

NBER WORKING PAPER SERIES

LEFT, RIGHT, LEFT:
INCOME, LEARNING AND POLITICAL DYNAMICS

John Morrow
Michael Carter

Working Paper 19498
<http://www.nber.org/papers/w19498>

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
October 2013

We thank Daron Acemoglu, Jorge Aguero, Yasushi Asako, Brad Barham, Jeff Cason, Swati Dhingra, Scott Gehlbach, Fabiana Machado, Aashish Mehta, Hiro Miyamoto, Shiv Saini and anonymous referees for insightful comments as well as seminar participants at UW-Madison Development and Political Economy Seminars, Universities of California at Davis and Riverside, University of Southern California, the Midwest Economic Development Conference, the Midwest Political Science Association, the Delhi School of Economics, Oslo University and the LSE. CEDLAS and The World Bank provided data through SEDLAC. The views expressed herein are those of the author and do not necessarily reflect the views of the National Bureau of Economic Research.

NBER working papers are circulated for discussion and comment purposes. They have not been peer-reviewed or been subject to the review by the NBER Board of Directors that accompanies official NBER publications.

© 2013 by John Morrow and Michael Carter. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

Left, Right, Left: Income, Learning and Political Dynamics
John Morrow and Michael Carter
NBER Working Paper No. 19498
October 2013
JEL No. D31,D72,D83,P16

ABSTRACT

The political left turn in Latin America, which lagged its transition to liberalized market economies by a decade or more, challenges conventional economic explanations of voting behavior. This paper generalizes the forward-looking voter model to a broad range of dynamic, non-concave income processes. The model implies support for redistributive policies materializes rapidly if few prospects of upward mobility are present. In contrast, modeling voters' ideologically charged beliefs about income dynamics shows a slow and polarizing shift toward redistributive preferences occurs. Simulation using fitted income dynamics suggests that imperfect information better accounts for the shift back to the left, and offers additional insights about political dynamics.

John Morrow
CEP, London School of Economics
Houghton Street
London WC2A 2AE UK
J.Morrow1@lse.ac.uk

Michael Carter
Department of Agricultural and Resource Economics
University of California, Davis
One Shields Avenue
Davis, CA 95616
and NBER
mrcarter@ucdavis.edu

1. INTRODUCTION

Most Latin American countries had transitioned to market economies by the early 1990's. The largely center-right political leadership that instituted these transitions continued to win national elections and persisted in power throughout the 1990s and into the early 2000's. Since that time, electoral politics have turned sharply left. Recent presidential elections have seen left-leaning candidates defeat more conservative opponents in Brazil, Bolivia, Chile, Ecuador, El Salvador, Honduras, Nicaragua, Paraguay, Peru and Venezuela.¹ Not only have these elections ushered in a political shift, they have in many instances been tightly contested by candidates offering fundamentally different economic visions. The goal of this paper is to provide a theoretical framework to help us understand the economic forces that underlie these political dynamics.

The influential body of political economy literature that focuses on economic inequality as a force that determines both political institutions and voting patterns would seem to offer a window into these political patterns (Acemoglu and Robinson, 2006; Boix, 2003). However, the fact that inequality measures tend to be remarkably stable over time makes it unlikely that inequality can explain Latin America's right-left voting dynamics. A recent paper by Robert Kaufman (2009) confirms the inconvenient empirical fact that existing measures of economic inequality do a very poor job of explaining both political institutions and voting patterns in Latin America.²

Although we could abandon the search for economic explanations of contemporary voting patterns, we instead take our cue from Benabou and Ok (2001) and Moene and Wallerstein (2001) who model voters as forward-looking agents who look beyond current income inequality and focus on how policies will influence their future economic prospects. From this starting point, we offer the following contributions:

- We analyze forward-looking political preferences under a wide variety of income dynamics, including concave dynamics that offer prospects for upward mobility ('POUM' as in Benabou and Ok), as well as empirically based dynamics which are neither concave or convex that offer no prospects of upward mobility ('No-POUM').
- We also consider political dynamics when voters lack full information and must live and learn about the income dynamics that characterize their economy. This is particularly relevant to transition countries that have fundamentally altered their economic model.

¹While the contemporary Latin American left cannot be defined by a shared economic model, this new left does share a largely populist impulse and desire to shift resources and opportunity to those at the bottom of the income distribution. For instance, Greene and Baker (2011) construct vote revealed leftism (VRL) from ideological ratings of presidents and parliamentary parties in Latin America from 1996-2008, showing that the left has an economic policy mandate to halt or partially reverse neoliberal economic policies.

²Fields (2007) makes this point even more strongly by showing how inequality can increase during the early stages of a period of upward mobility that would surely dampen political preferences for redistribution.

- We show that not only does the incorporation of learning provide a richer suite of possible political dynamics, it also reveals that voters' perceptions of the dead weight losses associated with redistribution can, in surprising ways, further fuel political instability.
- To draw out the implications of our model, we estimate income distribution dynamics for two Latin American countries, Chile and Peru, and show that the learning, forward-looking voter model is broadly consistent with the recent political histories of both countries.

In their seminal paper, Benabou and Ok show that concave income distribution dynamics that offer the prospect of upward mobility can account for surprising conservatism by voters below the mean income who would benefit in the short run from redistributive policies.³ While this POUM model has little to say about the right-left political dynamics observed in contemporary Latin America, we show here that the non-concave income transition functions suggested by poverty trap theory, which offer limited or no prospects of upward mobility can result in a surprisingly and increasingly redistributive electorate.⁴ Specifically, we show that forward-looking political preferences are determined by the smoothed envelopes drawn around income transition functions, where the transitions themselves need not be concave or convex. This generalizes the connection between redistribution and income beyond the usual concepts in the literature.

In an effort to corroborate this theoretical intuition, we calibrate income dynamics for Latin American countries. These reveal for some countries the sort of No-POUM dynamics that would be expected to generate an increasingly pro-redistribution electorate. Surprisingly, applying these dynamics to our full information, forward-looking voting model indicates that the demand for redistribution should have been stronger and should have occurred well in advance of the recent suite of Latin American presidential elections. This result presents a puzzle that questions fundamental assumptions about how economic voters perceive and react to their material prospects.

We argue it is the assumption that voters have full information about their economy's income distribution dynamics that is most problematic, especially in transition economies where the electorates have had little prior experience with liberalized market economies (e.g. Przeworski, 1991).^{5,6}

³Complementary endogenous explanations for anti-redistributive positions include disincentives for labor supply (Meltzer and Richards, 1981), asset formation (Persson and Tabellini, 1994), inefficient levels of public goods (Alesina and Rodrik, 1994), multidimensional policy spaces in which non-economic preferences conflict with pocketbook voting (Roemer, 2001). To highlight the roles of income dynamics and learning, we ignore the incentive effects of taxation (see Piketty, 1995), but do account for the role of dead weight loss.

⁴Tucker (2006) shows that voting in the post-Soviet bloc reflects economic experiences: areas with poor outcomes support "Old Regime" parties while good outcomes provide support for liberal "New Regime" parties.

