Learning Dynamics and the Support for Economic Reforms:
Why Good News can be Bad

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Abstract

Support for economic reforms has often shown puzzling dynamics: many reforms that started off successfully, lost public support nevertheless. We show that learning dynamics can rationalize this paradox, the reason being that the process of revealing reform outcomes is an example of sampling *without* replacement. We show that this concept challenges the conventional wisdom that one should start by revealing reform winners. We use our framework to explain why gradual reforms worked well in China (where successes in Special Economic Zones facilitated further reform), while this is much less so for Latin American and Central and Eastern European countries.

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1 Introduction

Why have gradual economic reforms worked out well for China, while this is much less so for most Latin American and Central and Eastern European countries? And how is it possible that so many reforms that started successfully while enjoying majority support, subsequently lost this support, while there are simultaneously examples of reforms that did not start off well, but nevertheless managed to maintain momentum among voters?

The most dramatic example of a reformist government that lost majority support in spite of impressive economic performance, is probably that of Slovakia in 2006. Back then, the *Wall Street Journal Europe* wrote:[1]

> "Imagine you're the leader of a country where economic growth is running at 6.3%, your government has been praised by the World Bank as the best market reformer in the world [and] unemployment has fallen to a record low of 10.6% from around 20% in just four years. [...]
>
> With this record in mind, now consider that you face parliamentary elections this Saturday at which, unless the opinion polls change dramatically, you risk annihilation by a leftist opposition party with no experience of government and a policy agenda filled with populist rhetoric.
>
> Welcome to the world of Mikuláš Dzurinda, prime minister of Slovakia, who for the past eight years has led what can reasonably claim to have been the most successful neo-liberal government of the 21st century so far."

Despite the impressive reform successes, Dzurinda lost the 2006 elections to Robert Fico of the SMER-party (a breakaway party from the SDL, the successor to the original Communist Party of Slovakia).

With important reforms currently being implemented in many African and Southern European states, it is important to understand why such puzzling developments occur. In this paper we therefore construct a learning model that sheds light on the

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[1] Robin Shepherd, "The Dzurinda Revolution," Wall Street Journal Europe, June 12 2006.

dynamics of public support for gradual economic reforms.[2] We believe that learning processes play a key role in determining support for reforms, but so far the literature has remained relatively silent on this issue: despite the fact that there are many informal discussions of learning from reform outcomes, formal treatments are scarce.[3]

Although in the long run everybody may gain from efficient reforms, there will almost inevitably be losers during the transitional phase (certain generations, professions, etc.). The model we construct captures the fact that reforms typically generate reform winners and reform losers, but (as emphasized in the seminal paper by Fernandez and Rodrik (1991)) these winners and losers cannot always be identified up front. Consequently, voters update their beliefs on whether they will end up in the winner-group (or in the group of losers) as the reform progresses over time.

The fact that reform measures that have already been taken may affect the distribution from which future sampling will take place, plays a key role in our analysis. More specifically, we incorporate that the process of revealing reform outcomes is an example of sampling *without* replacement. We show that this implies that the revelation of reform winners deteriorates the quality of the remaining pool - thereby making unreformed agents less eager to continue the reform process. We show that these dynamics can be so strong that they can even lead to the counterintuitive situation in which reform *successes* make the median voter start *opposing* a reform of which he used to be supportive. In those circumstances the reforming government suddenly loses majority support - despite (or maybe it is better to say: because) the reform is progressing in such a successful way.

We emphasize that this effect results from rational economic thinking and that it comes into play as soon as a reform is believed to generate some losers whose

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[2]With the possible exception of price decontrol, all reforms are gradual (as opposed to "big bang"), if only because of implementation delays. As for example noted by Gupta, Ham and Svejnar (2008), even reforms that were supposed to be "big bang" (such as the Balcerowicz reforms in Poland), were not completed instantaneously. In this sense, all reforms are gradual, but some reforms are "more gradual" than others.

[3]Some exceptions are Van Wijnbergen (1992, where voters learn about the effects of price reform), Dewatripont and Roland (1995, where the public uses the outcome of one reform to learn about the expected outcome of another one), and Veldkamp (2009, where laid-off workers learn about their re-employment chances).

identity is ex ante unknown - a feature that we see as being in accordance with many economic reforms in reality (also see Fernandez and Rodrik (1991) on this). In addition, sampling without replacement continues to play a role when one adds aggregate uncertainty (which implies that voters are also uncertain on the exact share of the population that will benefit from reform). In that setup, the revelation of winners also leads to an upward revision of the expected aggregate number of reform beneficiaries. Then, the "sampling without replacement"-effect will dominate when voters believe that the reform is sequenced in a strategic way, or when they have a tight prior belief on the aggregate fraction of winners (as a result of which Bayesian updating in that dimension occurs only slowly). In those cases, the standard practice of starting the reform by revealing reform winners may again sow the seeds for its own destruction.

Although this learning mechanism applies to many reform types (such as the phasing out of subsidies, the gradual abolition of price controls, or the reduction in trade barriers), we will often make the link with privatization. Privatization is a good example of a reform where learning dynamics may be important, and the choice between starting with "good" or "bad" companies comes up all the time.

On a more general level, this paper develops a theory of agents who are learning from realizations that are sampled without replacement. We believe that this is a broad concept that has significant implications for many other economic problems as well (the process of revealing the identity of banks in a financial crisis (good or bad?) being a topical example), which may make the model underlying this paper of independent interest.

Our results question the political feasibility of the so-called "sectoral gradualist" approaches to privatization. Those strategies have for example been advocated by the World Bank through its plea for the "case-by-case" approach (Welch and Frémond, 1998). This case-by-case approach, also favored by János Kornai in his 1990 book, has been applied to many countries in both Latin America and Central and Eastern Europe, as well as to the UK during its liberalization phase. It implies that one sector (or firm) is reformed after the other (cf. Berg and Blanchard (1994, p. 53, 63)). But by following such a gradual, sequential strategy, reformers will suffer from

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the "sampling without replacement"-effect sketched before, which may explain why practitioners have experienced political difficulties with the case-by-case approach: Lipton and Sachs (1990, p.298) for example note that "in almost all countries where privatizations have been attempted, there have been major political obstacles to the case-by-case approach", while Boycko, Shleifer and Vishny (1993, p. 148) state that reforms that proceed at a rather slow pace, are likely to reach a deadlock. As we will argue in Section 4 of this paper, "spatial gradualism" (reforming one *region* after another, as China for example did by installing Special Economic Zones) can avoid the "sampling without replacement"-problem when regions are similar in economic structure. Hereby, the mechanisms explored in this paper may help to explain why gradual reform strategies have been more successful in China than in Central and Eastern Europe.

