasing α_E. The second parameter, λ_R, represents the private marginal value of income and is directly related to modernization through income growth. The third parameter, N_R,

controls the extension of the franchise amongst voters of type R.

In appendix A, we formally derive the comparative static results. Here, we focus on the intuition. Modernization undermines the vote market and the electoral prospect of party E for two reasons. Firstly, an increase in the transaction cost (a fall in α_E) reduces the marginal benefit of each bribe and, as a consequence, party E targets fewer opposition voters and the vote market shrinks. This gives radical voters one less reason to vote and their turnout falls. Yet, the net effect is that party R is more likely to win a majority. Secondly, a fall in the private marginal value of income (a fall in λ_R), brought about by rising income levels, increases the price of a vote. Intuitively, radical voters value money less and so require a higher monetary compensation to shift their allegiance. This increases the cost of bribery for party E and it buys fewer votes. The vote market shrinks, and although turnout falls amongst voters of type R, the consequence is, again, that the win probability of party E goes down. An exogenous franchise extension–an increase in N_R–does not affect the absolute number of opposition voters party E wants to bribe but the relative share drops and, as a consequence, the win probability of party E falls. Suffrage reform makes vote buying uneconomical.

2.3 Ballot reform

At stage E, the winning party can, if the ballot regime at time t is open ballot, propose to adopt the secret ballot for future elections. Clearly, party E has a no reason to do so as long as it uses the vote market. Hence, a reform proposal must come from party R,which stands to improve its electoral prospect (permanently) under the secret ballot ($f_E^{OB} > f_E^{SB}$). The implication, then, is that a reform proposal is being tabled at time t if and only if party R wins the election at that time under the open ballot. This happens with probability $1 - f_E^{OB}$. As discussed above, both modernization and franchise extension undermine the vote market and with it party E's electoral prospect. This increases the likelihood that ballot reform gets on the agenda. It does not, however, follow immediately that the ballot will in actual fact be reformed. This depends on the elite's willingness to veto.

Suppose, therefore, that party R wins the election at time t and proposes a reform after having taken power. Party E can veto this proposal at cost $\rho > 0$. By doing

so, the ballot remains open in period $t+1$, but another veto may have to be called if party R happens to win again and so on. To evaluate whether the elite is willing to veto or not, we need to compare the present discounted value of a veto to the present discounted value of accepting the ballot reform. In appendix A, we show that these present values are:

$$W_E(\text{no veto}) = \beta \frac{\left(1 - f_E^{SB}\right) u_E(R) + f_E^{SB}(u_E(E) + M)}{1-\beta} \tag{13}$$

$$W_E(\text{veto}) = \beta \frac{\left(1 - f_E^{OB}\right) u_E(R) + f_E^{OB}(u_E(E) + M)}{1-\beta} - \frac{\beta v_E \Delta \lambda_R^{-1} n_{ER}^{b*}(.)}{1-\beta} - \frac{\beta\left(1 - f_E^{OB}\right)\rho}{1-\beta} - \rho. \tag{14}$$

Under secret ballot, power simply alternates between the two parties according to the win probability f_E^{SB}, which is determined by the relative turnouts of the two groups and random events. This is what the numerator of equation (13) represents. Since not calling a veto at time t means a permanent switch to secret ballot, starting at time $t+1$, this expected value is discounted by the factor $\frac{\beta}{1-\beta}$. A veto preserves the open ballot for another period. Under open ballot, power also alternates between the two parties but now according to the win probability f_E^{OB}, which takes into account the vote market. This is represented by the first term of equation (14). On top of this comes the cost of buying votes each period (the second term) and veto cost, which is paid after each electoral defeat in the future (the third term).[20] The fourth term is the veto cost paid at time t.

The elite's willingness to veto at time t is the difference between $W_E(\text{veto})$ and $W_E(\text{no veto})$. Calculating this difference and rearranging, we can express the condition under which the elite will veto as:

$$\frac{\beta}{1-\beta}\left\{\left(f_E^{OB} - f_E^{SB}\right)(\Delta + M) - v_E \Delta \lambda_R^{-1} n_{ER}^{b^*}(.)\right\} \geq \rho + \frac{\beta\left(1 - f_E^{OB}\right)\rho}{1-\beta}. \tag{15}$$

The left-hand side represents the net benefit of the veto. This depends positively on the electoral advantage that the vote market gives party E ($f_E^{OB} - f_E^{SB}$) and negatively on the cost of bribery. The right-hand side represents the veto cost.

The costs and benefits of a veto depend on the two parameters capturing modernization (α_E and λ_R) and on how extended the franchise is (N_R). In Appendix A, we

[20] Since the economy is stationary, if the elite wants to veto at time t, it will veto again in the future.

formally derive the relevant comparative statics. Modernization–represented either by an increase in the transaction cost or by income growth–makes the elite less likely to veto. The reason is that modernization reduces the electoral advantage gained from the vote market (the gap between f_E^{OB} and f_E^{SB} narrows) while at the same time the frequency with which a veto is required goes up because party R is more likely to win office. Franchise extension also makes the elite less likely to veto a subsequent reform proposal. Since the total number of opposition voters targeted is unaffected, the gap between f_E^{OB} and f_E^{SB} is unaffected by an increase in N_R. However, party R becomes more likely to win elections and, for that reason, the expected veto cost increases and this is what makes party E less willing to protect the open ballot with a veto.

We summarize the predictions from the model as three hypotheses which inform the empirical investigation. The first two are:

Hypothesis 1 *(The modernization hypothesis). Modernization increases the likelihood that the secret ballot is adopted by making it more likely that ballot reform is proposed and less likely that it is vetoed.*

Hypothesis 2 *(The franchise hypothesis). An increase in the franchise increases the likelihood that the secret ballot is adopted by making it more likely that a ballot reform is proposed and less likely that it is vetoed.*

The third hypothesis relates to the interaction between ballot reform, modernization, and electoral turnout. Under open ballot, modernization (as captured by falls in α_E and λ_R) reduces turnout. At the same time, the introduction of the secret ballot also makes electoral turnout drop. The common logic is that a reason for voting, namely that the vote can be sold for a price, either disappears overnight or is gradually deluded. To see how the two effects interact to generate a unique testable implication of the theory, we can imagine two societies which happen to introduce the secret ballot at the same time. The only difference between the two is that one is, say, richer (more "modernized") than the other. This implies that the vote market is less vibrant and that less voters bother to vote in the years leading up to the reform in the richer than in the poorer country. As a consequence, when the reform happens, the fall in electoral turnout is smaller in the rich than in the poor country. This gives us our third hypothesis:

Hypothesis 3 *(The turnout interaction hypothesis). The introduction of the secret ballot is associated with a fall in electoral turnout and this fall is smaller where modernization has progressed the most.*

3 Event history studies of the secret ballot

The aim of an event history study is to explain the differential timing of discrete events, in our case the introduction of the secret ballot. We model the (conditional) probability that a country or a state which has not yet adopted the secret ballot adopts it in a given year as a function of quantitative measures of modernization (income levels, urbanization, education standards, etc.), the size of the electorate, and other potential determinants of ballot reform.

We explore three different historical samples–Western Europe plus off-shoots, Latin America, and the US states–that cover the relevant period during the 19th and 20th centuries when the secret ballot replaced open voting. We are interested in the year in which the secret ballot was *de facto* rather than *de jure* adopted in a country or a state. By *de facto* we mean that the ballot rules were such that electoral corruption, vote buying, and intimidation were reduced to a minimum. This will, typically, be satisfied by the Australian ballot. The Australian ballot requires that an official ballot is printed at public expense and distributed only at the polling stations. The official ballot lists the names of the nominated candidates of all parties and it is marked in secret at the polling station. Other types of secret ballot, such as the "sealed ticket" system used in Sweden or France, do not qualify, unless our sources indicate that electoral corruption were *de facto* eliminated after the change in balloting procedures.[21]

The dependent variable $reform_{it}$ is coded 1 if country (or state) i introduced the secret ballot in year t and as 0 in the years before and after that. A country (or state) drops out of the sample in the year after its adoption. We assume that both countries and US states were at 'risk' of adopting the secret ballot from the beginning of the (relevant) sample period. This assumption is justified by historical facts. Mackie (2001), for example, observes that the principle of the secret ballot was known already in Roman times. By the late 18th century it was widely debated in liberal circles and

[21] Supplementary Appendix S1 provides information on the coding for each of the countries and states in our samples, and lists the sources we consulted in the process.

supported by liberal philosophers, such as Jeremy Bentham, and adopted, albeit in a somewhat imperfect form, after the French Revolution. In Britain, the secret ballot was proposed by the Westminster Committee as early as 1780 (Schofield, 2004) and was used before 1835 in some local British elections (Fredman, 1968, p.4). Thus, the principle of secret ballot was clearly known and on the agenda in many countries by 1820. It is therefore reasonable to assume that the countries (or states) in our samples could have adopted the secret ballot from 1820 (1840) onwards.[22]

We use a duration model to estimate the time conditional probability of adoption of the secret ballot (the hazard rate) and, as in Beck et al. (1998), we estimate the following discrete logistic model:

$$P\left(reform_{it}=1|\, x_{it}, m_{it-1}=0\right)=\frac{1}{1+e^{-(x_{it}\gamma+H(.))}}. \tag{16}$$

The variable m_{it-1} is an indicator variable equal to zero in each year before introduction of the secret ballot and equal to one thereafter. We allow for duration dependence in the hazard rate through the function $H\left(.\right)$.[23] In particular, we allow the hazard rate to be a function of the number of years a country has been at risk of adoption. This is important because it is reasonable to presume that the likelihood of adoption increases as time passes. By taking duration dependency into account, we can rule out that we are confounding any modernization effect with a spurious correlation between two upwards trending variables.

The vector x_{it} represents three main groups of explanatory variables.[24] The first group contains indicators of modernization, such as the log of real GDP per capita, the urbanization rate, and measures of education attainment standards. The second group contains variables related to the size of the electorate. This includes measures of the number of voters and indicators for literacy, gender, or other restrictions on the right to vote, as appropriate. The third group contains variables that capture alternative causes of ballot reform. Many scholars, e.g., Acemoglu and Robinson (2006, chapter 9), emphasize the importance of landholding and income inequality in rela-

[22] For countries that did not exist as independent units in 1820, we assume they enter the "risk set" at the time of independence.

[23] The argument of the function is $t-t_i^p$ where t_i^p represents either the year in which country i enters the "risk set". To model duration dependence, we estimate $H\left(.\right)$ using natural cubic splines and use the estimated spline coefficients along with the number of years a country has been at "risk" of adopting (or since entry to the sample). We use a specification with two knots for the splines.