⁵Accurate information in such environments can be exceedingly difficult to obtain. Feenstra et al. (2012) have found the World Bank's estimate of real GDP per capita is in need of substantial upward revision. Even in advanced market economies, serious information gaps regarding economic conditions persist. Norton and Ariely (2011), for example, show that Americans systematically overestimate existing income equality.

⁶Fernandez and Rodrik (1991) point out the importance of uncertainty in policy reform, although they explain why policies might increase in popularity after implementation, rather than decrease as in Latin America. Van Wijnbergen and Willems (2012) extend their approach with learning dynamics to explain why policies may decrease in popularity.

In such circumstances, voters have little choice but to fall back on priors about how such an economy might work.⁷ Edwards (1995), for example, largely credits the origins of the switch to liberal economic policies within Latin America to the failure of all other alternatives, although he notes that multilateral institutions influenced the “convergence of doctrinal views” through research, analysis, lending practices and conditionalities.

In Latin America, the shift to the liberal economic model was put forward on the grounds that it would boost incomes and well being for all, including the lower half of the income distribution.⁸ Assuming that voters begin with this “POUM prior,” we go on to model voters as Bayesian learners who experientially update their expectations based on their own stochastic income experience. Leveraging the POUM and No-POUM distinction, we characterize “Left” vs “Right” Bayesian beliefs about income dynamics. We show that this model of forward-looking, Bayesian voters offers an empirically tenable explanation of the recent right to left political evolution in Latin America. A key ingredient in this explanation is that dead weight loss induces political volatility in uncertain environments. While increased dead weight loss reduces support for redistribution for both right and left voters, the effect is proportionately stronger for right voters. This asymmetry then amplifies political volatility in which learning is moving some fraction of the electorate left.

The general tenor of this explanation is corroborated by some observers of transition economy politics. Weyland (2002), for example, notes that support for the liberal economic policies introduced in Latin America the late 1980s and early 1990s waned over time, especially as individuals began to learn and reassess their future prospects. Similarly, Graham and Pettinato’s (2002) analysis of Peru and Russia identifies a numerically significant group of “frustrated achievers,” who benefited initially from liberal reforms, but came to see little prospect for further advance and the possibility of catching up with the consumption standards of those in the upper deciles of the income distribution. These authors go on to note that this frustrated group shows waning support for market-oriented policies and speculate that their political behavior will likely change accordingly.⁹

Finally, evidence for the role of upward mobility in voting behavior has been mixed, and the reach of the income based approach can be extended by modeling more general income dynamics. Fong (2001) finds that variables reflecting personal benefit from redistribution are insignificant in predicting redistributive preferences in the US. On the other hand, Checchi and Filippin (2004) find experimental support that the POUM reduces chosen taxation rates and that longer time horizons

⁷Roemer (1994) models this process in a Downsian framework. In contrast, this paper conceptualizes beliefs about empirically based income dynamics as a ‘ideological space’ which voters learn about through personal experience.

⁸See for example Williamson (1990) for a classic statement of the so-called Washington Consensus about the desirability of liberal economic policies for Latin America.

⁹It is of course possible that people are fooled, or fool themselves, about the nature of income dynamics and vote against their true economic interests. Survey research which assesses voter’s subjective expectations about prospects has found “POUM captures hopes and expectations as well as realistic socioeconomic assessments” (Graham and Pettinato, 2002). Additional possibilities are considered by Puttermann (1996). Herrera (2005) careful studies how economic information was mediated by larger sets of social relations in post-USSR Russia.

tend to decrease chosen rates under POUM. Beckman and Zheng (2007) find tentative support for the POUM hypothesis using undergraduate surveys. At the international level, Wong (2004) examines the GSS and World Values Survey for redistributive preferences and finds the expected signs across incomes, but no evidence of the “tipping behavior” implied by median voter or POUM models.

The remainder of this paper is organized as follows. Section 2 develops a basic framework for individual and aggregate income dynamics in the presence of transient shocks, and models political support for redistributive policies by both myopic and forward-looking voters who enjoy full information about the income dynamic process. Section 3 then introduces both concave (POUM) and poverty trap (No-POUM) dynamics, and derives results on the political preferences of forward-looking voters who may be fully informed or instead must learn about extant income dynamics through experience. The analysis of Section 3 is applied to Latin American income dynamics in Section 4. Section 5 shows this model of forward-looking Bayesian voters who confront a No-POUM world can give rise to the political polarization and sudden political shifts that have been observed in twenty first century Latin America. Section 6 concludes.

2. FORWARD-LOOKING VOTERS AND THE DEMAND FOR REDISTRIBUTION

This section lays out machinery needed to discuss changing patterns in majoritarian voting when the electorate can choose among income redistribution schemes. The setting is a continuum of voters whose incomes evolve over time and fluctuate with idiosyncratic shocks each period. Voters care only about maximizing the present discounted value of income from all sources, whether public or private, and are thus “pocketbook voters.” We consider the fraction of the voter population who rationally prefer income redistribution, which we term the demand for redistribution.

In order to evaluate a particular redistributive policy, each voter considers three things: their individual income path, the aggregate income path of the economy and the longevity of the policy. Changes in the economy over time can thereby induce changes in voting patterns, and support for a given policy is dependent on expected economic conditions. To help unpack these relationships, this section defines income transitions, redistributive schemes and forward-looking demand for redistribution. After developing baseline analytical results, this framework will be extended in the next section to consider the role of beliefs under economic conditions which are more realistically characterized by imperfect information.

2.1. Income Transitions. Individuals are indexed by i and have an initial income y_{i0} . The initial income distribution F_0 is assumed to be bounded and absolutely continuous. After the initial period 0, individual i ’s income at time t is

$$(2.1) \quad y_{it+1} = f(\mathbb{E}_{\varepsilon_{it}}[y_{it}]) \cdot \varepsilon_{it+1}$$

where f as an income transition function¹⁰ and ε_{it} is iid across individuals and periods with $E_{\varepsilon_{it}}[\varepsilon_{it}] = 1$. These assumptions imply that the expected income path for any individual is deterministic, since

$$E_{\varepsilon_{it}}[y_{it}] = f(E_{\varepsilon_{it-1}}[y_{it-1}]) = f(f(E_{\varepsilon_{it-2}}[y_{it-2}])) = f^{(t)}(E_{\varepsilon_{i0}}[y_{i0}]) = f^{(t)}(y_{i0}),$$

while realized income is given by $y_{it} = f^{(t)}(y_{i0}) \cdot \varepsilon_{it}$.¹¹

When making decisions about the future, we assume individuals care only about present discounted income, discounted at rate δ each period. We can therefore write each individual's discounted income stream over T periods as:

$$(2.2) \quad \sum_{t=0}^T \delta^t y_{it} = \sum_{t=0}^T \delta^t f^{(t)}(y_{i0}) \cdot \varepsilon_{it}. \quad (\text{Discounted Income Stream})$$

Since $E[\varepsilon_{it}] = 1$, expected present discounted income can be seen from (2.2) to be $\sum_{t=0}^T \delta^t f^{(t)}(y_{i0})$. We now turn to policies which might redistribute this income.