The itinerary of this paper is as follows. First, Section 2 describes various examples of reforms for which support dynamics have been counterintuitive. In Section 3 we construct a learning model that provides an explanation for these puzzling dynamics. Section 4 will then deal with the question why gradualism worked quite well for China, while this is much less so for most Central and Eastern European and Latin American countries. Finally, Section 5 concludes.

2 Support dynamics for economic reforms: a short history

Next to the case of Slovakia we discussed in the Introduction, there are many more examples of economic reforms that lost support in spite of their initial success (and vice versa). Stokes (2001) provides a thorough analysis of support dynamics around various reforms. In that volume, several authors examine the public's reactions to reforms in Spain, East Germany, Poland, Mexico, Peru and Argentina. In her summary of the study, Stokes (2001, p.25) notes that "[their] most startling result is that in every country people sometimes reacted to economic deterioration by supporting the government and its economic program more strongly. Conversely, they sometimes

reacted to economic improvement with pessimism and opposition". Similar findings are reported by Tucker (2000), who analyzed election data from five post-communist countries and found that support for incumbents tends to *decrease* with economic performance.

Stokes (2001) gives various specific examples of these counterintuitive dynamics. For example, in all three Latin American countries studied (Mexico, Peru and Argentina), economic expansion (measured by either wage or GDP growth) was followed by pessimism about the future and opposition to the reform program.[4] Similarly, increased real wages in Poland did not generate support for the reforms, but created agnosticism instead.

With respect to the latter case, Rodrik (1995, p. 404) has also expressed his surprise. When discussing the return to power of the former Polish communist party in 1993, he writes that "why this should be so is not so easy to understand. [...] By most standards, Poland must be judged a success case".[5]

Regarding general experiences in Central and Eastern Europe, Fidrmuc (2000, p. 1491) notes that "the collapse of communism occurred amidst overwhelming popular support for fundamental economic and political reforms. However, only a few years later the pendulum swung back and the reformers were voted out." In a similar spirit, Blanchard, Froot and Sachs (1994, p.6), speak of "reform fatigue" plaguing most reformist post-communist governments some years into the reform. Slovenia for example faced great difficulties in its post-communist reform process - despite the fact that it already had quite a few positive experiences with market forces from the past (Pleskovic and Sachs, 1994). And although the 1968 Hungarian reforms started off successfully, they subsequently ran into difficulties in the mid-1970s when the country went through periods of recentralization (Qian and Xu, 1993). Similarly, after the second wave of reforms following the demise of communism, the reformist

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[4]In a broader sample of 12 Latin American countries, Remmer (1991) finds similar paradoxical results.

[5]Poland did have a high unemployment rate at the time, but as Rodrik (1995, p. 405) notes it is not clear whether that is to blame for the deadlock: the unemployed are too small a group to be decisive in national elections, while it is also not straightforward that their interests are best served by policies that slow down the reforms.

Hungarian government lost the 1994 elections and the former communist party came back in power (very much like in Poland and later on also Slovakia) - a pattern that led Kornai (2000) to conclude that the gradual reform strategy may not be that feasible from a political point of view.

Latin America offers additional examples of countries that have had similar experiences. Puzzled by this, Tommasi and Velasco (1996) for example ask: "Why did Venezuelans riot, twice attempt to overthrow and eventually impeach a president (Carlos Andrés Pérez) who in 1990-92 brought them an average growth rate of 7.8% (the highest in Latin America), while Peruvians massively reelected Alberto Fujimori, under whose stewardship consumption dropped by 15.3% in 1990?" Similarly, Iglesias (1994, p. 497-498) notes: "In my country (Uruguay), which is growing by 11.5 percent, where unemployment and inflation are down, and where reserves are up, the popularity rating of the president is 12 percent. That's why the administration lost its bid to privatize the telephone company".[6] A similar story holds with respect to India: notwithstanding the successes of the Indian liberalization policies adopted in the 1990s, India is currently struggling to get new reforms implemented and has turned into "a place that has fallen out of love with reform" (as stated in *The Economist* of March 24th 2012, p. 14). More generally, Sachs and Warner (1995) have documented how many countries slowed down (or even reversed) their liberalization policies in the 1960s and 70s, even though economic performance under the more liberal regime was impressive.

All these examples suggest that a successful reform start is by no means a sufficient condition for the reform to maintain majority support along the way - an observation that is at odds with the conventional wisdom that a favorable start facilitates continuation.

At the other end of the spectrum, however, are the gradual economic reforms in China. There, the government started up certain Special Economic Zones in 1980,

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[6]In 1994, Luis Alberto Lacalle (of the Partido Nacional) was president of Uruguay. After taking office in 1990, he started with significant economic reforms (in the sphere of both taxation and liberalization), but later his initiatives lost support (despite the successes; cf. Iglesias' quote). Subsequently, he lost the elections and was replaced by Julio María Sanguinetti of the rivaling Partido Colorado in 1995.

after which the economies of those regions started booming. Very much in contrast to the experiences of Central and Eastern Europe and Latin America, the initial successes of these Chinese reforms led to increased support for further reforms over there (see Litwack and Qian (1998) and Qian, Roland and Xu (1999, 2006)).

In the next section, we develop a model that is able to rationalize the confusing support dynamics in Latin America and Central and Eastern Europe, while it is simultaneously able to explain why the initial Chinese reform successes did not invoke such a paradoxical public response.