[24] See appendix B for definitions and sources.

tion to democratization in general. We expect that landholding inequality makes the secret ballot less likely because inequality along this dimension often reflects a social order that favors vote buying. Likewise, higher income inequality increases the demand for redistribution. This may strengthen the old elite's opposition to the secret ballot. Other scholars, e.g., Wejnert (2005) or Gleditsch and Ward (2006), emphasize the international diffusion of democracy. Governments in one country may learn from political reforms–in our case ballot reforms–in other countries, and more so from countries (or states) which are either linguistically or physically nearer. Finally, we take scale effects into account by controlling for population size.[25]

3.1 Western Europe plus off-shoots

The Western Europe plus off-shoots sample covers, for the period from 1820 to 1938, the 11 Western European countries listed at the top of column one of Table 1 plus the USA, Canada, and New Zealand. We see from the table that the first country in the sample to introduce the secret ballot was the Netherlands in 1849; the last ones were France and Germany in 1913. The dating of the *de facto* secret ballot in some of the countries–for example, France, Germany, the USA, and Sweden–required some judgement, and supplementary Appendix S1 contains a detailed discussion of this. Before the secret ballot, electoral corruption was widespread. Both in the United Kingdom and in Germany vote buying was concentrated in the countryside where social control and employment relations made it relatively easy for the landed elites to run effective vote markets (e.g., Ziblatt, 2009; Seymour, 1915, p. 433). In France, the practice that voters could write the name of their preferred candidate on their own ballot paper at home or receive a ballot in a distribution in the streets allowed active vote markets to operate until 1913 (e.g., Seymour and Frary, 1918; Mackie, 2000). Similar markets operated in the other European countries. In the USA, vote markets were particularly vibrant in the big migration cities where party machines exploited that colored voting papers, indicating party choice, could be handed out at the polling stations.

< Table 1 to appear here >

[25] Descriptive statistics are reported in Table A1. Supplementary Appendix S2 contains information on all robustness checks.

In Table 2, we report the results of the event history study.[26] Two variables capture the process of modernization: *urbanization rate* and *real GDP per capita*.[27] We see that the coefficients on *real GDP per capita* and *urbanization rate* are positive and statistically significant (columns one and two). When they enter together (column three), they are jointly significant and *real GDP per capita* remains significant on its own. The two variables are positively correlated, with a correlation coefficient of 0.75, and are likely to capture the same underlying concept of modernization. It therefore makes sense to extract the principal components. In column four, we replace the two modernization variables with the first principal component. The first principal component, which correlates strongly and positively both with *real GDP per capita* and with *urbanization rate*, has a positive and statistically significant coefficient.[28] Ballot reform is a rare event and this may bias the estimates. King and Zeng (2001) propose a logit estimator that deals with this. In columns 5 to 7, we report results using this estimator. The two modernization variables remain individually significant and jointly significant when entered together.

How big are these effects? To answer this question, suppose, for example, that *real GDP per capita* increases by a standard deviation keeping all other variables at their average values. As a consequence of this, the predicted probability of reform increases from 0.4 to 2.6 percent based on the model in column 3. All in all, these results support the modernization hypothesis. Economic development predicts the introduction of the secret ballot.

We use information on the number of eligible voters as a proportion of the adult population, *electorate/adult population*, to test the franchise hypothesis. Table 1 (columns four and five) records information on *electorate/adult population* in the first democratic election in and after the last election before the secret ballot in each country. The secret ballot was preceded by expansion of the franchise in most countries,

[26] A formal test for duration dependency in the hazard rate cannot reject that the baseline hazard is constant over time. Our strong prior is that the hazard is increasing with time and we report specifications with duration dependence although it makes no difference to the results.

[27] Data limitations prevent us from studying the effect of increasing education standards.

[28] The first principal component is strongly and positvely correlated with both modernization variables with a correlation coefficient of nearly 0.94. Thus, this variable captures modernization much better than the second principal component which is negatively correlated (correlation coefficient=-0.35) with urbanization rate and positively correlated with *GDP per capita* (correlation coefficient =0.35).

as suggested by the franchise hypothesis. The estimation results reported in Table 2, however, are less favorable. Although the point estimate on *electorate/adult population* is positive, it is only statistically significant in specifications where *real GDP per capita* is excluded. We have experimented with alternative definitions of the size of the electorate but the results are very similar. Overall, then, the evidence that it was the pre-secret ballot expansion of the suffrage that triggered the secret ballot is, at best, mixed.

We use the variable *gini coefficient* to measure income inequality. Income inequality is (statistically) unrelated to the timing of the secret ballot. This runs counter to other recent evidence on the effect of inequality on democratization.[29] The control variable *population* always has a negative coefficient, but is usually not significant, suggesting that scale effects were unimportant.[30] The variable *learning* captures diffusion effects. It is a "distance" weighted index of reforms in neighboring countries, where we use the information on linguistic similarities provided by Fearon (2003) to measure distance. Despite the fact that the adoptions of the secret ballot cluster in the 1870s, we find no evidence that social learning was important.

< Table 2 to appear here >

The results reported in Table 2 are estimated from a combination of between and within country variation in modernization, the size of the electorate, inequality, etc. It is, therefore, possible that the correlations between the timing of the secret ballot and the explanatory variables are driven by the same unobserved factors and that they are coincident rather than causal. To show that this is most likely not the case, Table 3 shows some estimations in which we instrument for *real GDP per capita* and *electorate/adult population*. As in Acemoglu et al. (2008), we use a weighted index of real GDP in the other countries in the sample as an instrument for *GDP per capita*

[29] See, e.g., Ziblatt (2008), Boix (2003, chapter 2), or Ansell and Samuels (2010). The positive point estimate is in line with the intriguing finding by Ansell and Samuels (2010) suggesting that income inequality makes it more likely that a majority of the adult male population can vote.

[30] One can question whether *population* belongs to a model in which we are interested in estimating the effect of real GDP per capita and other variables measured relative to population size. The argument in favor is that scale effects could be important and by not including population directly, we could introduce omitted variables bias. The argument against is that by keeping the denominator of all the ratio variables constant, we estimate the various effects from variation in the nominator. On balance, we decided to report specifications with population size included. However, as a robustness check, we have re-estimated all specifications without *population*. It makes no different to the results [not reported].

in a particular country.[31] The logic is the international transmission of business cycle shocks. The validity of the instrument can, however, be challenged if social learning effects are strong. As we noted above, this does not seem to be the case in our data, but by controlling for *learning*, we can rule out that movements in real GDP in other countries affect the probability of a secret ballot reform in a particular country, not through its effect on real GDP in that country, but through a social learning channel. While this instrument, in principle, is valid for the entire sample, the second instrument only makes sense for the Western European countries. For this reason, the IV estimations are restricted to this sub-sample. Aidt and Jensen (2011) demonstrate that revolutionary events (as defined by Tilly,1993 and others) in other countries affect suffrage reforms in a particular country through a process of international diffusion of information. Revolutionary pressures are unlikely to be a direct cause of ballot reform, and so we can use a measure of distance weighted revolutionary events, *revolutionary threat*, in other countries as an instrument for suffrage reform in a particular country.[32] In addition to this, we exploit the high degree of path dependency in suffrage rules and make use of the one-year lag of *electorate/adult population* as an instrument.

Table 3 reports the results of the instrumental variable (IV) estimation. The IV estimates are based on a linear probability model, and for the smaller sample that excludes the off-shoots. For comparison, we, therefore, report the results from a logit and linear probability estimation on this smaller sample in columns one and two.[33] The IV estimates in column three confirm the modernization hypothesis but reject the franchise hypothesis. The first stage regressions are reported in the last two columns. The instruments are highly significant with large F-statistics for joint significance and the J-test for over-identification is passed. All in all, this suggests that the correlation between modernization and the timing of the secret ballot does, in fact, represent a causal mechanism.

< Table 3 to appear here >

[31] Acemoglu et al. (2008) use bilateral trade to construct the weights. We do not have this information. Based on the gravity model of trade, we use physical distance instead.

[32] Przeworski (2010) reports a correlation between a measure of social unrest and transition from open to secret ballot. However, his sample covers the post-1918 period and thus includes many instances where ballot reform happened at the same time as suffrage reforms and this is most likely what is driving the correlation.

[33] One can question the validity of pooling the Western European countries with the off-shoots. These estimations show that the results are not driven by this design choice.

3.2 US States

Table 4 records when the secret ballot was *de facto* adopted for gubernatorial and senatorial elections across US states (listed in column one). The first state to adopt the secret ballot was Kentucky in 1882 and the last was South Carolina in 1950. Before the secret ballot, electoral corruption was widespread. Fredman (1968, p. 22) describes how it worked: "the simplest form of bribery occurred when ballot peddlers or district captains paid a voter as he emerged from the polling place. To check that he actually used the ballot it was colored or otherwise recognizable and the compliant voter was followed up to the booth." McCook (1892) estimates that sixteen percent of voters in Connecticut were up for sale at prices ranging from two to twenty dollars. The most corrupt 19th century state elections are said to have occurred in New York and San Francisco. The reason was the high concentration of poor voters and recent immigrants unused to the franchise (Fredman, 1968, p. 25). Congleton (2011, p. 560) notes that the introduction of the secret ballot "allowed votes to be cast without fear of rebuke by landlords or employers".

< Table 4 to appear here >

For the US state sample, we have three quantitative indicators of modernization– *real income per worker*, *average years of schooling*, and *urbanization rate*–for the entire sample period from 1840 to 1950. Table 5 shows the results of the event history study. Each of the modernization variables is positively and significantly correlated with the timing of the secret ballot (columns one to three). When included together in column four, they are jointly significant and *real income per worker* and *average years of schooling* remain significant on their own.[34] We have replaced the three variables with the first principal component in column five and we see that it is highly significant. These results are robust to alternative estimation techniques, as shown in columns six and seven. To evaluate the size of the modernization effect, suppose that *real income per worker* increases by a standard deviation. Using model (4) and keeping all other variables at their average values, this increases the predicted probability of a ballot

[34]The three modernization variables correlate positively with the first component (correlation coefficients above 0.87). As seen in Table 5, column 5, the first component is highly significant with a positve sign. As in the case of Western Europe and off-springs, the other components do not measure modernization well.

reform from 0.23 to 0.33 percent. This effect is somewhat smaller than in the Western Europe plus off-shoots sample, but still substantial.

Unlike the countries in Western Europe (and Latin America), the male suffrage was broad already in the 1840s with 60-90 percent of adult (white) males enfranchised. Nevertheless, the states applied various strategies to *de facto* restrict the suffrage. These included requiring payment in full of poll taxes and literacy tests (columns four and five of Table 4). These steps served to keep poor and illiterate males off the election roll, often aimed at disenfranchising African Americans (Keyssar, 2009, chapters 4 and 5). Women's suffrage rights also varied (column three of Table 4) and some of the frontier states granted women the right to vote long before it became mandatory in 1920 (Lott and Kenny, 1999). We use these restrictions to capture over-time and across-state variation in the size of the electorate. From Table 5, it is clear, however, that these restrictions had very little impact on the secret ballot. We must, again, conclude that there is little evidence supporting the franchise hypothesis.