2.2. Myopic Demand for Redistribution. Consider the political preferences of myopic, pocket-book voters whose incomes evolve according to a known income transition function f as above. Pocketbook voters choose policies which maximize their income, and for simplicity we assume voters are risk neutral. Following the convention in much of the political economy literature (e.g. Persson and Tabellini (2000), Roemer (2001)), we define redistribution schemes composed of a flat tax τ and a lump sum transfer to all voters. Thus if a tax τ is enacted in period t , each voter i receives income:

$$(2.3) \quad (1 - \tau) \cdot y_{it} + \tau \cdot (1 - D) \mu_t$$

Here $\mu_t = E_0[f^{(t)}(y)]$ denotes the mean income of the population at time t ,¹² and $D \in [0, 1]$ denotes any dead weight loss under the redistributive scheme.¹³ A myopic voter's most preferred policy τ^* must maximize expected income. Since at any period $t' < t$ we have

$$E_{t'}[(1 - \tau) \cdot y_{it} + \tau \cdot (1 - D) \mu_t] = (1 - \tau) \cdot f^{(t)}(y_{i0}) + \tau \cdot (1 - D) \mu_t,$$

either $\tau^* = 1$ (complete redistribution) or $\tau^* = 0$ (laissez-faire).

¹⁰Formally, by income transition we refer to any positive, strictly increasing and continuous function defined on bounded interval of the form $[0, B]$.

¹¹While the individual's history of realized incomes does not matter for expected future income, this history will matter when the individual does not know the true nature of the transition process and must deduce it from his or her own lived experience. The next section considers ramifications.

¹²Hereafter, $E_0[\cdot]$ denotes the expectation at time 0 over initial incomes distributed F_0 and all $\{\varepsilon_{it}\}_{i,t>0}$.

¹³Under perfect information, dead weight loss serves no dynamic role, but will allow us to quantify the appropriate level of loss that would provide majoritarian support for laissez faire in highly unequal economics. Under incomplete information, dead weight loss has surprising implications for volatility, as we discuss in the last section.

Now consider a majoritarian vote taken between $\tau = 1$ and $\tau = 0$ at the beginning of period t before idiosyncratic shocks are realized. A myopic voter i prefers $\tau = 1$ to $\tau = 0$ exactly when $E[y_{it}] = f^{(t)}(y_{i0}) \leq (1 - D)\mu_t$, which means they expect to be below average income, less any dead weight loss. Since f is increasing, all voters with initial incomes $y_{i0} \leq f^{(-t)}((1 - D)\mu_t)$ prefer $\tau = 1$ to $\tau = 0$. The fraction of such voters in the population is determined by the initial distribution of income F_0 to arrive at

$$\Pr(\text{Voter prefers } \tau = 1) = F_0\left(f^{(-t)}((1 - D)\mu_t)\right) \quad (\text{Myopic Demand for Redistribution}).$$

2.3. Forward-looking Demand for Redistribution. Here we follow Benabou and Ok's framework of forward-looking voters who consider redistributive policies that last from period 0 through period T . Over this time frame, define a voter's discounted income stream under laissez-faire ($\tau = 0$) as $g^T(y_{i0})$. From Equation (2.2), $g^T(y_{i0}) = \sum_{t=0}^T \delta^t f^{(t)}(y_{i0})$ and the average of all voters' discounted income streams is therefore $\mu^T \equiv \sum_{t=0}^T \delta^t \mu_t$. Complete redistribution ($\tau = 1$) over this period would pay out μ^T , less any dead weight loss, giving a discounted income of $(1 - D)\mu^T$. Consequently, a voter prefers $\tau = 1$ to $\tau = 0$ from periods 0 through T if and only if $g^T(y_{i0}) \leq (1 - D)\mu^T$. Akin to the myopic case, the proportion of voters demanding redistribution is

$$\Pr(\text{Voter prefers } \tau = 1) = F_0\left([g^T]^{-1}((1 - D)\mu^T)\right) \quad (\text{Forward Demand for Redistribution}).$$

This equation shows that the fraction of the population who wants redistribution takes into account discounting and the evolution of income during the policy. $[g^T]^{-1}((1 - D)\mu^T)$ is the forward-looking generalization of the term $f^{(-t)}((1 - D)\mu_t)$ that determines the demand for redistribution in the myopic voter case. Note that a voter who looks forward only one period (or who considers a policy that will last only one year) has the same preferences as a myopic voter. The next section develops a method to explore voter dynamics under any income transition function, a family that is broad enough to encapsulate the processes implied by theories of both convergent and divergent income distribution dynamics.

3. POLITICAL DYNAMICS UNDER FULL AND IMPERFECT INFORMATION

This section first recaps the political implications of concave income dynamics which exhibit Upward Mobility and have been studied in detail by Benabou and Ok (2001). We then consider the political implications of more convoluted income dynamics which do not exhibit such convergence (e.g. Banerjee and Newman, 1994), and fail to be concave or convex. Such NoPOUM dynamics may fail to offer upward prospects and are the context for income and political dynamics in this paper.

In reality of course, perfect information is unlikely as income dynamics and the prospects for mobility are complex and hard to understand, especially in economies which had fundamentally

altered their economic model.¹⁴ At the end of this section, we relax this assumption and consider the behavior of voters who must learn about the true income dynamics from their own experience, but vote over future policies based on ideological priors.¹⁵

3.1. Political Dynamics under Prospects of Upward Mobility. The Solow model of neoclassical economic growth relies on an assumption of diminishing capital returns and implies that poorer nations will tend to catch up over time, or converge, with the incomes of richer nations.¹⁶ When transported to the individual or microeconomic level, the Solow assumptions imply a process of convergence among the population of a single country.