3 Support dynamics for economic reforms: a formal model

Our model builds upon Fernandez and Rodrik (1991). In contrast to that paper however, we focus at a dynamic setup in which it takes time to finish reforms, so that reforms are completed gradually (as in reality; recall footnote 2) and agents update beliefs about their chances of benefiting from the reform as it progresses over time. (In Fernandez and Rodrik (1991) the reform decision is binary: it is either implemented fully and instantaneously in one go, or it is not implemented at all.)

To build intuition for the mechanisms at play and to set the stage for our full model, we first consider the standard Fernandez-Rodrik setup in which there is only individual uncertainty, but no uncertainty in the aggregate. That is: in Section 3.1 individuals know *what fraction* of the population will gain from the reform, but ex ante they do not know yet *who* these winners will be.

In Section 3.2 we incorporate aggregate uncertainty: individuals are also not sure *what fraction* of the population will benefit from reform (a feature of reality that has been stressed before by Dewatripont and Roland (1995)).

3.1 Without aggregate uncertainty

To build intuition, we first illustrate our point in a setup without aggregate uncertainty. In particular, time is discrete, the horizon infinite and there is a large number

of risk neutral voters aligned uniformly between 0 and 1. We assume that these in-dividuals are rational and forward looking.[7] They are faced with a reform proposal R_γ, which is to replace the status quo. The latter is assumed to leave everyone with a net present value payoff of 0. Reform R_γ on the other hand, is known to bene-fit a fraction $\gamma > \frac{1}{2}$ of the population with certainty (yielding them a net present value payoff of $S > 0$); the losing fraction $(1 - \gamma)$ is assumed to receive a symmetric negative payoff of $-S$ (where the symmetry simplifies the algebra, without loss of generality).[8] This implies that there is no aggregate uncertainty and since $\gamma > \frac{1}{2}$ the reform is efficiency-enhancing and would always be welcomed by a majority ex post.

The electorate does face individual uncertainty however: although there is a frac-tion α_t that already knows ex ante that it will get to belong to the group of reform winners, and a fraction β_t that knows that it will be among the losers (with $\alpha_t < \frac{1}{2}$ and $\beta_t < \frac{1}{2}$), the remaining fraction $(1 - \alpha_t - \beta_t)$ does not know at time t whether they will gain or lose from the reform. Consequently, that fraction will base its decision upon the expected value of the reform for them. If we sort all individuals (indexed by i) such that the γ ex post winners of the reform are located on the left of the interval and the $(1 - \gamma)$ losers on the right, we get the configuration shown in Figure 1.[9]

Voters with $i < \alpha$ know that they are among the reform winners, while voters with $i > 1 - \beta$ (where the "one minus" follows from the fact that β is measured from the right; see Figure 1) know that they are among the losers. At the start of the reform α and β can be equal to 0, but this does not necessarily have to be the case:

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[7]Whether voters are for- or backward looking is somewhat debated. While especially the early papers on this issue report that voters are myopic and backward looking (see e.g. Kramer (1971)), more recent studies tend to find that rational forward looking behavior dominates (cf. MacKuen, Erikson and Stimson (1992) and Fidrmuc (2000)).

[8]Note that the distribution of winners thus follows a binomial distribution with success proba-bility γ.

[9]We rule out partial reform (just reform the winners and keep the losers under the state wing) as a desirable outcome. Clearly, analysis of such an outcome would require the introduction of interactions between reformed and unreformed parts of the economy and of costs attached to the use of public funds (keeping loss making, government-owned firms in operation is costly to society). Incorporation of this point would detract from the clarity of our core message, as a result of which we do not introduce these obfuscating factors here. See Murphy, Shleifer and Vishny (1992) for a model that does address the problems related to partial reforms.

Figure 1: Graphical illustration of the setup

it is perfectly possible that some agents already operate under the new regime before the reform starts (for example as a remnant of uncompleted past reform attempts) or that their identity is just obvious up front. Agents in between α and $1 - \beta$ are uncertain about their identity and do not know whether they will be a reform winner or a reform loser. Since the identity of more and more individuals is revealed as the reform progresses over time, α and β become time-varying and thus obtain a time index; γ on the other hand is a time-invariant structural parameter characterizing the reform. (Note that with aggregate uncertainty, the public's *estimate* of γ can become time-varying (even though γ itself is fixed), which is what we will allow for in the next section.)

In this setup, the expected value of the reform for uncertain individuals (i.e. those with $i \in (\alpha_t, 1 - \beta_t)$) equals:

$$\mathbb{E}\left\{R_\gamma | i \in (\alpha_t, 1 - \beta_t)\right\} = (\gamma - \alpha_t) \cdot S + (1 - \gamma - \beta_t) \cdot (-S) \tag{1}$$

Individuals in that group follow the decision rule:

$$\delta_t = \begin{cases} 1 & \text{if} \quad \mathbb{E}\left\{R_\gamma | i \in (\alpha_t, 1 - \beta_t)\right\} > 0 \\ 0 & \text{if} \quad \mathbb{E}\left\{R_\gamma | i \in (\alpha_t, 1 - \beta_t)\right\} \leq 0 \end{cases} \tag{2}$$

Here, δ_t is a support indicator that takes the value 1 if the uncertain group votes in favor of the reform, and zero otherwise. Since α_t and β_t are both smaller than $\frac{1}{2}$, the decisive median voter is located in this uncertain group.[10]

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[10]Like Fernandez and Rodrik (1991) we assume that a reform is more likely to be adopted if there is a larger number of individuals in favor of it, but we use the language of majority voting for

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The insight of Fernandez and Rodrik (1991) was that the expected value of this uncertain group (expressed by (1)) can be negative for a wide range of parameter combinations - thereby making all $(1 - \alpha_t - \beta_t)$ uncertain individuals oppose the reform package ex ante. Because $\alpha_t < \frac{1}{2}$ this implies that the reform does not enjoy majority support up front, even though it would be welcomed by a majority ex post (since $\gamma > \frac{1}{2}$).[11] As Fernandez and Rodrik emphasize, this result does not rely on risk aversion, irrationality, or hysteresis due to sunk costs.