We use the variable *share of land held by the 20% largest farms* to capture land-holding inequality (Galor et al., 2009). It is only available from 1880, so we lose over half the observations when we include it in the specification shown in column seven of Table 5. Yet, landholding inequality is highly significant and exerts a negative impact on the secret ballot. This is in line with the findings of Ziblatt (2008) and Ansell and Samuels (2010) in other contexts. We find little evidence that scale effects or social learning mattered amongst the US states.

< Table 5 to appear here >

In Table 6, we present estimations in which we instrument for *real income per worker*, *average years of schooling*, and *urbanization rate*. We use a weighted index of real income in other states and regional dummies for the eight economic areas of the USA as instruments. The logic behind the first instrument is the common business cycle. The dummies for the economic areas capture that states that are located in the same region share similar geographical conditions, e.g., access to the sea, which are likely to affect economic development (GDP, urbanization, and human capital accumulation) but not, conditional on *learning*, the timing of the secret ballot. For comparison, we, again, report the results from a logit and linear probability model

in columns one and two. The IV estimates in column three shows that the positive effect of *average years of schooling* is robust to instrumentation and that the three instrumented modernization variables are jointly significant. The first stage regressions are reported in the last three columns. The instruments are strong and the J-test for over-identification is passed. All in all, this suggests that the correlation between modernization and the timing of the secret ballot does, in fact, represent a causal mechanism.

< Table 6 to appear here >

3.3 Latin America

Latin America has a turbulent political history. For example, since independence, Peru has changed or modified its constitution 13 times, Chile has modified its constitution 11 times, while Brazil and Colombia have made 8 and 12 changes, respectively. In the elections that did take place during the 19th and early 20th centuries, "voting was often a public, oral act, with registration rolls controlled by local government officials" (Hartlyn and Valenzuela, 1994). Gradually, however, secrecy was introduced, but later and more reluctantly than in Europe and the USA.

Table 7 reports when the secret ballot was adopted in the countries in the Latin American sample (listed in column one). The volatile political history of the countries in the sample makes it difficult to determine whether voting became *de facto* as well as *de jure* secret at the dates recorded in column two, which are based on Drake (2009, Table 2.4), Nohlen (2005, Table 2), and Hartlyn and Valenzuela (1994). The issue is that electoral corruption returned or persisted in many countries after the secret ballot was *de jure* introduced. For example, in Colombia–one of the first Latin American countries to introduce the secret ballot in 1853–"coercion and other forms of fraud" persisted (Hartlyn and Valenzuela, 1994, p. 129). Likewise, Argentina introduced the secret ballot in 1912, but openly fraudulent elections took place in the 1930s and there is evidence of vote buying as recent as in 2002 (Stokes, 2005). Even so, Drake (2009, p. 44) concludes that Latin Americans, over time, "increasingly tallied the ballots honestly and respected the results", and, in some countries, the secret ballot was effective at weeding out electoral corruption. Baland and Robinson (2008), for example, demonstrate how the introduction of the secret ballot in Chile in 1958 broke

pervasive patron-client relationships. All in all, the dates in column two constitute our best estimate of when the secret ballot was *de facto* introduced, but there is more uncertainty about this than for the other samples. Universal male suffrage sometimes preceded the introduction of the secret ballot, although we note from column three of Table 7 that there are many exceptions.

<Table 7 to appear here>

Table 8 reports the results of the event history study. It covers the period from when the countries became independent, as recorded in column one of Table 7, to 1958. Historical socioeconomic data, including information on real GDP per capita, are sparse for Latin America and we measure modernization by primary school enrollment per capita (*primary education enrollment*) and urbanization (*urbanization rate*). We see from Table 8 that the two aspects of modernization affected the adoption probability positively, but only education is statistically significant. To reduce co-variation, we have, as for the other samples, extracted the principal components. The first component correlates positively with *urbanization rate* and *primary school enrollment,* with a correlation coefficient of 0.91, and is statistically significant (column three). However, the results are not robust to rare events estimation, as shown in columns four to six, although we note that the first principal component remains significant at the ten percent level.[35]

In contrast to Western Europe, literacy requirements imposed on the right to vote were widely used in Latin America (see column four of Table 7). We use these restrictions to test the franchise hypothesis. We observe that the effect of the dummy variable *literacy test* (which is equal to one if the right to vote was subject to a literacy test) is statistically significant with a negative sign in some specifications. Literacy tests were often designed to disenfranchise poor, illiterate native voters. Since the secret ballot also requires a minimum of literacy–voters must be able to read the ballot paper–the secret ballot and literacy restrictions might, partly, have served a common purpose. We capture landholding equality with the variable *share of family-owned farms* (Vanhanen, 2003). Landholding equality is not statistically significant. The

[35] As discussed in footnote 30, including the population in the model is not unproblematic. When log(*population*) is excluded, results are robust to rare events, and it may therefore be that the results reported in Table 8 reflect a precision issue.

variable *population* is occasionally significant at the 10 percent level while *learning* is not.[36]

< Table 8 to appear here >

4 Turnout and vote buying

The evidence presented so far supports the view that rising incomes and education standards, and to a lesser extent, urbanization–factors all related to modernization–systematically affected the timing of the introduction of the secret ballot. The underlying mechanism, however, remains unclear. In our theory the link between modernization and secret ballot reform is the vote market. The available quantitative evidence on the operation of vote markets comes from a handful of insightful studies of particular markets and none of these consider the role of modernization.[37] In this section, we provide new evidence on the interaction between modernization and the secret ballot by testing the turnout interaction hypothesis.[38] The logic behind this hypothesis is, we recall, that the secret ballot, by and large, eliminates the vote market and with it one reason to vote. This reduces electoral turnout, as first pointed out and demonstrated empirically by Heckelman (1995). Our theory also suggests that turnout falls but adds that the fall should be smaller in polities which have undergone significant modernization in the years before the reform of the ballot system than in polities that have not.

We implement this test in two different contexts: a sample of US states from 1870 to 1950 and a sample of parliamentary constituencies in Great Britain before and after the Ballot Act of 1872. It is of particular interest to study and compare these two cases because of differences in the vote market in Great Britain and in the USA. As for

[36] Given the volatile political history of Latin America, we control for the general nature of the political environment (*polity IV dummy*) and for the level of conflict (*civil war*) in all the estimations. We observe that these factors are not in themselves systematically related to the introduction of the secret ballot.

[37] Ziblatt (2009) studies electoral corruption in Imperial Germany between 1871 and 1912, Baland and Robinson (2008) study the vote market in Chile in the 1950s, Stokes (2005) studies vote buying in Argentina in 2002, and Collier and Vicente (2012) study electoral corruption in a number of contemporaneous African countries.

[38] An alternative is to test iwhether incumbents are less likely to win under secret than under open ballot and whether the (conjectured) erosion of the incumbency advantage is smaller in polities which are more "modernized". Przeworski (2010) shows that the secret ballot reduces the probability that incumbents win elections but does not investigate the interaction with modernization.

the US states, Ostrogorski (1964, p. 170) attributes the increase in electoral bribery after the Civil War to the rapid growth of cities. In Great Britain, vote markets were most effective in the countryside or in small urban constituencies where many voters were directly dependent on the local landed elite for their livelihood.

4.1 The US states

For the sample of US states, we extend Heckelman's (1995) baseline model for the electoral turnout rate[39], and estimate the following panel model:[40]

$$(turnout\ rate)_{it} = \delta_i + \eta_t + \beta_0 SB_{it} + \beta_1 SB_{it} * M_{it} + \beta_2 M_{it} + Z_{it}\beta_3 + e_{it}, \qquad (17)$$

where i represents a state, t represents elections, SB_{it} is a dummy variable equal to zero before the secret ballot and equal to one after, M_{it} is a "modernization" variable of interest, Z_{it} is a vector of additional control variables, and δ_i and η_t are state and time fixed effects. The turnout interaction hypothesis predicts that $\beta_0 < 0$ and $\beta_1 > 0$.

<Table 9: Turnout model for US states>

Table 9 reports the results. We use three alternative measures of modernization: *real income per capita*, *school enrollment,* and *urbanization rate*. In column 1, we reproduce Heckelman's (1995) finding that the secret ballot has a significant, negative effect on turnout, consistent with the hypothesis that before the secret ballot turnout is kept high because of vote buying.[41] Columns two to four report on specifications with the interaction between modernization and secret ballot. The coefficient on the interaction term is positive and is significant in each specification. To facilitate interpretation, we introduce one interaction term at the time. In column 5, we include all three interactions simultaneously. They are less precisely estimated but two of them remain significant at the ten percent level and they are jointly significant at the one percent level. The turning points for the modernization variables are all within sample

[39] The turnout rate is defined as the total number of votes cast in a gubernatorial election divided by the age and sex eligible population.

[40] The data cover all elections from 1870–the first census year after the Fifteenth Amendment, which made discrimination at the polls based on race illegal–to 1950 for the 48 contiguous states.

[41] In contrast, for a large cross national sample of countries, Przeworski (2008) finds that turnout increases after adoption of the secret ballot. One reason for this is that the expressive benefit of voting might increase when voting can be done independently. This effect might dominate the effect of the ballot on the vote market in some contexts, a point we return to in the text.

and are indicated at the bottom of the table along with the observed range for each variable. We can, for example, imagine a state which starts with a low education level but expands education over the years. If this state happened to introduce the secret ballot early, the consequence would be a fairly large drop in turnout, but if it adopts later the drop will be smaller and eventually turnout might even increase. The last effect is not explained by our model because we keep the expressive benefit of voting constant. However, in practice this benefit may increase when voting can be done independently and secretly. This would produce a countervailing effect that could dominate the effect of the ballot on the vote market, in particular in cases where the importance of the pre-secret ballot vote market has already been curtailed by the forces of modernization. We note that women's suffrage, the poll tax, and the literacy requirement lower turnout. Overall, these results corroborate the hypothesis that modernization undermines the vote market.