FIGURE I. POUM and No-POUM Income Transitions

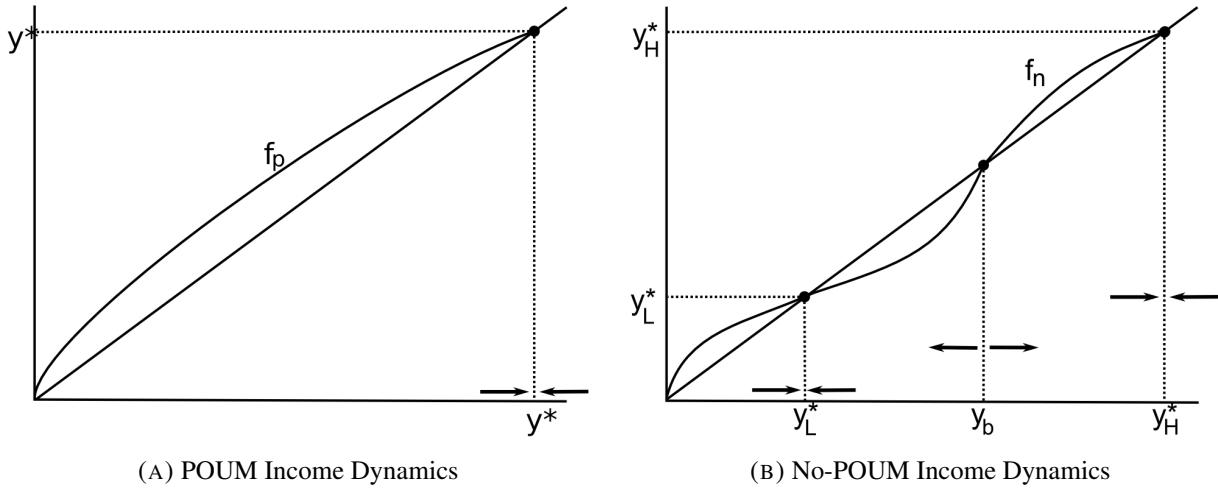


Figure I(a) illustrates a typical income dynamic implied by accumulation under decreasing returns. Note that this concave transition process, maps incomes in period t into incomes in period $t + 1$, implies a unique long term or steady state income level, y^* , at the point where $f_p(y)$ crosses the 45-degree line. Under this transition process, individuals who begin with incomes below the steady state level will converge towards it, while those who begin above the steady state level will drop back towards it. Note that this sort of concave income process offers prospects of upward mobility (POUM) to voters whose initial income levels are less than the steady state income level.

¹⁴This approach to modeling ideology as an idiosyncratic evolving process echoes Bates et al. (1998) as a means to complement cultural and ideological political theories with rational choice.

¹⁵This specification naturally incorporates the possibility that repression or fear constricted the political space, leading people to vote differently. Voters may fear possible retribution for revealing their ideological “type” because of political policing (e.g. a potential return to dictatorship in early 1990’s Chile). In this case, the ideological space can be modeled as constrained to an ideological spectrum which expands with “political thawing” and faith in democratic institutions over time. This gradual expansion of publicly admissible views might also help explain large shifts.

¹⁶For an early review of both the theoretical and empirical controversies, see Romer (1994). A more recent review with a theoretical emphasis is Azariadis and Stachurski (2005).

This Prospect of Upward Mobility for the poor to achieve convergence with the population at large can serve to lessen preferences for redistribution.

As shown in Section 2, the fraction of myopic voters who demand redistribution at time t is $F_0(f^{(-t)}((1 - D)\mu_t))$. Whether this increases or decreases over time depends on $f^{(-t)}((1 - D)\mu_t)$. In a POUM world, the global concavity of f implies (through Jensen's inequality) the demand for redistribution is always decreasing over time. Similarly, if voters are forward-looking, the fraction of the population that wants redistribution monotonically decreases as the duration of a policy increases. Therefore in a POUM world with forward-looking voters, the demand for redistribution decreases with time in two senses: as evaluations each single period and as policy longevity increases. This is the type of behavior that Benabou and Ok (2001) deduce and discuss, and these two aspects of POUM redistributive dynamics can be summarized as

Proposition (POUM Dynamics). *Suppose f is concave. Then:*

- (1) *The demand for a single period of redistribution decreases over time.*
- (2) *The demand for redistribution over a T period horizon decreases in T .*

The obvious twin result which follows from Benabou and Ok is that if income dynamics are convex, the demand for redistribution increases both over time and over longer policy periods. However, empirical income dynamics are seldom so ideal as to satisfy pure concavity or convexity.

3.2. Political Dynamics under (No) Prospects of Upward Mobility. In contrast to Figure I(a), individuals need not face uniformly decreasing returns in asset accumulation. The increasingly well developed theory of poverty traps suggests a number of mechanisms that can trap households at low living standards (see the reviews in Azariadis and Stachurski (2004) and Carter and Barrett (2006)). Central to all of these theories of poverty traps is exclusion from financial markets.¹⁷ Put differently, if households have access to loan markets and insurance instruments, then even when confronted by locally increasing returns to scale and risk, they can successfully engineer a strategy to obtain the assets needed to jump to a high level equilibrium. But absent access to those financial markets, households below a critical initial asset level may remain stuck in a low level, poverty trap equilibrium.

The result of such poverty trap models is Figure I(b) which illustrates income transition dynamics with multiple steady states.¹⁸ The non-concave income transition function, $f_n(y)$, has multiple crossings of the 45-degree line and admits multiple equilibria: y_H^* is the high income steady state; y_L^* is the low level steady state. Bifurcation occurs around the unstable equilibrium income level, y_b . Households with incomes in excess of y_b will tend toward the high level equilibrium while those

¹⁷There is now a plethora of theory about why financial markets are often thin, missing and, or biased against low wealth agents. For a recent contribution, see Boucher et al. (2007).

¹⁸For empirical examples see Lybbert et al. (2004) and Adato et al. (2006). Banerjee and Newman (2000) construct a macroeconomic model of “dynamic institutional change” which implies non-concave income dynamics and exhibits path dependence on the distribution of wealth.

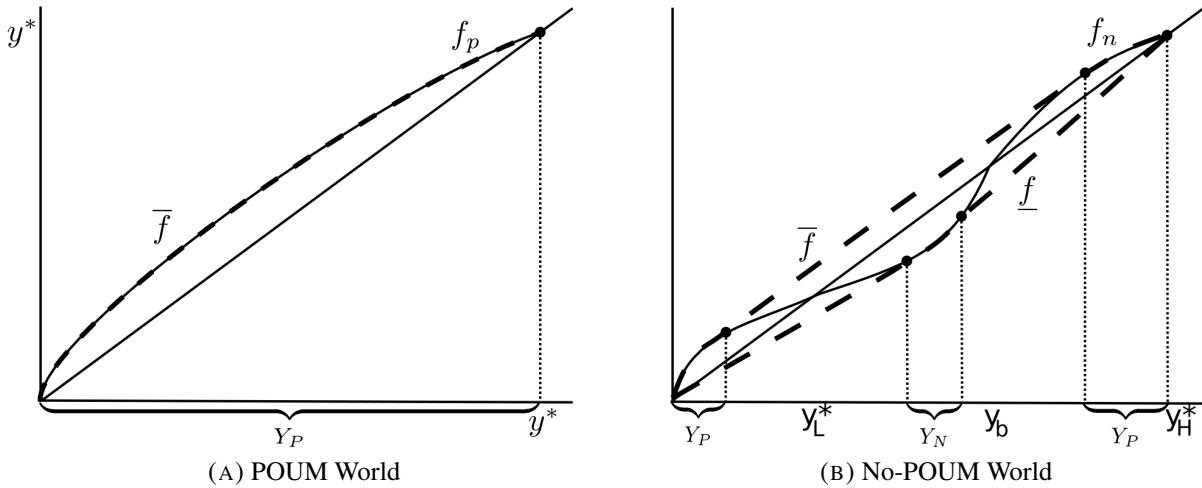
that begin below this critical threshold will head towards the low level, poverty trap equilibrium, y_L^* . This implies no prospect of upward mobility (No-POUM) for voters below the threshold y_b . In contrast to an economy with a concave income transition function, economic polarization will occur and inequality can deepen when income transitions are governed by a non-concave function like $f_n(y)$.¹⁹

The remainder of this section considers any income transition function, allowing for both f_p and f_n types of income transitions and then derives a general set of results with political implications. We show that relaxing the assumption of concavity can generate rich patterns in the demand for redistribution. We then provide a theorem showing how these new income transitions create both increases and decreases in the demand for redistribution, even when the transition function is neither globally concave nor convex.