Here, one sees how the presence of individual uncertainty can prevent an efficiency-enhancing reform from being implemented. In particular, there are currently ex post winners blocking the reform ex ante, because they do not know that they will be among the ex post winners.

Since individual uncertainty is at the core of the problem, one may think that reducing individual uncertainty by revealing some additional winners (i.e. increasing α_t to $\alpha_{t+1} = \alpha_t + \Delta\alpha_{t+1}$, bringing it closer to γ) would make a yes vote more likely. This turns out *not* to be true, opening a perspective on intriguing voter dynamics. To see this, consider how the expected value for uncertain individuals changes with α:

$$\frac{\partial \mathbb{E}_t \{R_\gamma | i \in (\alpha_t, 1 - \beta_t)\}}{\partial \alpha_t} = -S < 0 \tag{3}$$

So a decrease in individual uncertainty brought about by the revelation of additional winners, makes individuals who remain uncertain only more *negative* about their chances of gaining from the reform. The reason is that in the absence of aggregate uncertainty (which will be added in the next section), increasing α_t to α_{t+1} implies that there are $\Delta\alpha_{t+1}$ fewer gaining places left for those who remain uncertain (since the revelation of reform outcomes is an example of sampling *without* replacement). This makes these uncertain individuals more pessimistic about their chances of ending up as a reform winner and when the median voter is located within this

concreteness.

[11]Note that the Fernandez-Rodrik model assumes that it is not possible to compensate the losers ex post. Given the well-known difficulties that governments face in committing to future policies, this assumption may not be that unrealistic.

uncertain group, he also becomes more pessimistic.

Revealing losers on the other hand will increase the expected value of the reform for those who remain uncertain:

$$\frac{\partial \mathbb{E}_t \left\{ R_\gamma | i \in (\alpha_t, 1 - \beta_t) \right\}}{\partial \beta_t} = S > 0 \tag{4}$$

At this stage, one should note that there is a wide range of values for α and β where changes in uncertainty will not change the outcome of the vote. For example, if the vote is "No" to begin with, increases in α will only make $\mathbb{E}_t \left\{ R_\gamma | i \in (\alpha_t, 1 - \beta_t) \right\}$ more negative and the median voter will continue to oppose the package.

But there is an intriguing possibility if the median voter initially supports the reform package. To see this, hold β_t constant at $\overline{\beta}$ for a moment[12] and let us investigate what happens if the government tries to complete the reform gradually by increasing α_t (i.e.: revealing winners). Then, if the increase in α is small enough, δ will remain 1 and the median voter continues to vote "Yes", pushing the overall vote in favor. But because of the effect captured by (3), one can define a critical value for α, call it α^*, such that if α rises above α^*, the median voter swings around, causing a rejection of the package.[13] The critical value α^* is thus the point at which the median voter starts opposing a reform that he used to support. Mathematically, α^* is defined as that value of α for which $\mathbb{E} \left\{ R_\gamma | i \in \left(\alpha^*, 1 - \overline{\beta} \right) \right\} = 0$, so from (1) we can derive that:

$$\alpha^* = 2\gamma + \overline{\beta} - 1 \tag{5}$$

More formally, one can now see that if the median voter initially favors the reform (i.e. $\delta_t = 1$), the total supporting fraction (given by $\Psi_t = \alpha_t + \left(1 - \alpha_t - \overline{\beta} \right) \delta_t$) will remain constant if α increases to an $\alpha_{t+1} < \alpha^*$. Hence:

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[12]The same argument applies, mutatis mutandis, to changes in β_t if the median voter initially opposes reform. However, in that case the reform cannot be started along democratic lines.

[13]The last part of this statement of course assumes that $\alpha^* < 1/2$ - a condition to which we will return to in the next section.

$$\Delta\delta_{t+1} = 0 \Leftrightarrow \Delta\Psi_{t+1} = \Delta\alpha_{t+1}(1 - \delta_t) = 0$$

$$\text{if: } (i) \; \delta_t = 1$$

$$(ii) \; \alpha_t + \Delta\alpha_{t+1} < \alpha^*$$

In this case, the revelation of $\Delta\alpha_{t+1}$ additional winners does not make α cross the critical value α^*. When increasing α, there are more individuals supporting the reform (since they have now found out that they are among the winners of the reform), but the uncertain block (which also supports the reform in this case) shrinks one-for-one with the increase in α. On balance, total support for the reform remains unaffected.

But as more and more winners are revealed, α will eventually exceed α^*. If this happens when $\alpha^* < \frac{1}{2}$ (a condition to which we will return to in Section 3.2), the median voter switches sides and starts opposing the reform package of which he used to be supportive. A sudden loss of majority support for the reforming government results:

$$\Delta\delta_{t+1} = -1$$

$$\text{if: } (i) \; \delta_t = 1$$

$$(ii) \; \alpha_t < \alpha^* \leq \alpha_t + \Delta\alpha_{t+1} < \frac{1}{2}$$

This opens up the possibility of a reform that starts off well (individuals involved with reformed firms/sectors turn out to be better off), but as individual uncertainty continues to decrease, the "sampling without replacement"-effect captured by (3) eventually causes the median voter to swing against the package. Hereby, the model reproduces support dynamics that are very much like the practical experiences of many reformist governments (recall Section 2 of this paper).

Hence, when one takes into account that the process of revealing reform outcomes is an example of sampling without replacement, the conventional sequencing wisdom that one should start by reforming firms or sectors that are most likely to benefit

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from reform (in order to boost public support) is heavily challenged.

This conventional wisdom is for example expressed in Roland (1994, p. 1164). There he writes that "if the best firms get privatized first [...] the likelihood of a successful economic performance will be higher. Initial economic successes for privatized firms will enhance support for privatization and build constituencies for further reforms." Similarly, *The Economist* of March 24th 2012 writes about the opposition the Cuban reform process is currently experiencing and states that, in order to increase public support for the reform process, "Raúl Castro urgently needs to create some winners" (p. 20). This line of reasoning however overlooks the "sampling without replacement"-effect. By taking this effect into account, the present paper points out that Raúl Castro may very well decrease support for his reforms even further by revealing winners.