4.2 The Ballot Act of 1872

The Second Reform Act of 1867 extended the voting franchise to a fairly broad segment of the male population of Great Britain. It was followed five years later, in 1872, by the Ballot Act which introduced the Australian ballot in elections to the House of Commons. We use the Ballot Act as a natural experiment.[42] We study electoral turnout patterns at the constituency level in the general elections in 1868 and 1874, both of which were conducted according to the (new franchise and districting) rules laid down in 1867, but under different ballot conditions. As in the previous section, we propose to test the turnout interaction hypothesis. To do so, we proxy modernization with the number of inhabitants per house in each constituency ($density_{it}$). The outcome variable is $turnout_{it}$ which records the number of voters who voted in constituency i in election t for $t \in \{1868, 1874\}$. We consider the following model for $turnout_{it}$:

$$turnout_{it} = \alpha_i + \nu_t + \alpha_1 R_t + \alpha_2 density_{it} R_t + \alpha_3 density_{it} + \alpha_4 electors_{it} + \varepsilon_{it}, \quad (18)$$

where $R_{1868} = 0$ and $R_{1874} = 1$ indicate that the reform of the ballot took place between 1868 and 1874, α_i is a constituency specific fixed effect, ν_t is an aggregate time effect,

[42] Berlinski and Dewan (2011) use a similar design to study the impact of the Second Reform Act on the rise of the Liberal Party.

$electors_{it}$ is the number of registered voters. We notice that we allow $density_{it}$ to have a direct impact on turnout, in addition to its interaction with the ballot reform. Taking the first difference of equation (18), we get

$$\begin{aligned}\Delta turnout_{it} &= (v_{1874} - v_{1868} + \alpha_1) + \alpha_2 density_{i1874} + \alpha_3 \Delta density_{it} \\ &\quad + \alpha_4 \Delta (electors)_{it} + (\varepsilon_{i1874} - \varepsilon_{i1868}) . \end{aligned} \tag{19}$$

Clearly, the direct effect of the reform (α_1), which we expect to be negative, cannot be identified independently of the common time effects. However, we can identify α_2 and in this way recover the interaction effect between the reform dummy variable and the indicator of modernization. We conjecture that a constituency that is more densely populated is also more urbanized. We test whether the (negative) effect of the Ballot Act on voter turnout was (numerically) smaller in constituencies that were more urban, i.e., whether $\alpha_2 > 0$, and whether turnout was lower in places that experienced an increase in population density or urbanization between the two elections, i.e., whether $\alpha_3 < 0$. Moreover, we expect that the number of electors affects turnout positively, i.e., $\alpha_4 > 0$.

It is, however, difficult to implement these tests because information on the number of voters who voted does not exist. Craig (1977) reports the votes polled for each candidate. In constituencies with more than one seat, voters could cast as many votes as there were seats. Consequently, the number of votes is not, in general, equal to the number of voters. However, for the constituencies with only one seat, the number of votes *is* equal to the number of voters who turned out to vote, and our test is based on the sub-sample of one-seat constituencies.[43] The estimation results are[44]

$$\Delta turnout_{it} = \underset{(-1.57)}{-263} + \underset{(1.92)}{61.5} density_{i1874} - \underset{(-2.09)}{614} \Delta density_{it} + \underset{(5.31)}{0.47} \Delta electors_{it}, \tag{20}$$

where the figures in parentheses are t-statistics based on robust and clustered standard errors. The combined estimate of the reform and the aggregate time effect is negative, consistent with a post-reform drop in turnout, but not statistically significant. More importantly, we observe that the coefficient on *density* is positive with a

[43] Our sample comprises 65 borough constituencies in England and Wales and 9 county constituencies in Wales and Scotland. This is not the entire universe of one-seat constituencies because data are sometimes missing and the 1868 or 1874 elections were sometimes uncontested.

[44] The results are robust to controlling for population growth (which in itself is not significant).

p-value of 0.06. Consistent with the turnout interaction hypothesis, this suggests that the vote market, before the reform, was more vibrant in places that were less urban. This conclusion is supported by the negative coefficient on change in *density* which we interpret as evidence that urbanization undermines the voting market and, as a consequence, induces a fall in turnout. Overall, the results are consistent with the causal mechanism suggested by our theory and they are corroborated by the insightful case study by Stokes (2011) of the causes behind the introduction of the Ballot Act. She concludes that the reason why political parties in Britain adopted legislation to limit electoral corruption and vote buying was that industrialization had made vote buying uneconomical.

5 Conclusion

This paper "unbundles" the concept of democracy in order to evaluate in a more nuanced way the interplay between modernization and democratization. Our event history study of the introduction of the secret ballot demonstrates a remarkably robust correlation between modernization and its adoption and our instrumental variable estimations point towards a causal relationship. This finding is important because it grants the forces of urbanization, rising education standards, and income growth a role in explaining political development. For sure, the role is more limited than envisaged by Lipset (1959), but we contend that modernization, while probably not causally linked to the timing of the major suffrage reforms and thus to the evolution of the overall package of democratic institutions, was a causal factor in getting the secret ballot introduced. Moreover, we propose and provide evidence that the mechanism through which this happened was the vote market, which was made uneconomical by modernization.

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6 Appendix A: Proofs

One party only buys votes. The two first order conditions are

$$n^b_{j,-j} : \frac{\partial g}{\partial v}(v) \leq \frac{v_j \widehat{\eta} \Delta}{\lambda_{-j} \alpha_j (\Delta + M)} + \frac{\Delta}{2\alpha_j} \equiv K_j. \tag{21}$$

The left-hand side is the same. If $K_E \neq K_R$, then at most one of these equations can be satisfied with equality. Since the function g is strictly concave (so that $\frac{\partial g}{\partial v}(v)$ is decreasing in v), it is the equation associated with the minimum of K_E and K_R that may admit an interior solution. Under Assumption 1, $K_E < K_R$ and $n^{b*}_{ER} > 0$ and $n^{b*}_{RE} = 0$. The second order conditions, including

$$\Upsilon \equiv \frac{\Delta + M}{\widehat{\eta}} \alpha_E^2 \frac{\partial^2 g}{\partial v^2} < 0 \tag{22}$$

are satisfied.

The continuation values of veto and reform. To calculate the continuation payoff for party E following a veto, let $V(OB, E)$ be the expected present value for party E at the beginning of a period if the present ballot regime is OB and it wins the next election, and let the corresponding expected present value if it loses be $V(OB, R)$. Under the assumption that party E will veto when needed, we can write the value of calling a veto at the end of the current period as follows:

$$W_E(\text{veto}) = -\rho + \beta f_E^{OB} V(OB, E) + \beta \left(1 - f_E^{OB}\right) V(OB, R), \tag{23}$$

where

$$\begin{aligned} V(OB,E) &= u_E(E) + M - v_E\Delta\lambda_R^{-1}n_{ER}^{b^*}(.) + \beta f_E^{OB}V(OB,E) + \beta\left(1-f_E^{OB}\right)V(OB,R), \\ V(OB,R) &= u_E(R) - v_E\Delta\lambda_R^{-1}n_{ER}^{b^*}(.) - \rho + \beta f_E^{OB}V(OB,E) + \beta\left(1-f_E^{OB}\right)V(OB,R). \end{aligned}$$

We can solve these two equations for $V(OB,E)$ and $V(OB,R)$, which yields

$$\begin{aligned} V(OB,E) &= \frac{\left(1-\beta\left(1-f_E^{OB}\right)\right)\left(u_E(E)+M\right)+\beta\left(1-f_E^{OB}\right)\left(u_E\left(R\right)-\rho\right)-v_E\Delta\lambda_R^{-1}n_{ER}^{b^*}(.)}{1-\beta}, \\ V(OB,R) &= \frac{(1-\beta f_E^{OB})(u_E(R)-\rho)+\beta f_E^{OB}(u_E\left(M\right)+M)-v_E\Delta\lambda_R^{-1}n_{ER}^{b^*}(.)}{1-\beta}. \end{aligned}$$

Substituting these two equations into equation (23) and simplifying give equation (14) in the text. The continuation value following a permanent transition to secret ballot can be constructed in a similar fashion, but we may simply note that the per period expected utility of the elite is equal to

$$\left(1-f_E^{SB}\right)u_E(R) + f_E^{SB}(u_E(E)+M)$$

and that this is repeated for all periods starting one period ahead and is therefore discounted back to the present by $\frac{\beta}{1-\beta}$. This gives equation (13) in the text.

Comparative statics. Total differentiation of equation (10) yields:

$$\frac{\partial n_{ER}^{b^*}}{\partial\alpha_E} = -\frac{\frac{1}{\widehat{\eta}}\frac{\partial g}{\partial v}(\Delta+M)}{\Upsilon} > 0; \frac{\partial n_{ER}^{b^*}}{\partial\lambda_R} = -\frac{\Delta v_E}{\lambda_R^2\Upsilon} > 0; \frac{\partial n_{ER}^{b^*}}{\partial N_R} = 0. \tag{24}$$

Substituting $n_{ER}^{b^*}$ along with the equilibrium values of electoral turnout from equation (6) into equation (12) gives

$$f_E^{OB} = f_E(n_{ER}^{b^*}(\alpha_E,\lambda_R),0,n_E^*(0,N_E),n_R^*(n_{ER}^{b^*}(\alpha_E,\lambda_R),N_R)). \tag{25}$$

The comparative statics results are

$$\frac{\partial f_E^{OB}}{\partial\alpha_E} = \frac{1}{\widehat{\eta}}\left[\frac{\Delta v_E\widehat{\eta}}{\lambda_R(\Delta+M)}\right]\frac{\partial n_{ER}^{b^*}}{\partial\alpha_E} + \frac{1}{\widehat{\eta}}\frac{\partial g}{\partial v}n_{ER}^{b^*} > 0, \tag{26}$$

$$\frac{\partial f_E^{OB}}{\partial\lambda_R} = \frac{1}{\widehat{\eta}}\left[\frac{\Delta v_E\widehat{\eta}}{\lambda_R(\Delta+M)}\right]\frac{\partial n_{ER}^{b^*}}{\partial\lambda_R} > 0, \tag{27}$$

$$\frac{\partial f_E^{OB}}{\partial N_R} = \frac{1}{\widehat{\eta}}\left[\frac{-1}{2}\frac{\partial n_R^*}{\partial n_{ER}^{b^*}} + \alpha_E\frac{\partial g}{\partial v}\right]\frac{\partial n_{ER}^{b^*}}{\partial N_R} - \frac{1}{2\widehat{\eta}}\frac{\partial n_R^*}{\partial N_R} = -\frac{1-c}{2\widehat{\eta}} < 0, \tag{28}$$

where we, in each case, use the first order condition for $n_{ER}^{b^*}$ and the relevant comparative statics from equation (24) to sign the effects. Rewrite equation (15) and define

$$D(\alpha_E,\lambda_R,N_R) \equiv \beta\left(f_E^{OB}-f_E^{SB}\right)(\Delta+M) - \beta v_E\Delta\lambda_R^{-1}n_{ER}^{b^*}(.) - \left(1-\beta f_E^{OB}\right)\rho. \tag{29}$$