3.3. Demand for Redistribution: What's in the Envelope? While voter dynamics under POUM are relatively straightforward, non-convexities under general income transitions lead to more complex political dynamics. To better describe this complex process, we connect the changing demand for redistribution to the upper and lower envelopes of an income dynamic. We first define the upper envelope of f , \bar{f} , as the smallest concave function everywhere above f . The lower envelope \underline{f} is defined as the largest convex function everywhere below f . Both types of envelopes are illustrated in Figure II and defined in Equation (3.1).²⁰

$$(3.1) \quad \bar{f}(x) \equiv \inf\{h(x) : h \text{ is concave}, h \geq f\}, \quad \underline{f}(x) \equiv \sup\{h(x) : h \text{ is convex}, f \geq h\}.$$

FIGURE II. Upper and Lower Envelopes



¹⁹Strictly speaking, this non-concave income transition function implies increasing polarization, not necessarily increasing inequality, as Esteban and Ray (1994) discuss.

²⁰This is equivalent to finding the envelope created by tracing all lines which are above, but do not cross f . In practice, there are several efficient algorithms to construct such envelopes numerically, e.g. Jarvis (1973).

Clearly for each y we have $\bar{f}(y) \geq f(y) \geq \underline{f}(y)$ and necessarily \bar{f} is concave and \underline{f} is convex. Two special cases stand out. When f is concave, \bar{f} and f coincide. When f is convex, \underline{f} and f coincide. Therefore in a POUM world, $f = \bar{f}$. We define the sets of incomes where f and \bar{f} exactly coincide as Y_P (as this is the domain of upward mobility). Similarly define the domain of downward mobility, Y_N , as incomes where f and \underline{f} coincide. The relationship of Y_P and Y_N to the path of redistributive preferences is Proposition 1:

Proposition 1. *If $\mu_t \in Y_P$ then the demand for redistribution decreases in period t relative to period $t - 1$. Conversely, if $\mu_t \in Y_N$ then the demand for redistribution increases.*

Proof. We consider $\mu_t \in Y_P$ as the other case is similar. We want to show that $f^{(-t)}(\mu_t) \geq f^{(-t+1)}(\mu_{t+1})$. This holds iff $\mu_{t+1} \leq f(\mu_t)$ and by assumption $f(\mu_t) = \bar{f}(\mu_t)$. Therefore we are done if we can show $\mu_{t+1} = \int f^{(t+1)} dF_0 \leq \bar{f}(\mu_t)$. Since $f \leq \bar{f}$ we know that $\int f^{(t+1)} dF_0 \leq \int \bar{f} \circ f^{(t)} dF_0$ so we need to show $\int \bar{f} \circ f^{(t)} dF_0 \leq \bar{f}(\mu_t)$. In fact, this last inequality holds by Jensen's inequality since by construction, \bar{f} is concave. \square

Proposition 1 says that if the mean income next period μ_t lies in Y_P , the demand for redistribution *decreases*. Conversely, if μ_t lies in Y_N , the demand for redistribution *increases*. In this sense, the upper and lower envelopes of f are natural definitions of Right and Left income transitions based on f . This also highlights the differences between POUM and No-POUM income dynamics. In a POUM world, f is concave and equals \bar{f} so all incomes (including μ_t) are in Y_P . Therefore the demand for redistribution is always decreasing (Figure IIa). In contrast, a No-POUM income dynamic has both Y_P and Y_N regions. Depending on where μ_t lies the next period, the demand for redistribution can either increase or decrease (Figure IIb).

In a No-POUM world, the determination of whether the demand for redistribution is increasing or decreasing depends simultaneously on the current period, the expected income transition and the initial distribution of income. Although the demand for redistribution may be directly computed, in general it is hard to derive a particular path analytically due to its dependence on the range of possible income distributions. In the appendix, we illustrate this point with a concrete example where small changes in F_0 cause qualitative changes in the demand for redistribution over time. The appendix also shows that for a large class of income dynamics, whether the demand for redistribution is increasing or decreasing depends heavily on the initial distribution of income.

In a POUM world, the demand for redistribution decreases with policy length, as discussed above. However, in a No-POUM world, longer policy horizons may include relatively precipitous drops in present discounted income for some segments of the population. In such cases, policy longevity inspires increased demand for redistribution. The following proposition formalizes this argument, the key condition being that mean incomes lie in the region of downward mobility, Y_N , for successive periods.

Proposition 2. Suppose for an income transition f , $\mu_t \in Y_N$ for all periods t . Then the demand for redistribution increases in policy longevity. Conversely, if $\mu_t \in Y_P$ for all periods t then demand for redistribution decreases.

Proof. By definition, $g^T = g^{T-1} + \delta^T f^{(T)}$, so consider the intuitive result (see appendix):

Lemma. Suppose f and g are income transition functions. Then the myopic demand for redistribution implied by the income transition $f + g$ is between that implied by f and g .

It is therefore sufficient to show that $f^{(-T)}(\mu_T) \geq (g^{T-1})^{-1}(E[g^{T-1}])$, or equivalently

$$(3.2) \quad g^{T-1} \circ f^{(-T)}(\mu_T) \geq E[g^{T-1}].$$

Now consider that $\mu_t \in Y_N$ for all t implies $f^{-1}(\mu_t) \geq \mu_{t-1}$ so $\mu_t \geq f(\mu_{t-1})$. Recursing this equation k times shows

$$(3.3) \quad \mu_t \geq f^{(k)}(\mu_{t-k}) \quad \text{for all } t, k \geq 0.$$

Expanding $g^{T-1} \circ f^{(-T)}(\mu_T)$ and substituting in Equation (3.3) shows

$$g^{T-1} \circ f^{(-T)}(\mu_T) = \sum_{t=0}^{T-1} \delta^t f^{(t-T)}(\mu_T) \geq \sum_{t=0}^{T-1} \delta^t f^{(t-T)} \circ f^{(T-t)}(\mu_{T-(T-t)}) = E[g^{T-1}].$$

Which is precisely Equation (3.2), so demand for redistribution increases. \square

While these results are based on a deterministic income transition process, they generalize naturally to the case in which the income transition function is stochastic and drawn from a family of income transition functions $\{f_\theta(y)\}_{\theta \in \Theta}$, where an iid aggregate shock, θ_t determines the income transition f_{θ_t} faced each period.²¹

Proposition 3. Under aggregate shocks, the demand for redistribution will increase in policy longevity when all possible mean incomes lie in the common domain of downward mobility of all income transitions. Similarly, the demand for redistribution decreases if mean incomes lie in the common domain of upward mobility.

Proof. See Appendix. \square

Our analysis so far has assumed that voters know the true income transition function and use this knowledge to construct their forward looking income forecasts and vote accordingly. We now relax this assumption by considering the role of voters' beliefs, which though informed by experience, may reflect ideological priors rather than incumbent economic conditions.