3.2   With aggregate uncertainty

Now let us introduce aggregate uncertainty. In this case, voters do not know the true value of γ (the fraction of individuals that will benefit from the reform ex post) with certainty. Instead, the public has beliefs about γ. Let us use $\widehat{\gamma}_t$ to indicate the beginning of period t estimate of γ. Any valuable information that becomes available during period t will lead to an updated estimate, $\widehat{\gamma}_{t+1}$ (where updating occurs by application of Bayes' rule).

Voters hold a prior belief on γ that is given by a $Beta\,(\alpha, \beta)$-distribution. This distribution is a natural choice as it is the conjugate prior of the binomial distribution underlying the present model (cf. footnote 8). In this case, we have that for $\alpha = \alpha_t$ and $\beta = \beta_t$, the time t estimate of γ equals:

$$\widehat{\gamma}_t = \frac{\alpha_t}{\alpha_t + \beta_t} \tag{6}$$

Expression (6) is intuitive: $(\alpha_t + \beta_t)$ represents the total sample of outcomes we have gathered so far, while α_t is the number of winners in this sample. The ratio of these two is the time t estimate of γ.

After revealing $\Delta\alpha_{t+1}$ additional winners and $\Delta\beta_{t+1}$ additional losers during period t, Bayes' rule implies that the posterior estimate of γ (which is the prior at the beginning of period $t+1$) equals:

$$\widehat{\gamma}_{t+1} = \frac{\alpha_t + \Delta\alpha_{t+1}}{\alpha_t + \Delta\alpha_{t+1} + \beta_t + \Delta\beta_{t+1}} \tag{7}$$

From equations (6) and (7) one can confirm the intuitive notion that application of Bayes' rule leads to an upward revision of the expected fraction of reform beneficiaries ($\widehat{\gamma}$) after $\Delta\alpha_{t+1}$ additional winners have been revealed (and vice versa after the revelation of losers). Since this implies that beliefs about γ can change over time, the critical value for α (α^*) also becomes time-varying. In particular, after plugging (6) into (5) we obtain that:

$$\alpha_t^* = 2\widehat{\gamma}_t + \beta_t - 1 = \frac{2\alpha_t}{\alpha_t + \beta_t} + \beta_t - 1 \tag{8}$$

Now, the key question is going to be: can we get $\alpha_t \geq \frac{1}{2}$ before $\alpha_t \geq \alpha_t^*$? If this is the case, the government is able to reveal that the median voter is a reform winner (which happens when α_t crosses $\frac{1}{2}$), before this pivotal voter starts opposing the reform package (which happens if and only if α_t exceeds α_t^* while $\alpha_t < \frac{1}{2}$). Subsequently, the government can complete the reform with no risk of losing majority support along the way.

Since empirical studies like Carlin and Mayer (1992), Frydman, Rapaczynski and Early (1993), Marcincin and Van Wijnbergen (1997) and Gupta, Ham and Svejnar (2008) all present evidence that reforms start by revealing ex post winners, it is interesting to see what our model predicts would happen if the reform follows such a selective path. To investigate this, we make the following assumption on the sequencing within the reform:

Assumption 1 *Sequencing is such that the reform starts by revealing ex post winners.*

The reason for the presence of this selection bias can be twofold. First, it can result from a situation of asymmetric information in which the government knows ex ante who will benefit and who will lose from reform (but is, like in Perotti (1995), unable to transmit this information credibly to the public).[14] Especially in our privatization example this assumption seems realistic, as the government (being the incumbent owner of the firms that are to be privatized) has inside information on firm profitability, future policies that may benefit or harm each firm, etc. etc. If this government then follows the conventional wisdom and starts with reforming the ex post winners (which is often recommended to reformers in practice; cf. Roland (2000, p. 49)), Assumption 1 materializes.

Second, in the light of our application to privatization, Assumption 1 can also be the natural outcome resulting from the fact that better firms tend to find buyers more rapidly (Roland, 2000: p. 248). This point has also been recognized by policy makers: according to Egyptian government officials in the New York Times of June 27 2010, Egypt suspended its privatization program in 2009 because "most of the likely candidates had already been either privatized or dissolved, leaving hard-to-sell industries that were technologically outdated and overstaffed with ill-trained workers".

In the Appendix we explore the alternative case in which the government is not able to identify winners and losers up front. That case is probably more relevant to trade reform, as such a reform type does not come with a natural selection process, while it is also not clear that the government knows the identity of the winners and losers up front in that setting. Then, reform outcomes are just sampled randomly from the true underlying distribution. Crucially, the Appendix shows that the "sampling without replacement"-effect continues to be present under random sampling. In particular, that specification leads to two regions in the (α, β)-space where the dynamics are anomalous (i.e. favorable reform outcomes decreasing support for reform and vice versa). More generally, the importance of the "sampling without

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[14]In this sense, the government in our model is thus a bit like Monty Hall in the "Monty Hall problem": he also knows ex ante behind which doors the gains and losses are located. Note that the counterintuitive solution to the Monty Hall problem also follows from the fact that sampling takes place without replacement.

replacement"-effect is increasing in the tightness of the prior belief on γ: the tighter the prior on γ is, the less responsive voters' beliefs on γ are to news, and the more dominant the "sampling without replacement"-effect becomes (since the latter works independently of the tightness of γ's prior). In the limit, as the prior on γ converges on a point, the model collapses to the one discussed in Section 3.1 (without aggregate uncertainty).

Turning to the setting in which Assumption 1 does hold, it is instructive to first think through what would happen if voters do *not* take the selection bias into account and hold a diffuse prior belief on γ at the start of the reform (call this "time 0"). In particular, let us assume that both α_0 and β_0 (the fractions of winners and losers whose identities are clear ex ante already) are close to zero (which minimizes the tightness of the prior). Then, Bayes' rule implies that voter beliefs about γ are revised upwards when winners are revealed $(\partial\widehat{\gamma}_t/\partial\alpha_t = \beta_t/\left(\alpha_t + \beta_t\right)^2 > 0)$. In particular, voter beliefs about γ will quickly converge to 1, as voters only observe favorable reform outcomes and erroneously think that this is the result of random sampling from the underlying true distribution of winners and losers. This implies that $\alpha_t^* \to 1$ (cf. equation (8)), which allows the reforming government to reveal that the median voter is a reform winner before $\alpha_t \geq \alpha_t^*$ (provided that $\gamma > \frac{1}{2}$ of course, i.e. that the reform is efficient). Subsequently, the reform can be completed with no risk of losing majority support.