Since the elite vetoes only if $D(\alpha_E,\lambda_R,N_R)\geq 0$, any factor that reduces $D(.)$ makes a veto less likely and ballot reform more likely. The comparative statics are

$$\begin{aligned} \frac{\partial D}{\partial\alpha_E} &= \beta\frac{\partial f_E^{OB}}{\partial\alpha_E}(\Delta+M) - \beta v_E\Delta\lambda_R^{-1}\frac{\partial n_{ER}^{b^*}}{\partial\alpha_E} + \beta\frac{\partial f_E^{OB}}{\partial\alpha_E}\rho \\ &= \beta(\Delta+M)\frac{1}{\widehat{\eta}}\frac{\partial g}{\partial v}n_{ER}^{b^*} + \beta\frac{\partial f_E^{OB}}{\partial\alpha_E}\rho > 0 \end{aligned} \tag{30}$$

$$\begin{aligned}\frac{\partial D}{\partial \lambda_R} &= \beta \frac{\partial f_E^{OB}}{\partial \lambda_R}(\Delta + M) - \beta v_E \Delta \lambda_R^{-1} \frac{\partial n_{ER}^{b^*}}{\partial \lambda_R} + \beta v_E \Delta n_{ER}^{b^*} \lambda_R^{-2} + \beta \frac{\partial f_E^{OB}}{\partial \lambda_R}\rho \\ &= \beta v_E \Delta n_{ER}^{b^*} \lambda_R^{-2} + \beta \frac{\partial f_E^{OB}}{\partial \lambda_R}\rho > 0, \end{aligned} \tag{31}$$

where we use the first order condition for $n_{ER}^{b^*}$ and the results in equations (26) to (27) to get the second line of each expression. Moreover, we find that

$$\frac{\partial D}{\partial N_R} = \beta(\Delta + M)\left(\frac{\partial f_E^{OB}}{\partial N_R} - \frac{\partial f_E^{SB}}{\partial N_R}\right) + \beta \frac{\partial f_E^{OB}}{\partial N_R}\rho = \beta \frac{\partial f_E^{OB}}{\partial N_R}\rho < 0 \tag{32}$$

since $\frac{\partial f_E^{SB}}{\partial N_R} = \frac{\partial f_E^{OB}}{\partial N_R} = -\frac{1-c}{2\widehat{\eta}}$ because $\frac{\partial n_{ER}^{b^*}}{\partial N_R} = 0$.

7 Appendix B: Definitions and sources

Western Europe plus off-shoots

real GDP per capita is real GDP in international 1990 Geary-Khamis dollars, adjusted for the impact of border changes, per capita. Source: Maddison (2003).

urbanization rate is the percentage of the population living in towns with more than 20,000 inhabitants. Missing values are interpolated linearly. Source: Banks (2003) and Mitchell (2003a,b).

electorate/adult population is the electorate (for parliamentary/house elections) in percentage of the adult population. Data are only recorded in election years and assumed to be constant between elections. Suffrage is coded zero for periods without elections. Source: Flora et al. (1983), Mackie and Rose (1991), Mitchell (2003a,b), Cook and Paxton (1998), www.elections.org.nz, and www.elections.ca.

gini coefficient is the Gini coefficient for income inequality. A value of zero (one) expresses total equality (inequality). Data are available with 20-year intervals and missing observations interpolated linearly. Source: Bourguignon and Morrisson (2001, 2002).

learning is defined as a distance weighted average of secret ballot adoptions in other countries:

$$learning_{it} = \sum_j \left(1 - \sqrt{\frac{15 - \#common_{ij}}{15}}\right) A_j(t), \tag{33}$$

where $A_j(t)$ is 1 if country j has adopted the secret ballot at time t and zero otherwise. The variable $\#common_{ij}$ is the number of common notes in the linguistic tree between country pair i and j with the maximum number of common notes being 15. Source: Fearon (2003) and own calculations.

population is the total population in 1000s. Source: Mitchell (2003a,b) and Maddison (2003).

revolutionary threat is a weighted sum of revolutionary events taking place in other countries. The weights are the distance between the capitals of each pair of countries. Source: Aidt and Jensen (2011) and Tilly (1993).

distance weighted GDP is a weighted sum of log GDP in other countries where the weights are the distance (in kilometers) between the capitals of each pair of countries. Source: Maddison (2003) and own calculations.

US states

real income per worker is real state output (until 1920) or income (from 1929) per worker in 2000 dollars. Source: Turner et al. (2007).

average years of schooling is the average years of schooling of the workforce, estimated using the perpetual inventory method. Source: Turner et al. (2007).

urbanization rate is the share of the population living in urban areas. Available for census years only. Interpolated linearly for the years in between. Source: Lee et al. (1957) and various US Census reports.

women's suffrage is a dummy taking the value one if women had the right to vote and zero otherwise. Source: Lott and Kenny (1999).

poll tax is a dummy equal to zero in years without a poll tax requirement and equal to one otherwise. Source: Lott and Kenny (1999).

literacy test is a dummy equal to zero in years without a literacy test requirement and equal to one otherwise. Source: Lott and Kenny (1999).

share of land held by the 20% largest farms is the share of land held by the 20 percent largest farms. Source: Galor et al. (2009).

learning is defined as

$$learning_{ij} = \sum_{j} \frac{A_j(t)}{D_{ij}}, \tag{34}$$

where D_{ij} is the distance (in miles) between the state capitals of state i and j and $A_j(t)$ is one if state j has adopted the secret ballot at time t and zero otherwise. Source: Own calculations.

population is the number of inhabitants in the state in 1000s. Available for census years only. Interpolated linearly for the years in between. Source: Lee et al. (1957) and various US Census reports.

distance weighted income is a weighted sum of log *income* in other states. The weights are the distance between state capitals (in miles). Source: Turner et al. (2007) and own calculations.

regional dummies are coded according to the eight Bureau of Economic Analysis regions. Source: www.bea.gov.

turnout rate is equal to the total number of votes cast in a gubernatorial election divided by the age and sex eligible population. Source: Burnham et al. (1971).

Latin America

primary school enrollment/population is total primary school enrollment as a percentage of the population. Source: Aidt and Eterovic (2011).

urbanization rate is the percentage of the population living in towns with more than 20,000 inhabitants. Source: Banks (2003).

literacy test is a dummy equal to zero in years without a literacy test and equal to one in years with. Source: Nohlen (2005).

share of family owned farms is the share of agricultural land occupied by family farms, where family farms are defined as farms that provide employment for less than five people, are cultivated by the family itself, and are owned by the holder family or held in owner-like possession. Available only with 10-year intervals. We have interpolated the missing observations linearly. Source: Vanhanen (2003).

population is the total population in 1000s. Source: Maddison (2003).

learning is defined as for the US state sample.

civil war is a dummy equal to one if the country is at civil war and zero otherwise. Source: Singer and Small (1994).
polity IV dummy is equal to one when the Polity IV index is greater than zero and zero otherwise. Source: Marshall and Jaggers (2000).

Great Britain

turnout is the total number of votes cast in each one-seat constituency in England, Wales, and Scotland in 1868 and 1874. Source: Craig (1977) and Berlinski and Dewan (2011).
density is inhabitants per house in each constituency in 1861 and 1871. Source: 1861 and 1871 Census of Great Britain.
electorate is the number of registered voters in each constituency in 1868 and 1874. Source: Craig (1977) and Berlinski and Dewan (2011).

Table 1: Institutional information for the Western Europe plus off-shoots sample.

Country (year of entry to sample)	Year of *de facto* adoption of the secret ballot	Year of franchise extensions (1820-1913)	*Electorate/adult population* in year of first election or at independence	*Electorate/adult population* in year of adoption
Western Europe				
Netherlands (1830)	1849	1848, 1887, 1894	4.6	4.6
Switzerland (1848)	1872	1848	38.9	38.9
United Kingdom (1820)	1872	1832, 1867, 1884	8.6	14.9
Belgium (1830)	1877	1831, 1848, 1893	1.9	3.7
Norway (1820)	1884	1814, 1884, 1897	11.4	11.4
Denmark (1820)	1901	1849	25.7	29.0
Finland (1820)	1906	1869, 1906	8.3	76.2
Austria (1867)	1907	1867, 1896, 1907	10.6	37.7
Sweden (1820)	1907	1866, 1907	9.8	14.0
France (1820)	1913	1824, 1830, 1848	0.5	43.4
Germany (1871)	1913	1871, 1919	33.0	38.7
Western off-shoots				
New Zealand (1856)	1870	1860, 1867, 1879	29.1	33.8
Canada (1867)	1874	1898	22.0	23.1
USA (1820)	1891[a]	1870	n.a.	40.6

Notes: Italy is not included in the sample because it *de facto* adopted the secret vote in 1861 at unification. Australia is not included in the sample because the secret ballot was introduced at the time of independence. a. This is the year when the majority of the US states has secret ballot.
Sources: See supplementary appendix S1.

Table 2: Main results for the Western Europe plus off-shoots sample.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES								
The modernization hypothesis								
log(real *GDP* per capita)	6.361**		6.620*		5.429**		5.322	
	[2.439]		[1.768]		[2.105]		[1.44]	
urbanization rate		0.010***	-0.0010			0.09***	-0.0001	
		[3.648]	[-0.209]			[3.383]	[-0.01]	
first principal component				1.458***				1.293***
				[3.271]				[2.936]
Joint significance of modernization variables			**6.24****				**4.91***	
The franchise hypohesis								
electorate/adult population	0.0365	0.0551**	0.0338	0.0501*	0.0341	0.0512**	0.0333	0.033
	[1.256]	[2.302]	[0.938]	[1.871]	[1.186]	[2.167]	[0.937]	[0.937]
Inequality								
gini coefficient	28.49	12.33	28.35	16.80	25.36	12.03	26.21	26.21
	[1.444]	[0.664]	[1.389]	[0.928]	[1.30]	[0.66]	[1.30]	[1.302]
Control variables								
Log(population)	-0.498**	-0.755***	-0.464	-0.709**	-0.414*	-0.658**	-0.399	-0.399
	[-2.043]	[-2.799]	[-1.354]	[-2.543]	[-1.72]	[-2.47]	[-1.18]	[-1.181]
learning	-1.179	1.017	-1.257	0.217	-1.033	0.929	-1.025	-1.025
	[-0.944]	[1.559]	[-0.945]	[0.273]	[0.837]	[1.44]	[-0.78]	[-0.781]
Control for duration dependence and constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	779	732	732	732	779	732	732	732
Number of countries	14	14	14	14	14	14	14	14
Estimation method	Logit	Logit	Logit	Logit	Rare events	Rare events	Rare events	Rare events

Notes: Robust z-statistics correcting for clustering in brackets; *** p<0.01, ** p<0.05, * p<0.1;

Table 3: Instrumental Variables Estimation for the Western Europe sample.