²¹Here we assume θ is a Borel measurable random variable with realizations $\theta_t \in \Theta$.

3.4. Income Dynamics under Imperfect Information. To keep this problem manageable, we assume voters face a known family of possible expected income transition functions $\{f_\lambda(y)\}_{\lambda \in [0,1]}$ indexed by the parameter λ . The family of income transitions is assumed to be bracketed by two extreme specifications, one representing a right perspective or vision of how the economy operates f_R (at $\lambda = 1$) and the other a left perspective f_L ($\lambda = 0$). Specifically, the right perspective is that the laissez faire economy offers substantial prospects of upward mobility such that voters need not support redistributive policies. In contrast, the left perspective is that the economy intrinsically offers few prospects for upward mobility, requiring redistributive policies if significant fractions of the electorate are to get ahead economically. We refer to these specifications as “ideologies,” using this word to denote a model or understanding of how the world works.

To analyze the connection from beliefs about economic prospects to voting behavior, we derive conditions under which there is a monotone relationship from λ to demand for redistribution in Proposition 4. Here, successively higher values of λ correspond to more exaggerated right ideologies that promise greater upward mobility and imply less demand for redistribution. Higher values of λ also imply greater ideological polarization, in that left and right positions become more sharply differentiated. Proposition 4 characterizes which members of a family of income transitions are more ideologically “Right”, in that they induce lower demand for redistribution.²²

Proposition 4. *Let $\{f_\lambda(y)\}$ be a family of income transitions. Assume each $f_\lambda(y)$ is strictly increasing and twice continuously differentiable. Then demand for redistribution decreases in λ for all income distributions if and only if $\frac{\partial}{\partial y} \ln \frac{\partial}{\partial y} f_\lambda(y)$ decreases in λ .*

Proof. See Appendix. □

At any point in time t , the individual’s understanding of the economy can be represented by a probability density $\pi_{it}(\lambda)$ over possible values of λ while the true value of λ , labeled λ_0 , is unknown to voters. Note that this specification naturally describes someone with a left view of the world as placing a large probability weight on low or left values of λ , whereas a right view of the world would have probability weight near the right side of the spectrum or 1. We normalize the true value of state of the world λ_0 to be $1/2$. This specification of how voters predict their future income under incomplete information will be incorporated into our model of forward-looking voters. However, we first consider how the critical new element, the voter’s probability distribution $\pi_{it}(\lambda)$, is formed and evolves over time.

Each voter i begins with a prior distribution $\pi_{i0}(\lambda)$ over possible values of λ . We also assume that voters keep track of their idiosyncratic income histories $H_{it} \equiv \{y_{i0}, \dots, y_{it}\}$. The history H_{it} is used to update beliefs each period to a posterior belief $\pi_{it}(\lambda | H_{it})$ according to Bayes rule. In

²²This result analytically characterizes families of income transitions, and generalizes the often used ‘more concave than’ ordering within the space of concave functions. However, here no particular f_λ need be concave. Of particular interest are families constructed by letting f_λ at $\lambda = 1/2$ correspond to an arbitrary empirically derived function, thus making ‘real world’ income dynamics amenable to analysis.

our context, we can think of $\pi_{i0}(\lambda)$ as the initial ideological beliefs a voter has about the income transitions they face, while $\pi_{it}(\lambda|H_{it})$ are the voter's new ideological beliefs after t periods of learning the true income dynamic.

In order to make this learning process concrete, we will analyze it assuming an explicit structure of the transient income shocks in Assumption 1.

Assumption 1. *The income dynamic each voter faces satisfies the following:*

- (1) *The shock ε_{it} is distributed Uniform $(1 - \sigma, 1 + \sigma)$ for some $\sigma \in (0, 1)$.*²³
- (2) *Voters know the value of σ .*

Recalling the true state of the world is $\lambda_0 = 1/2$, actual incomes are $y_{it} = f_{1/2}^{(t)}(y_{i0}) \cdot \varepsilon_{it}$, so voters receive some random fraction, ε_{it} , of their true expected income. Under Assumption 1, the magnitude of σ determines whether fluctuations around the expected value are large or small, with a larger σ obscuring the true income dynamic from voters.

Now consider how voters update their beliefs under Assumption 1. Since for any true state of the world λ , $\varepsilon_{it} = y_{it}/f_\lambda^{(t)}(y_{i0})$ and each voter knows that $|\varepsilon_{it} - 1| \leq \sigma$, voters know

$$(3.4) \quad \left| y_{it}/f_\lambda^{(t)}(y_{i0}) - 1 \right| \leq \sigma.$$

Equation (3.4) encapsulates the fact that a voter knows that realized income y_{it} must be within the fraction σ of expected income $f_\lambda^{(t)}(y_{i0})$. Therefore any state λ for which Equation (3.4) fails to hold cannot correspond to the true income dynamic. Eliminating these impossible states is exactly what Bayes rule dictates as the updating rule. Accordingly, $\pi_{it}(\lambda|H_{it})$ is exactly $\pi_{i0}(\lambda)$ restricted to all values of λ that satisfy (3.4) for the voter's history H_{it} , normalized to integrate to one.

Appendix D develops the mechanics of learning dynamics in more detail. Under imperfect information, voting behavior is determined by each voter's beliefs given their income history and the expected redistributive transfer for each state of the world λ . A myopic voter (looking forward only one period) prefers redistribution in period t when he *believes* expected transfers are positive:

$$\int_0^1 \underbrace{\left[(1 - D) \int f_\lambda^{(t+1)}(y) dF_0(y) - f_\lambda^{(t+1)}(y_{i0}) \right]}_{\text{Expected Transfer}|\lambda, y_{i0}} \cdot \underbrace{\left[\pi_{it}(\lambda|H_{it}) \right]}_{\text{Beliefs}|H_{it}} d\lambda \geq 0.$$

This expression naturally generalizes to the case when policies persist and voters look forward by more than one period. As this expression makes clear, evolving voter beliefs inserts another dynamic element into the determination of political preferences.

3.5. Dead Weight Loss and Political Volatility. In the model of Bayesian voters faced with imperfect information just discussed, dead weight loss has a surprising role in generating potentially

²³The distributional form of ε_{it} is not crucial, since the driving force for voting is convergence through learning to a tight posterior around the true income transition state. Other distributions give similar results, but induce updating rules that include weights from ε_{it} for each voter history that increase computational dimensionality.

radical political swings. At first glance, one might think that dead weight losses would uniformly depress the demand for redistribution, but would have no effect on its volatility. But, as we now explain, this volatility effect is systematic and explained by the asymmetric effect that D has on a Right partisan with a strong belief in f_R in comparison to a Left partisan with a strong belief in f_L . Increases in D attrit support for redistribution much faster for a Right partisan than for a Left partisan, creating a wider gulf to cross as voters learn. As individuals learn and their beliefs move away from f_R , their sensitivity to dead weight losses evaporates, further powering a large shift in the population's support for redistributive policies.