So when voters have a diffuse prior belief on γ at the start of the reform and when they do not take the selection bias into account, the government is able to complete efficient reforms gradually by revealing winners while running no risk of losing majority support.

This case however imposes an unrealistically high degree of naivety on voters: they think that the reform is sequenced in a truly random way and do not take into account that the government (or nature, recall our discussion following Assumption 1) starts with revealing reform winners.

Consider therefore the more realistic case in which the public does take the selection bias into account. Then, the revelation of additional outcomes provides no valuable information: the public realizes that these draws do not come from the true

underlying distribution, as a result of which Bayes' rule may no longer be applied.[15] Consequently, agents cannot update their estimate of γ and $\widehat{\gamma}_t$ remains constant at $\widehat{\gamma}_0$ $\forall t$ (where $\widehat{\gamma}_0$ is the exogenously given belief on γ at the start of the reform). This leads to the following results:

Proposition 1 *If the public believes that the reform starts with reforming the ex post winners, and if it believes that the reform is "sufficiently efficient" (in a sense that $\widehat{\gamma}_0 \geq \frac{3}{4} - \frac{1}{2}\beta_0$), the reform can still be completed gradually by revealing only winners from time 0 onwards.*

Proof. From equation (8) it follows that $\widehat{\gamma}_0 \geq \frac{3}{4} - \frac{1}{2}\beta_0 \Leftrightarrow \alpha_0^* \geq \frac{1}{2}$. Revealing only winners (i.e.: keeping β_t constant at β_0) implies that α_t^* remains constant at $\alpha_0^* \geq \frac{1}{2}$ over time. This implies that the threshold $\alpha_t^* \geq \frac{1}{2}$ $\forall t$, as a result of which the reforming government can reveal that the median voter is a reform winner before this voter starts opposing the reform (i.e. the government can push $\alpha_t \geq \frac{1}{2}$ before $\alpha_t \geq \alpha_t^*$). ■

Corollary 2 *If the public believes that the reform starts with reforming the ex post winners, but if $\widehat{\gamma}_0 < \frac{3}{4} - \frac{1}{2}\beta_0$, even reforms that are believed to be efficient (i.e. reforms for which $\widehat{\gamma}_0 > \frac{1}{2}$) can never be completed gradually by revealing only winners from time 0 onwards.*

Proof. From (8) it now follows that $\widehat{\gamma}_0 < \frac{3}{4} - \frac{1}{2}\beta_0 \Leftrightarrow \alpha_0^* < \frac{1}{2}$. This implies that the reform is not believed to be "sufficiently efficient" (as defined in Proposition 1). Revealing only winners (i.e.: keeping β_t constant at β_0) then decreases the expected value of the median voter via (3). Since constancy of β_t again implies constancy of α_t^* (at $\alpha_0^* < \frac{1}{2}$), $\alpha_t \geq \alpha_0^*$ before $\alpha_t \geq \frac{1}{2}$ and majority support is lost before the reform is completed. ■

Hence, those reforms on which beliefs are such that $\widehat{\gamma}_0 < \frac{3}{4} - \frac{1}{2}\beta_0$ can no longer be completed gradually by revealing only winners. Do note that this result arises even

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[15]After all, the only thing that is being revealed if α_t is increased to α_{t+1}, is that $\gamma \geq \alpha_{t+1}$ (which was already known given that $\alpha_{t+1} < 1/2$, while voters know that the reform is efficient, i.e. $\gamma > 1/2$). However, under Assumption 1 this is by no means informative on whether there are still any winners located *beyond* α_{t+1}.

if the reform enjoys majority support at its start, and even if the reform is believed to be efficient (in a sense that it is believed to generate more winners than losers, i.e. $\widehat{\gamma}_0 > \frac{1}{2}$).

The intuition for what is going on is exactly as in Section 3.1: every additional winner revealed reduces the perceived probability of ending up as a winner for those who remain uncertain. As a result of this, the median voter will at some point start opposing the reform that he used to support.

Similar dynamics arise when we drop Assumption 1 and assume instead that reform outcomes are sampled *randomly* from the underlying distribution (see the Appendix for a discussion of this case). Then, the revelation of winners also implies that voters become more enthusiastic about the reform as they revise their estimate of the aggregate fraction of winners ($\widehat{\gamma}$) in the upward direction. However, when the prior belief on the aggregate state is tight, the updating process in the aggregate dimension will proceed at a rather slow pace and the "sampling without replacement"-effect will get to dominate.

Moving back to the setup in which Assumption 1 does hold, revealing losers is no longer effective (in contrast to the case without aggregate uncertainty).

Proposition 3 *If the public believes that the reform starts with reforming the ex post winners, any reform will lose majority support as soon as a loser is revealed before $\alpha_t \geq \frac{1}{2}$.*

The proof is intuitive and simply follows from the fact that the public expects the government to start with revealing reform winners. If a loser shows up, the public thinks that all winners have already been revealed and that those individuals who are still uncertain on their identity will all be losers. If this happens while $\alpha_t < \frac{1}{2}$, majority support is immediately lost.

3.3 Summarizing

The main lesson from Fernandez and Rodrik (1991) is far-reaching: reforms that are welfare-enhancing may not enjoy majority support at their start because the reform winners cannot be identified up front.

In a way, the message of this paper is even more discouraging: even welfare-enhancing reforms that do enjoy majority support at their start (as a result of which they can get started along democratic lines), may not come to completion because of the learning dynamics that enter the story. In particular, by revealing winners the government suffers from the "sampling without replacement"-effect as a result of which it will at some point lose majority support if $\widehat{\gamma}_0 < \frac{3}{4} - \frac{1}{2}\beta_0$, while revealing losers immediately ends support. The reforming government thus finds itself trapped and destined to lose majority support - irrespective of what action it takes.