Model	(7)	(8)	(9)	(10)	(11)
	Secret ballot	Secret ballot	Secret ballot	Log(GDP per capita)	Electorate/ adult population
Log(real GDP per capita)	8.413*	0.0644**	0.0648**		
	[1.842]	[3.081]	[2.330]		
electorate/adult population	0.0466	0.000657	-0.00015		
	[1.268]	[0.814]	[-0.467]		
Instrumental variables					
distance weighted GDP				2.093***	1.282
				[26.49]	[0.664]
lagged electorate/adult population				-0.003***	0.975***
				[-6.702]	[77.60]
revolutionary threat				0.0067*	0.352***
				[1.660]	[3.553]
Control variables					
gini coeficient	9.761	0.0856	0.147	4.097***	3.859
	[0.291]	[0.329]	[0.510]	[10.37]	[0.400]
log(population)	-0.899**	-0.011**	-0.0083**	0.099***	0.121
	[-2.456]	[-2.451]	[-1.990]	[18.21]	[0.908]
learning	-2.079	-0.0219	-0.00429	0.184***	-0.39
	[-1.315]	[-0.814]	[-0.138]	[6.223]	[-0.538]
Control for duration dependence and constant	Yes	Yes	Yes	Yes	Yes
Observations	692	692	688	688	688
F-test of instruments				236.36***	2227.99***
J-test of over-identifying restrictions					0.686
Number of countries	11	11	11	11	11
Estimation method	Logit	OLS	IV	First stage	First Stage

Notes: Robust z-statistics correcting for clustering by country in brackets; *** p<0.01, ** p<0.05, * p<0.1. The off-shoots are not included in the estimations.

Table 4: Institutional information for the US states sample.

State	Secret Ballot	Women's suffrage	Poll tax	Literacy test
Kentucky	1882	1920		
Massachusetts	1888	1920	-1891	1857-
Indiana	1889	1919		
Montana	1889	1914		
Rhode Island	1889	1917	-1888	
Mississippi	1890	1920	1889-1963	1890-
Oklahoma	1890	1918		1912-
Vermont	1890	1920		
Washington	1890	1910		1896-
Wyoming	1890	1869		1889-
Arizona	1891	1912		1912-
Arkansas	1891	1917	1891-1963	
California	1891	1911		1894-
Colorado	1891	1893		
Delaware	1891	1920	-1907	1897-
Idaho	1891	1896		
Illinois	1891	1913		
Maine	1891	1919		1892
Michigan	1891	1918		
Minnesota	1891	1919		
Missouri	1891	1919		
Nebraska	1891	1917		
Nevada	1891	1914	-1910	
New Hampshire	1891	1920		1902-
North Dakota	1891	1917		
Ohio	1891	1919		
Oregon	1891	1912		1924-
Pennsylvania	1891	1920	-1933	
South Dakota	1891	1918		
West Virginia	1891	1920		
Iowa	1892	1919		
Maryland	1892	1920		
Alabama	1893	1920	1901-1963	1901-
Kansas	1893	1912		
Virginia	1894	1920	1875-1882, 1902-1963	1902-
Wisconsin	1894	1919		
Florida	1895	1920	1889-1927	
New York	1895	1917		1921-
Louisiana	1896	1920	1898-1934	1898-
Utah	1896	1870		
Texas	1905	1918	1902-1963	
Connecticut	1909	1920		1856-
New Jersey	1911	1920		
New Mexico	1912	1920		
Tennessee	1921	1919	1870, 1890-1951	
Georgia	1922	1920	-1945	1908-
North Carolina	1929	1920	1899-1920	1900-
South Carolina	1950	1920	1895-1951	1895-

Sources: Heckelman (1995), Lott and Kenny (1999, table 1), and Ludington (1911).

Table 5: Main results for US states sample.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
The modernization hypothesis							
log(real income per worker)	1.454***			1.205**		1.160**	0.555
	[3.598]			[2.413]		[2.335]	[1.018]
average years of schooling		0.506***		0.299*		0.288*	0.698***
		[3.616]		[1.786]		[1.729]	[2.698]
urbanization rate			0.0215**	-0.00556		-0.00388	0.0168
			[2.055]	[-0.341]		[-0.239]	[0.991]
First principal component					0.569***		
					[2.971]		
Joint significance of modernization variables				**19.64*** **		**19.07*** **	**15.09*** **
The franchise hypothesis							
women's suffrage	0.207	-0.117	0.096	0.156	0.188	0.187	-0.109
	[0.467]	[-0.254]	[0.196]	[0.335]	[0.417]	[0.405]	[-0.193]
literacy test	-0.823	-0.857	-0.848	-0.759	-0.838	-0.7	-0.306
	[-1.202]	[-1.183]	[-1.321]	[-1.088]	[-1.247]	[-1.009]	[-0.630]
poll taxes	-0.312	-0.453	-0.582	-0.265	0.188	-0.214	-0.501
	[-0.842]	[-0.939]	[-1.402]	[-0.655]	[0.417]	[-0.534]	[-0.934]
Joint significance of size-of-electorate variables	**2.36**	**2.07**	**3.48**	**1.76**	**2.75**	**1.59**	**1.39**
Inequality							
share of land held by the 20% largest farms							-27.93***
							[-3.283]
Control variables							
log(population)	-0.0567	-0.265**	-0.185	-0.0742	-0.104	-0.0915	-0.0977
	[-0.554]	[-2.406]	[-1.360]	[-0.852]	[-1.071]	[-1.056]	[-0.858]
learning	-0.412	-4.755	-13.12	-6.203	-10.37	-6.518	8.331
	[-0.0348]	[-0.390]	[-0.985]	[-0.440]	[-0.808]	[-0.465]	[0.712]
Control for duration dependence and constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,230	2,205	2,242	2,177	2,177	2,177	729
Number of states	45[a]	48	47[b]	44	44	44	44
Estimation method	Logit	Logit	Logit	Logit	Logit	Rare events	Logit

Notes: Robust z-statistics correcting for clustering in brackets; *** p<0.01, ** p<0.05, * p<0.1; a. Income data are missing for South and North Dakota and Oklahoma; b. Urbanization is missing for Idaho.

Table 6: Instrumental variables estimation the US states sample.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Secret ballot	Secret ballot	Secret ballot	Log(real income per worker)	average years of schooling	urbanization rate
The modernizationhypothesis						
Log(real income per worker)	1.205**	0.0103**	0.0156			
	[2.413]	[2.163]	[1.418]			
average years of schooling	0.299*	0.00244	0.00943*			
	[1.786]	[1.015]	[1.873]			
urbanization rate	-0.00556	0.000452	-0.000529			
	[-0.341]	[1.281]	[-1.016]			
Joint significance of modernization variables	**19.64*** **	**7.75*** **	**29.06*** **			
The franchise hypothesis						
women's suffrage	0.156	0.00942	0.0158	-0.251*	-0.0685	0.815
	[0.335]	[0.444]	[0.738]	[-1.811]	[-0.395]	[0.375]
literacy test	-0.265	-0.0138	-0.00164	-0.0137	-0.322*	4.544
	[-0.655]	[-1.242]	[-0.128]	[-0.173]	[-2.007]	[0.937]
poll taxes	-0.759	-0.0391*	-0.0319	0.127	-0.581**	3.653
	[-1.088]	[-1.841]	[-1.308]	[1.185]	[-2.019]	[0.464]
Joint significance of size-of-electorates variables	**1.76**	**1.74**	**4.13**			
Control variables						
Log(population)	-0.0742	-0.00065	0.00185	-0.00245	0.188***	3.203*
	[-0.852]	[-0.343]	[0.658]	[-0.0914]	[2.721]	[1.909]
learning	-6.203	0.629	0.739	0.391	3.078	77.97
	[-0.440]	[1.249]	[1.582]	[0.373]	[0.795]	[1.030]
Instrumental variables						
weighted total income per worker				0.00427	-0.00961	10.49
				[0.0277]	[-0.0413]	[1.500]
New England				-0.402	0.854**	-7.371
				[-1.434]	[2.279]	[-0.707]
Mid East				-0.322	-0.609	-7.505
				[-1.138]	[-1.450]	[-0.809]
Great Lakes				-0.419*	-0.374	-19.88***
				[-1.800]	[-0.919]	[-3.493]
Plains				-0.511**	-0.752**	-18.38***
				[-2.334]	[-2.071]	[-4.382]
South East				-1.059***	-2.255***	-28.51***
				[-4.895]	[-7.056]	[-4.904]
South West				-0.626***	-2.321***	-19.39***
				[-3.319]	[-4.029]	[-4.647]
Far West				0.216	-0.175	-2.406
				[1.022]	[-0.616]	[-0.471]
First stage F-test				390.46***	975.03***	306.31***
J-test (over-ID test)			4.409			
Estimation method	Logit	OLS	IV-regression	First stage	First stage	First stage
Control for duration dependence and constant	Yes	Yes	Yes	Yes	Yes	Yes
Number of states	44	44	44	44	44	44
Observations	2,177	2,177	2,177	2,177	2,177	2,177

Notes: Robust z-statistics correcting for clustering by state in brackets; *** p<0.01, ** p<0.05, * p<0.1; Excluded region is Rocky Mountains.

Table 7: Institutional information for the Latin America sample.

Country (year of entry to sample)	Secret ballot	Male suffrage	Literacy tests abolished
Colombia (1819)	1853	1936	1936
Mexico (1821)	1857	1857	1857
Ecuador (1830)	1861	1861	1870
Dominican Republic (1865)	1865	1865	1865
Nicaragua (1850)	1893	1893	1893
Honduras (1838)	1894	1894	1894
Paraguay (1811)	1911	1870	1870
Argentina (1816)	1912	1912	1912
Uruguay (1828)	1918	1918	1918
Costa Rica (1850)	1925	1913	1913
Peru (1879)	1931	1931	1979
Brazil (1825)	1932	1932	1985
Venezuela (1845)	1946	1857	1947
El Salvador (1898)	1950	1883	1945
Guatemala (1821)	1956	1879	1946
Chile (1844)	1958	1925	1970

Notes: For details on the coding of the secret ballot years, see supplementary appendix S1. The year of entry is the year in which independence was recognized (not the year in which it was declared).
Sources: Drake (2009, Table 2.4), Nohlen (2005, Table 2), Hartlyn and Valenzuela (1994) and Przeworski (2010).

Table 8: Main results for Event history study for Latin American sample.