In order to formalize this idea, let $\tilde{y}_R = f_R^{-1}((1-D)E_0[f_R])$ denote the income level of a voter who is indifferent about a single period of redistribution under f_R , and similarly let $\tilde{y}_L = f_L^{-1}((1-D)E_0[f_L])$ denote the income of a voter who is indifferent under f_L . By definition, the fraction of voters preferring redistribution under f_L is $F_0(\tilde{y}_L)$ while under f_R the fraction is $F_0(\tilde{y}_R)$. The gap between these two fractions, $F_0(\tilde{y}_L) - F_0(\tilde{y}_R)$, is completely accounted for by the range of possible beliefs held by voters, and quantifies potential political volatility. Under plausible assumptions, $\partial [F_0(\tilde{y}_L) - F_0(\tilde{y}_R)] / \partial D > 0$. Direct manipulation shows this inequality is equivalent to Equation (3.5), which we verify step-by-step below while detailing our assumptions.

$$(3.5) \quad (F'_0(\tilde{y}_L) / F'_0(\tilde{y}_R)) \cdot (E_0[f_L] / E_0[f_R]) < (f'_L(\tilde{y}_L) / f'_R(\tilde{y}_R))$$

Our first assumption regards the income distribution. It is a stylized fact of real world income distributions that the median is below the mean. Similarly, most real world income distributions are unimodal, and the mode typically occurs below the mean. It follows that voters at or below this unique mode would likely vote for redistribution, even allowing for substantial dead weight loss of redistribution. This is Assumption 2.

Assumption 2. *Voters at the unique mode of the income distribution prefer redistribution under both f_L and f_R .*

Our second assumption is that income transitions deserve the labels of Right and Left, in that f_L implies greater demand for redistribution than f_R , i.e. $F_0(\tilde{y}_L) > F_0(\tilde{y}_R)$. This assumption may be satisfied in many ways, not least by constructing a continuum of Right-Left income transitions via Proposition 4. We therefore assume that f_R is no more pessimistic about average growth than f_L , in that $E_0[f_R] \geq E_0[f_L]$. With reference to our particular construction of Right and Left, $E_0[f_R] = E_0[f_L]$. This is Assumption 3.

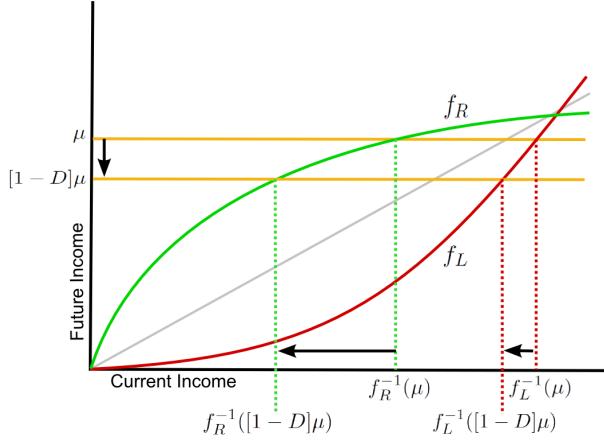
Assumption 3. *Left voters prefer more redistribution than Right voters. In addition, average growth under the Right transition is at least as high as under the Left transition.*

So far, these two assumptions guarantee the left hand side of Equation (3.5) is less than one. Assumption 3 directly implies $E_0[f_L] \leq E_0[f_R]$, and also that $\tilde{y}_L > \tilde{y}_R$. Since the income distribution is unimodal, the density of the distribution F'_0 is decreasing for all incomes above the mode. Since

by Assumption 2 the incomes \tilde{y}_L and \tilde{y}_R are above the mode, it follows that $F'_0(\tilde{y}_L) < F'_0(\tilde{y}_R)$. Putting these together, we see (3.5) holds so long as $f'_R(\tilde{y}_R) \leq f'_L(\tilde{y}_L)$. Figure III makes this intuitive through a graphical analysis, which is a natural consequence of modeling Right and Left transitions in terms of curvature. This is Assumption 4:

Assumption 4. *At the income levels where Right and Left voters are (respectively) indifferent about redistribution, Left income is increasing faster than Right income.*

FIGURE III. Changes in Right vs Left Income as Dead Weight Loss Increases



In order to explain Assumption 4, we depict idealized transitions f_R and f_L in Figure III. This figure supposes f_R is concave while f_L is convex, which is approximately true when f_R and f_L are constructed as described above. Fix any future mean income μ above median income, and consider the level of support for redistribution next period as dead weight loss D increases, depicted in Figure III as a shift in the horizontal line μ to $(1 - D)\mu$. As dead weight loss increases, the fraction of the population supporting redistribution decreases under both f_R and f_L . Under f_R , this decrease is from $F_0(f_R^{-1}(\mu))$ to $F_0(f_R^{-1}((1 - D)\mu))$ which in Figure III is larger than the drop in support under f_L , from $F_0(f_L^{-1}(\mu))$ to $F_0(f_L^{-1}((1 - D)\mu))$. This asymmetric effect of dead weight loss holds because in the illustrated range, the concavity of f_R implies f_R is much flatter than f_L , which is convex. A local characterization that f_R is flatter than f_L is $f'_R(\tilde{y}_R) \leq f'_L(\tilde{y}_L)$, which is precisely Assumption 4 and ensures that Equation (3.5) holds.²⁴ Formally,

Proposition 5. *Under Assumptions 2-4, the response of Right voters to dead weight loss is larger than the response of Left voters.*

Proposition 5 summarizes that when ideologies are modeled as income dynamics, Right voters intrinsically have more aversion to dead weight loss than Left voters. Dead weight loss further

²⁴This assumption is stronger than needed to achieve Equation (3.5). It can be relaxed to the extent that average growth is higher under f_R than f_L or that incomes are more concentrated at lower incomes, i.e. around \tilde{y}_R compared to \tilde{y}_L .

polarizes support for redistribution between Right and Left, and when voters update their beliefs away from extreme priors, the effect will be to accelerate right-left (or left-right) political swings beyond what would happen in the absence of dead weight loss.

In the next two sections we quantify the political implications of this model based on estimates of actual income dynamics in Latin America. We will explore whether the forward-looking voter model, possibly augmented with Bayesian learning effects, can explain contemporary Latin American political dynamics.

4. THE RIGHT-LEFT POLITICAL SHIFT IN LATIN AMERICA

The prior section has shown that political dynamics for forward looking voters will depend on both the income transition and the initial distribution of income. This section asks if these two considerations can help us understand recent electoral dynamics in Latin America. Building on the method of Shorrocks and Wan (2008),²⁵ we first recover income distributions for several periods, and then use these to calibrate income transition functions as the basis for the analysis of political dynamics in Chile and Peru.