4   How can the loss-of-support problems be avoided?

Is there anything reformers can do to overcome the loss-of-support problems set out in the previous section? In this respect, especially the Chinese reform experience suggests that there does exist a route towards successful gradual reform. After all, China also followed a more gradual path - and with quite some success: in sharp contrast to the experiences of many Latin American and Central and Eastern European countries (described in Section 2 of this paper), the initial Chinese reform successes only seem to have increased support for further reforms (see Litwack and Qian (1998) and Qian, Roland and Xu (1999, 2006)). This raises the question why the experiences with gradualism have been so different across countries.

In this respect it is crucial to note that the Chinese gradual reform strategy is rather different from the Latin American and Central and Eastern European approaches: while most countries in the latter regions tried to reform gradually along the *sectoral* dimension (which implies that one firm or sector is reformed after the other; cf. our discussion of the "case-by-case" approach to privatization in the Introduction), China reformed gradually along the *spatial* dimension. In particular, China first introduced market forces in Shenzhen, Zhuhai, Shantou and Xiamen by designating those areas as Special Economic Zones in 1980 (soon to be accompanied by other regions, such as Hainan).

By reforming gradually along the spatial dimension, Chinese policy makers allowed the Chinese public to learn about the effects of the proposed reforms by looking

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at reform outcomes in these Special Economic Zones. Of course, the citizenry will only find the information acquired via the spatial dimension useful if the Special Economic Zones are representative for the rest of the country. Here, China had a major advantage over many other countries: as set out in Qian, Roland and Xu (2006, p. 394), the Chinese economy is organized along territorial lines. This implies that all Chinese regions are relatively self-contained, in a sense that these regions can be seen as rough miniature versions of the Chinese economy as a whole. As argued in Démurger *et al.* (2002), this is the result of a conscious decision made by Mao Zedong: next to the two guiding principles of Soviet development (common ownership and central planning), Mao added a third principle, namely that of regional economic self-sufficiency. This third guiding principle, originally adopted to reduce provincial inequality, required each region to be self-sufficient, not only in food production but also in industrial goods. The Soviet Union did not adhere to this last principle at all: their ideology called for an organization of the country along industrial lines with high degrees of industrial concentration (cf. Qian and Xu (1993)). Consequently, each Soviet region was much more specialized, dependent of other regions, and less representative of the Union as a whole.

Because of this, China had (in contrast to e.g. Russia) the possibility to start reforms by taking representative samples of small mass of the entire Chinese economy (in the form of certain regions) and use them to show voters where the gains and losses of the proposed reform are likely to occur. This strategy would reduce individual uncertainty (the root of all problems), but – crucially – does not suffer from the "sampling without replacement"-effect. Instead, this sampling strategy does not affect the distribution from which future sampling will take place as it is a form of sampling from a different, smaller urn (where the distribution of balls in this smaller urn was sampled randomly from the large urn – the latter representing the rest of the country, which remains untouched in this sampling strategy).

In Russia this spatial strategy would not have worked: over there, reform outcomes in one region were less relevant to those in other regions due to the higher degree of spatial heterogeneity. Simultaneously, the higher degree of industrial concentration would give any spatial reform strategy a sectoral flavor: after all, if certain sectors

are concentrated in certain areas, reforming one area is equivalent to reforming one sector. Then, "sampling without replacement" would enter the story again.[16]

For the spatial strategy to work, it is furthermore crucial that agents who know that they will be among the winners (i.e. those with $i < \alpha_t$) cannot self-select into the Special Economic Zones, since that would imply that the zone becomes less representative for the country as a whole. To keep the urn-analogy: the smaller urn needs to be isolated from the larger one. Strikingly, this is exactly what the Chinese "hukou" system (which restricts the mobility of citizens within China) achieves. So although one could debate the fairness of this system (just like one could debate fairness of mobility restrictions between different countries), it does seem to play an economic role in the Chinese reform process.

Finally, this view on Special Economic Zones shines a new light upon their *raison d'être*: in a static setup, Hamilton and Svensson (1982) show that Special Economic Zones are actually welfare decreasing in a second-best world where the suboptimal regime continues to apply outside the zone. This raises the question why governments bother installing them in the first place. In this respect, the present paper argues that Special Economic Zones could produce large *dynamic* gains, as they can facilitate the implementation of reforms that bring the entire country closer to the first-best.

Summarizing, our results indicate that countries can ease their reform process if they have the possibility to start the reform by first implementing it in a region of small mass that is representative for the country as a whole. In this sense, there is an important difference between sectoral and spatial gradualism and this difference may be key as to why the gradual reform strategy has worked for China, while this is much less so for many other countries.

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[16] As Dani Rodrik pointed out to us, the spatial strategy could however be applied to reforms that entail only one particular sector (say sector X). The "sampling without replacement"-effect would then operate *within* sector X (since cross-sectoral heterogeneity no longer plays a role). In the case of one sector reforms, governments could get round this effect by first transforming a region of small mass that contains a representative sample of sector X firms into a Special Economic Zone. Subsequently, the sector X firms inside the Zone can be used to reduce individual uncertainty by giving other firms in the sector outside the Zone an idea of what the reform would do to them. The Special Economic Zones in Malaysia and Mauritius seem to have fulfilled such a role successfully for the electronics and apparel sector respectively (see Auty (2011)).

5   Conclusion

In this paper, we have constructed a model which takes into account that the process of revealing reform outcomes is an example of sampling *without* replacement. We have shown that this implies that the revelation of winners early in the reform process, makes those who remain uncertain on whether they will gain or lose from reform more pessimistic about their chances of ending up as a reform winner. This channel can be so strong that it can even induce the median voter to start opposing a reform of which he used to be supportive - in which case the reforming government loses majority support. The conditions under which such a destructive interaction between rational learning and political support will occur are relatively mild: as soon as one combines the presence of individual uncertainty (as in the seminal paper by Fernandez and Rodrik (1991)) with rational belief updating, the "sampling without replacement"-effect kicks in.