	(1)	(2)	(3)	(4)	(5)	(6)
The modernization hypothesis						
primary school enrollment	0.623**			0.321		
	[2.154]			[1.135]		
urbanization rate		0.00682			0.00545	
		[1.223]			[0.990]	
first principal component			1.140***			0.644*
			[3.213]			[1.853]
The franchise hypothesis						
literacy test	-9.345	-4.538**	-7.895**	-3.34	-3.764**	-3.547
	[-1.245]	[-2.505]	[-2.479]	[-0.454]	[-2.107]	[-1.136]
Inequality						
share of family owned farms	-0.215	-0.0462	-0.217	-0.0161	-0.0122	-0.0343
	[-1.006]	[-0.392]	[-1.593]	[-0.0768]	[-0.105]	[-0.257]
Control variables						
Log(population)	2.11	0.733*	1.526*	0.569	0.606	0.52
	[0.984]	[1.885]	[1.805]	[0.271]	[1.579]	[0.628]
learning	-25.95	-5.022	65.64	-33.1	-7.819	18.44
	[-0.150]	[-0.0353]	[0.403]	[-0.195]	[-0.0558]	[0.115]
civil war	2.629	1.687	2.514*	2.286	1.782	2.324
	[1.614]	[1.330]	[1.725]	[1.432]	[1.424]	[1.626]
polity dummy	2.11	0.733*	1.526*	0.569	0.606	0.52
	[0.984]	[1.885]	[1.805]	[0.271]	[1.579]	[0.628]
Control for duration dependence and constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	544	779	544	544	779	544
Countries	12	13	12	12	13	12
Estimation method	logit	logit	logit	Rare events	Rare events	Rare events

Notes: Robust z-statistics correcting for clustering by country in brackets; *** p<0.01, ** p<0.05, * p<0.1. Columbia, Mexico and Ecuador drop out of the sample in specifications with *primary school enrollment*; Columbia and Mexico drop out of the sample in specifications with *urbanization rate*. **Dominican Republic had secret ballot from the year it enters the sample and cannot be included in any specifications.**

Table 9: Results for the turnout rate model for the US states sample.

	(1)	(2)	(3)	(4)	(5)
secret ballot	-6.08**	-168.7***	-28.22***	-8.784**	-133.60**
	[-2.193]	[-4.164]	[-3.339]	[-2.085]	[3.43]
secret ballot* income per worker)		17.93***			12.43*
		[4.127]			[1.76]
secret ballot* average years of schooling			5.245***		3.19*
			[3.349]		[1.70]
secret ballot* urbanization rate				0.160*	0.014
				[1.780]	[0.11]
average years of schooling		4.263***	1.735	3.781**	2.16**
		[2.834]	[1.068]	[2.076]	[2.03]
income per worker		-20.64***	-9.779**	-13.45***	-15.57**
		[-4.535]	[-2.559]	[-3.495]	[-2.28]
urbanization rate		-0.490**	-0.536***	-0.503***	-0.56**
		[-2.495]	[-2.763]	[-2.803]	[-2.62]
women' suffrage	-13.28***	-11.54***	-9.484**	-11.27***	-10.20***
	[-4.209]	[-3.475]	[-2.422]	[-2.992]	[-3.03]
poll tax	-19.09***	-14.57***	-15.51***	-15.76***	-13.84***
	[-6.03]	[-5.536]	[-5.521]	[-5.173]	[-5.08]
literacy test	-8.271***	-4.554	-5.581**	-6.419**	-4.53*
	[-3.237]	[-1.661]	[-2.041]	[-2.160]	[-1.72]
Constant	68.74***	258.7***	172.0***	196.9***	736.22**
	[15.15]	[6.224]	[5.159]	[5.580]	[1.96]
Joint significance of the Interaction terms					5.69***
Observations	1,426	1,408	1,408	1,408	1,408
R-squared	0.79	0.82	0.82	0.81	0.83
time trend	No	No	No	No	No
Number of states	48	48	48	48	48
Turning point	n/a	9.41	5.38	55.07	Not reported
Interval		[7.8,10.8]	[0.4,11]	[0,92.6]	

Notes: Robust z-statistics correcting for clustering by state in brackets; *** p<0.01, ** p<0.05, * p<0.1. Secret ballot is a dummy variable equal to one after adoption of the ballot and equal to zero before. All estimations include state and year fixed effects.

Table A1: Descriptive statistics for the variables used in the estimations.

Variable	Obs.	Mean	Std dev	Min	Max
Western Europe plus off-shoots					
real GDP per capita	2681	4753.56	4541.49	400	28129.23
urbanization rate	1488	197.45	135.91	0	631
electorate/adult population	1732	31.48	31.01	0	101.90
gini coefficient	1403	0.52	0.02	0.48	0.56
learning	1091	0.16	0.25	0	1.32
population	2722	24571	38601	70	290343
revolutionary threat	1452	0.0003	0.001	0	0.015
distance weighted GDP	1872	0.35	0.10	0.12	0.56
US states					
real income per worker	4778	12043.2	6336.738	1989.977	47727.45
average years of schooling	4798	4.92	2.55	0.20	11.11
urbanization rate	4828	32.29	21.84	0	92.62391
share of land held by the 20% largest farms	1225	0.16	0.053	0.006	0.47
Learning	2627	0.008	0.02	0	0.10
Population	4858	1,682,579	1,942,818	6,077	14,900,000
distance weighted income	5220	1.64	0.58	0.28	2.89
turnout rate	1426	52.30	19.30	2.13	99.99
Latin America					
primary school enrollment/population	544	5.630551	3.062156	0.34	14.79
urbanization rate	1046	116.8609	107.8202	0	446
share of family owned farms	783	8.128736	6.311428	1	30.8
Population	1079	3071.438	4947.492	80.66667	34957
Learning	1084	0.003897	0.004369	0	0.02058
Great Britain					
turnout	74	2260	1812	572	8496
Density	74	5.6	1.8	4	13.5
electorate	74	2813	2391	706	10352

Note: We do not report statistics for dummy variables.

Supplementary material

Appendix S1: Timing of the secret ballot

The Netherlands: 1849. Stuurman (1991, pp. 462-463) notes that "in the autumn of 1849 Thorbecke, the architect of the new constitution, was at last called upon to form a Cabinet and it was his government that produced the final Electoral law [...] There was a secret ballot in all elections."

New Zealand: 1870. "Verbal voting lasted until 1870, when Parliament finally agreed to adopt the secret ballot. Each voter was given a printed ballot paper listing the candidates in their electorate. They marked the paper in private behind a screen and then deposited it into a locked ballot box" (www.elections.org.nz/democracy/history/years.html). Mackie (2000) confirms this year. Przeworski (2010) dates the secret ballot to 1937. The reason for this is that Maoris were not granted the right to a secret ballot until then.

United Kingdom: 1872. This was the year of the Ballot Act, which introduced the Australian Ballot (Asquith, 1888; Mackie, 2000, Seymour, 1915).

Switzerland: 1872. Hewitt (1977) and Engerman (2003).

Canada: 1874. Pillon (2006) and Engerman (2003).

Belgium: 1877. Seymour and Fray (1918, vol. II, p. 193) and Mackie (2000). Przeworski (2010) dates it to 1879, but this is the first election in which it applied.

Norway: 1884. Nerbørvik (1986). Some sources, e.g., Engerman (2003) and Przeworski (2010), give 1885, but this is the year of the first election conducted with secret ballot.

United States: 1891. The dating of the secret ballot for senatorial elections in the USA is complicated by the fact that the ballot rules were decided at the state level. We use 1891 as the benchmark because the majority of states had adopted the secret ballot for senatorial elections in that year (Mackie, 2000).

Denmark: 1901. Elkit (1988, p. 22) and Seymour and Frary (1918, vol. II, p. 177).

Finland: 1906. "The Parliament Act that came into force on 1 October 1906 was a monumental reform [...] The new Parliament Act called for Members of Parliament to be elected directly and by secret ballot according to a proportional system based on districts." (http://web.eduskunta.fi/Resource.phx/parliament /aboutparliament/presentation/history.htx). Mackie (2000) Przeworski (2010) give 1907, but this is the first election under the new rules.

Sweden: 1907. Carstairs (1980). Esaiasson (1990) gives 1911 but this is the first election with secret ballot. Przeworski (2010) dates it to 1866. While it is true that the older and varying regulations often demanded the use of "sealed tickets" (slutna sedlar), it was not till the election in 1911 that voting became de facto secret.

Austria: 1907. (http://www.parlament.gv.at/) and Seymour and Frary (1918, vol. II, pp. 62-63).

Germany: 1913. Anderson (2009, p. 88) argues that the secret ballot was effective in Germany from 1913. Przeworski (2010) dates it to 1867 (i.e., from the constitution of the Northern German Confederation). The constitution of Imperial German, Article 20, guaranteed a secret ballot, but since it was based on the "sealed tickets" it was not Australian. We follow Anderson (2009) and use 1913 to date when the ballot became

de facto secret, although Ziblatt, (2009, p. 12) notes that the ballot was partially secret in 1903.

France: 1913. France had semi-secret elections early in the 19th century, but it was not until 1913 that it became effectively secret, e.g. Baland and Robinson (2008, p. 1738), Seymour and Frary (1918, vol. I, p. 379), Markoff (1999) and Crook and Crook (2007). The constitution of 1795 included provisions for the secret ballot (and Przeworski (2010) dates it to 1820), but it is widely seen to have been ineffective because voters could write the name of their preferred candidate on their own ballot paper at home or receive a ballot in a distribution in the streets. As stressed by many authors (e.g. Seymour and Frary, 1918; Markoff, 1999; Mackie, 2000; Crook and Crook, 2007), this provided ample leeway for corruption and intimidation. For example, Seymour and Frary (1918, p. 379) note that the vote was *de jure* secret, but "in practice almost as public as in Prussia, where it is oral." In 1913, the ballot rules were tidied up and although the ballot remained non-Australian, the reform is widely considered to have been effective in providing secrecy and weeding out most corrupt practices.

US states: Heckelman (1995), Lott and Kenny (1999), Fredman (1968), and Ludington (1911). In some states, e.g., Kentucky, Maryland, Minnesota, Tennessee, Texas, Missouri, and Wisconsin, the secret ballot was not initially applied uniformly throughout the entire state and the coding of these cases follow Heckelman (1995).

Latin America: Our main coding is based on Nohlen (2005, Table 2), Drake (2009, Table 2.4), Hartlyn and Valenzuela (1994), Baland and Robinson (2008), and Przeworski (2010). Some of our dates are different from those recorded by Przeworski (2010). Przeworski (2010) codes the Republic of Guatemala as having secret ballot in 1945, while Nohlen (2005, Table 2) and Drake (2009, Table 2.4) give 1956 as the year with secret ballot. The Constitution of the Republic of Guatemala of 1956 requires secret ballot for elections of all officials. The Constitution from 1945 did not secure secrecy for illiterates who had to vote publicly and non-secretly and we use 1956 as the year of *de facto* adoption. Przeworski (2010) codes Chile as having secret ballot in 1890 and Drake (2009) notes that voting was secret as early as 1874. In 1890, Chile adopted a system based on "official envelopes with isolation space", but this allowed ample opportunity for verifying who a voter actually voted for, and Seymour and Frary (1918, vol. 2, p. 228) note that "almost all writers are agreed upon the prevalence of bribery in electoral contests" after this reform. Nohlen (2005, Table 2) gives 1925, but notes that this did not include a single ballot (which is needed to insure against fraud). Baland and Robinson (2008) discuss how "landlords of large holdings usually registered all their employees by teaching them how to sign their names (as literacy was a condition for vote registration). The day of the election, the employer would go vote with all their employees" and in that way in the years leading up to the 1958 reform effectively control large number of votes. We date the de facto secret ballot to 1958. Przeworski (2010) codes the Dominican Republic as having secret ballot in 1844, while Nohlen (2005, Table 2) and Drake (2009, Table 2.4) say 1865. In 1844 the Dominican Republic declared its independence from Haiti. The Dominican Republic's first Constitution was adopted on November 6, 1844, and article 69 (in the revised version of 1854) required "votación secreta" (secret ballot). Spain abandoned the island in 1865 and a new constitution was adopted that year and we use that as the year

of de facto secret ballot. Finally, Venezuela is coded as being on the secret ballot in 1893 by Przeworski (2010) while the other sources say 1946. The Constitution of 1893 eliminated public voting and introduced some measure of secrecy but not Australian rules (Brewer-Carias, 1997, p. 164). The new constitution of 1946 required direct and secret elections of all representatives and the president (Brewer-Carias, 1997, p. 195) and we date the secret ballot to that year.

Appendix S2: Empirical robustness checks

Western Europe plus off-shoots We have, based on information from Flora et al. (1983), Mackie and Rose (1991), Cook and Paxton (1998), constructed an alternative measure of the size of the electorate, *voters per MP*, defined as the number of voters per seat of parliament. This measure is also insignificant. Importantly, the results for the modernization variables are unchanged. We have estimated all models with a random effects logit estimator. The test of country specific random effects fails to reject the null of no country specific effects. Importantly, the modernization variables remain significant. We can measure landholding equality by the variable *share of family owned farms* (Vanhanen, 2003). This variable is only available from 1858. Accordingly, by including it in the model, we lose more than half the observations and three countries. The variable is not significant. The coefficient on real GDP per capita is significant and the two modernization variables remain jointly significant. The coefficient on electorate/adult population is negative but insignificant. We have checked that the results are unaffected if we, instead, date the secret ballot in the USA to 1896 (rather than 1891) when ninety percent of the states were using the secret ballot (Mackie, 2000). We have checked that the results are robust to excluding the USA or all the off-shoots from the estimations. We have checked that the results are robust to not conditioning on population size.

The US states Boix (2003, p. 122) notes that racial motives might have played a role in relation to the secret ballot. The share of blacks in the population is itself insignificant and it has no effect on our main results. We have re-estimated the model for the period after the civil war and the 15th amendment (1870 onwards) and without population size. Doing so, again, matters little for the results. Adding state specific random effects also has little effect on the results. The test of heterogeneous random effects across states fails to reject the null of no state specific effects. In the turnout model, the outcome variable (*turnout rate*) is a fractional variable bounded between zero and one. Papke and Wooldridge (1993) propose to use a logit link for fractional variables instead of the linear estimator. We find that using this method matters little for the results. We have added a linear trend to all the specifications. The trend is not significant and it makes no difference to the variables of interest.

Latin America We have added an indicator variable for women's suffrage to the model. The indicator is insignificant and only matters little for the other results. We have also used an alternative measure of urbanization, namely *occupational diversification*, defined as the average of the urban and non-agricultural population (Vanhanen, 2003). Using this variable instead of *urbanization rate* gives a positive and marginally

significant coefficient in specifications where *occupation diversification* is entered as the only modernization variable. For the Latin American sample, the random effects are significant, and affect the magnitude of coefficients on the modernization variables. *Urbanization rate* also becomes marginally significant in these specifications. Maddison (2003) reports GDP per capita data for nine countries before secret ballot adoption. For four of the countries the data go back to 1870; for three countries they are only available from 1920. For Chile the data go back to 1820. For Peru, the data can be tracked back to 1896. A Logit model which includes *GDP per capita* as the only independent variable yields a positive and significant coefficient. However, once we include other variables, the likelihood function becomes non-concave, and we fail to find a maximum. We have checked that the results are robust to not conditioning on population size and, in fact, both *primary school enrollment* and the *first principal component* becomes more significant in the logit models, and significant at the 1 percent level in the rare events models.

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Appendix S3: Assumptions

This appendix briefly discusses the main simplifying assumptions made in the theoretical model.

1. Voter type is observable. We assume that the parties can observe who the opposition voters are and so offer them their reservation price in exchange for their

vote. The other extreme is to assume that the parties cannot observe who is who but know the reservation prices of the various types and so that $p_R < p_E$. In stage C, party E can offer p_R. At this price only voters of type R will sell. Party E can get them to self-select and so the probability that it offers a bribe to an opposition voter is 1. Party R needs to offer p_E to induce voters of type E to sell. At this price, both types are willing to sell and so the party R must buy votes at random. The probability that it buys a voter of type E is $\frac{1}{n_R+n_E}$. In stage B, we maintain the assumption that voters expect that everyone shows up when they calculate their own chances of being offered a bribe. A voter of type R expects to get a bribe from party R with probability $\frac{n^b_{ER}}{N_R}$ or from party E with probability $\frac{n^b_{RE}}{N_R+N_E}$ (this assumes he cannot get bribed twice) and his expected bribe income is $p_R\frac{n^b_{ER}}{N_R}+p_E\frac{n^b_{RE}}{N_R+N_E}$. A voter of type E expects to get a bribe from party R with probability $\frac{n^b_{RE}}{N_R+N_E}$. The turnouts of voters of the two groups are:

$$\begin{aligned} n_E^{OB} &= N_E(1-c)+N_E\frac{n^b_{RE}}{N_R+N_E}p_E\lambda_E, \\ n_R^{OB} &= N_R\left(1-c\right)+N_R\lambda_R\left(p_R\frac{n^b_{ER}}{N_R}+p_E\frac{n^b_{RE}}{N_R+N_E}\right), \end{aligned}$$

where

$$n_E^{OB}+n_R^{OB}=\left(N_R+N_E\right)\left(1-c\right)+\Delta(n^b_{ER}+n^b_{RE}).$$

In stage A, the two parties now internalize both the effect on turnout and on their chance of buying an influential vote. We let

$$v=\alpha_E n^b_{ER}-\alpha_R\frac{n^b_{RE}}{n_R^{OB}+n_E^{OB}}.$$

The first order condition will now have to take into account that v is influenced by total turnout which is influenced by voting buying with

$$\begin{aligned} \frac{\partial v}{\partial n^b_{ER}} &= \alpha_E+\alpha_R\frac{n^b_{RE}}{\left(n_R^{OB}+n_E^{OB}\right)^2}\Delta, \\ \frac{\partial v}{\partial n^b_{RE}} &= -\alpha_R\frac{\left(n_R^{OB}+n_E^{OB}\right)-n^b_{RE}\Delta}{\left(n_R^{OB}+n_E^{OB}\right)^2}. \end{aligned}$$

We write the first order conditions as

$$\begin{aligned} \frac{\partial v}{\partial n^b_{ER}}\frac{\partial g}{\partial v} &\leq \alpha_E K_E, \\ -\frac{\partial v}{\partial n^b_{RE}}\frac{\partial g}{\partial v} &\leq \alpha_R K_R, \end{aligned}$$

with $K_E < K_R$ defined in Appendix A. Conjecture that only party E will buy. Then $\frac{\partial v}{\partial n^b_{ER}}=\alpha_E$ and $\frac{\partial g}{\partial v}=K_E$. Look at

$$\alpha_R\frac{\left(n_R^{OB}+n_E^{OB}\right)-n^b_{RE}\Delta}{\left(n_R^{OB}+n_E^{OB}\right)^2}K_E\leq\alpha_R K_R.$$

If $\frac{\left(n_R^{OB}+n_E^{OB}\right)-n_{RE}^b\Delta}{\left(n_R^{OB}+n_E^{OB}\right)^2} < 1$, which it is if $\left(n_R^{OB}+n_E^{OB}\right) > 1$, then the conjecture is correct and only party E bribes. In this case, all the relevant comparative statics derive from $\frac{\partial g}{\partial v} = K_E$ and are exactly as before.

2. Rational expectations about turnout. If voters believe that their chance of getting a bribe is proportional to turnout rather than to the size of their group, then the expected utility value of the bribe is

$$u_j^e = \frac{n_{-jj}^b}{n_j} p_j \lambda_j. \tag{35}$$

At equilibrium the expected turnout must be equal to actual turnout, so turnout for group j is defined by

$$n_j = N_j \left(1 - c + \frac{n_{-jj}^b}{n_j} p_j \lambda_j\right), \tag{36}$$

with the solution[45]

$$n_j^*(n_{-jj}^b, N_j) = \frac{1}{2} N_j (1-c) + \frac{1}{2}\sqrt{N_j^2 (1-c)^2 + 4 N_j n_{-jj}^b p_j \lambda_j}. \tag{37}$$

The main difference between this and the case considered in the text is that the marginal effect of bribery on turnout is not independent of n_{-jj}^b. Under the assumption that

$$\frac{p_R \upsilon_E \widehat{\eta}}{\alpha_E(\Delta_E + M)} + \frac{1}{2}\frac{\partial n_R^*}{\partial n_{ER}^b} < \frac{p_E \upsilon_R \widehat{\eta}}{\alpha_R(\Delta_R + M)} + \frac{1}{2}\frac{\partial n_E^*}{\partial n_{RE}^b},$$

it remains true that only party E is active in the vote market. All comparative static results continue to hold as long as vote buying is optimal. The only result that requires an additional assumption is the one regarding the effect of N_R on the net value of a veto.

3. $\Delta_E = \Delta_R$. Since these represent per capita benefits, the natural alternative is that $\Delta_E > \Delta_R$, i.e., each member of the (small) elite stands to lose a lot more than each member of the (large) majority. All results go through when $\Delta_E > \Delta_R$ because this simply increases the reservation price for elite voters. If, for some reason, $\Delta_E < \Delta_R$, all results holds as long as this difference is not sufficient to violate Assumption 1.

4. Secret ballot as an absorbing state. If we allow for reversals, it is possible that there exist equilibria where the society fluctuates between the two ballot systems (this would for example be the case if $\rho = 0$), but there will also exist parameter values such that a transition to secret ballot is permanent. It is a question of finding parameters such that party E will not veto, while party R will.

[45] We disregard the negative root of the polynomial.

5. The vote buying technology. This is the critical assumption that leads to the asymmetric outcome in the vote market with at most one party buying. Other technologies lead to situations where both parties buy votes. This makes the analysis more blurred, but as long as one of the parties has a clear advantage under open ballot and the other has an advantage under secret ballot, the logic of reform continues to apply and modernization continues to undermine the value of the vote market by pushing up prices and increasing transaction costs.