This "sampling without replacement"-effect challenges the conventional wisdom that sequencing should be such that favorable reform outcomes are revealed first. Instead, our model illustrates that a reform strategy based on revealing winners first may backfire. The reason is that such an approach leads to a deterioration in the quality of the remaining pool, triggering reform fatigue in spite of the successes of those firms that are already reformed. Strikingly, this is consistent with the puzzling experiences that many reformers have had in practice: there are numerous examples of reforms that were started while enjoying majority support, but subsequently lost this support - even though they were progressing in a successful way.

We have also outlined a strategy that is able to overcome the problems related to the learning process. In particular, if a country happens to consist of individual regions that are rough miniature versions of the entire country, the "sampling without replacement"-effect can be avoided by reforming gradually along the *spatial* (rather than along the *sectoral*) dimension. This is the approach China has taken and implies that policy makers first introduce the proposed reform in certain regions of the country that are thought to be representative for the country as a whole. Subsequently, the public can learn from reform outcomes in these regions ("Special

Economic Zones") to get an idea of where the gains and losses of the reform are going to be located. This enables the reforming government to reduce individual uncertainty (the root of all problems) without running the risk of losing majority support due to a lack of replacement in the sampling procedure.

On a more general level, this paper has developed a theory of agents who are learning from realizations that are sampled without replacement. To the best of our knowledge, this has not been modeled before in the economics literature, despite the fact that a lot of economic problems take this form. In many environments the distribution from which future sampling will take place is not static and time-invariant, but changes over time instead - often as a result of past sampling actions (the process of authorities revealing the identity of banks in a financial crisis (good or bad?) being a clear example). Applying the concepts developed in this paper to different problems that entail sampling without replacement might therefore be a fruitful avenue for further research.

6   Appendix

Although there are certain reform-types (such as privatization) for which the government is likely to have an ex ante idea on where the gains and losses of the reform are going to be located, there are also cases in which the reforming government does not have this information. This Appendix therefore explores the properties of our model when we drop the assumption that the reform is sequenced in a non-random, selective way.

Instead, here we will assume that the government cannot identify the reform winners and losers up front either. In addition, we will assume that there is no natural selection process present that could lead to a non-random sequencing of events. Consequently, reform outcomes are just sampled randomly from the true distribution. Moreover, we will also assume that the public *believes* that these outcomes are sampled randomly, as a result of which they perceive new observations to be informative and apply Bayes' rule to update their estimate of γ (the aggregate fraction of winners) in response to new information.

Since we feel that this case may deserve a closer study in its own right, we leave a full analysis for future work, but present some main results in this Appendix. In particular, we show that the "sampling without replacement"-effect discussed in the main text continues to be at work in this alternative setting.

The core of the model is unaffected and the critical value for α (α^*) is still given by:

$$\alpha_t^* = \frac{2\alpha_t}{\alpha_t + \beta_t} + \beta_t - 1 \tag{A1}$$

Using expression (A1), one can analyze how the distance between α_t (the fraction of sure-winners) and α_t^* (the cut-off level for α_t above which the median voter starts opposing the reform) varies with the revelation of additional winners and losers. In particular, one can verify that:

$$\frac{\partial\left(\alpha_t^* - \alpha_t\right)}{\partial\alpha_t} = \frac{2\beta_t}{\left(\alpha_t + \beta_t\right)^2} - 1 \tag{A2}$$

Here, the first term shows that the revelation of winners pushes up α_t^* (since it leads to an upward revision of the expected fraction of reform winners $\widehat{\gamma}_t$ through application of Bayes' rule), while the second term ("-1") captures the fact that the revelation of winners simultaneously makes those who remain uncertain more pessimistic on their individual chances of ending up as a winner. In particular, this term reflects the fact that revealing a reform outcome is an example of sampling without replacement. From (A2), one can derive that as long as

$$\alpha_t > \sqrt{2\beta_t} - \beta_t, \tag{A3}$$

the "sampling without replacement"-effect dominates. Under condition (A3), the public's estimate of γ increases less than one-for-one with α_t (mathematically: $\partial\left(\alpha_t^* - \alpha_t\right)/\partial\alpha_t < 0 \Leftrightarrow \partial\widehat{\gamma}_t/\partial\alpha_t < 1$) and the median voter becomes more *pessimistic* as more and more *favorable* reform outcomes are revealed. Hence, under this condition the revelation of additional winners produces an increase in $\widehat{\gamma}_t$ that is insufficient to compensate for the fact that sampling takes place without replacement.

Similarly:

$$\frac{\partial\left(\alpha_t^* - \alpha_t\right)}{\partial\beta_t} = \frac{-2\alpha_t}{\left(\alpha_t + \beta_t\right)^2} + 1, \tag{A4}$$

captures the exact same two effects for the revelation of losers. In this case, the median voter becomes more *optimistic* when additional *losers* are revealed (i.e. $\partial\left(\alpha_t^* - \alpha_t\right)/\partial\beta_t > 0$) as long as

$$\beta_t > \sqrt{2\alpha_t} - \alpha_t \tag{A5}$$

Conditions (A3) and (A5) yield two regions of (α, β)-combinations, displayed as the shaded areas in Figure 2, where one can characterize the learning dynamics as "anomalous". That is: in region A3, good reform outcomes decrease support for the reform, while the revelation of bad reform outcomes increases support for reform in region A5.

Figure 2: Region where favorable reform outcomes decrease support for the reform (A3) and vice versa (A5).

Now, one can ask: is the government able to complete the reform without a loss

of majority support along the way? As the sequencing of the reform is random in this case (since the government (or nature) is no longer able to select the winners up front), it is no longer possible to analyze this question analytically. Instead, one would have to simulate the reform process and the answer to the question would depend upon the amount of time a typical simulation spends in the shaded areas of the state space. As we feel that this issue would deserve a full discussion in its own right, we leave this for future work.

The main point to take away from this Appendix is that the "sampling without replacement"-effect continues to be present when reform outcomes are revealed in a truly random fashion. This then leads to two regions in the (α, β)-space where the support dynamics can be characterized as "anomalous".

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