4.1. Income Distribution Dynamics in Chile and Peru. The analysis here relies on income decile data from SEDLAC (CEDLAS and The World Bank, 2011). We first use this data to construct approximate income distributions $\{\hat{F}_t\}$ for each period by fitting a monotone spline to recover each distribution.²⁶ In order to recover income dynamics $\hat{f}(y)$, we consider all functions which are composed of line segments spanning each income decile. Letting β denote a vector of ten line slopes (one for each decile), we can write every admissible income dynamic $\hat{f}(y)$ as $f_\beta(y)$ for some β . To calibrate $f_\beta(y)$, we make use of the identity that if $F_t(y)$ is the distribution of expected incomes $E[y_{it}]$, then

$$(4.1) \quad f^{(t)}(y) = F_t^{-1} \circ F_0(y)$$

which fixes the relationship between the annual distribution of income $F_t(y)$ and the true income dynamic $f(y)$.²⁷ Equation (4.1) combined with estimates of the income distribution each period, say $\{\hat{F}_t\}$, provides a basis to calibrate $f_\beta(y)$ since Equation (4.1) implies $f_\beta^{(t)}(y) \approx \hat{F}_t^{-1} \circ \hat{F}_0(y)$ for each observed period t .

²⁵These authors use a parametric approach to back out income distributions from income decile data. Synthetic income distributions generated by their method have surprising accuracy compared with known distributions.

²⁶The SEDLAC income measures include monetary, non-monetary and transfer income in addition to imputed rent, and we use the following country-year pairs: Chile (1994, 1996, 1998, 2000, 2003, 2006) and Peru (1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006).

²⁷To see this identity, note that inverting both sides of $f^{(t)}(y) = F_t^{-1} \circ F_0(y)$ shows $F_0^{-1} \circ F_t(y) = f^{(-t)}(y)$, and

$$F_t(y) = \Pr(y_{it} \leq y) = \Pr\left(f^{(t)}(y_{i0}) \leq y\right) = \Pr\left(y_{i0} \leq f^{(-t)}(y)\right) = F_0\left(f^{(-t)}(y)\right).$$

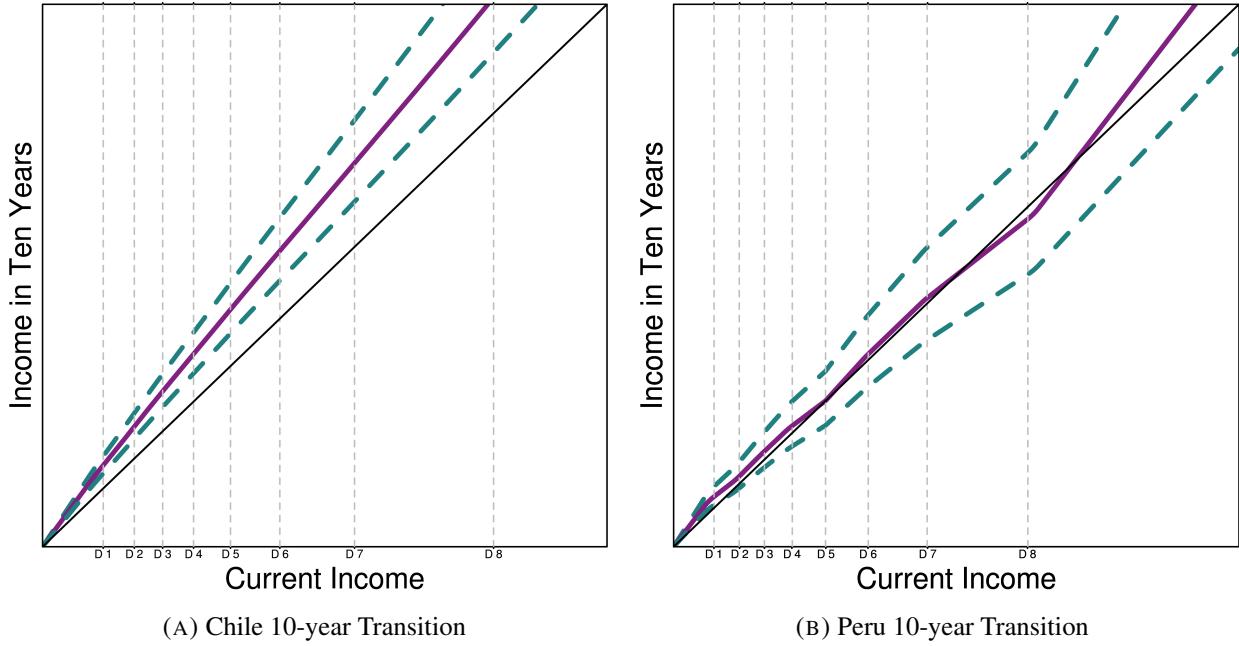
Using these relationships, we then fit $f_\beta(y)$ to best explain the recovered income distributions for each observed year, $\{\hat{F}_t\}$. To do this, we assume $\hat{F}_t^{-1} \circ \hat{F}_0(y) = f_\beta^{(t)}(y) \cdot \varepsilon(y)$ with the error term $\varepsilon(y)$ distributed lognormal $(0, \sigma)$. This implies that for each y , $\hat{F}_t^{-1} \circ \hat{F}_0(y)$ is distributed lognormal $(f_\beta^{(t)}(y), \sigma)$. Taking our cue from maximum likelihood estimation, let $\phi(y, \mu, \sigma)$ denote the log normal likelihood for an observation y . We then maximize the log likelihood summed across all years and incomes by finding β and σ to solve (4.2), with further details in the Appendix:

$$(4.2) \quad \max_{\beta, \sigma} \sum_{t \text{ observed}} \int \ln \phi \left(y, f_\beta^{(t)}(y), \sigma \right) dF_0(y).$$

Having calibrated $f_\beta(y)$ to recover income dynamics $\hat{f}(y)$ for Chile and Peru, we present the results graphically in Figure IV. A benchmark of ten years is illustrated as this roughly corresponds to two presidential election cycles in Latin American countries. Thus Figure IV shows the calibrated income dynamic over ten years ($\hat{f}^{(10)}$) for each country, with a 95% confidence band illustrated in dashed lines. For both countries, the interval estimates are wide, signaling that it is difficult to precisely recover income dynamics, both for us as econometricians and presumably also for those individuals who were living that experience. In Section 5, we will explicitly model how noise in the income distribution process affects voters' ability to learn about income dynamics. For the remainder of this section, we will treat the estimated dynamic patterns as known and use these patterns to draw out the implications of the forward-looking voting model.

As can be seen in Figure IV, the expected income dynamics for Peru show areas of convexity for much of the income distribution and therefore exhibit No-POUM dynamics. In particular, note that those who begin in the lowest five deciles are predicted to converge towards the initial median income level. Those who begin from about the sixtieth to the eighty-fifth percentiles converge to an intermediate income position equivalent to the starting level of the seventy-fifth percentile, while those who begin above the eighty-fifth percentile grow rapidly towards ever higher income levels. In contrast, the income dynamics for Chile show prospects for absolute, if not relative, mobility for all deciles of the income distribution.

FIGURE IV. Calibrated Income Transition Functions



4.2. Predicted Political Dynamics Under Full Information. Using the recovered income transition functions for Peru and Chile, we now derive the electoral dynamics implied by our model of voters who possess full information on the underlying income transition process. We consider the historical time period covered by our income decile data (mid-1990s to the mid-2000s) and consider policy longevities (degrees of forward-lookingness) of 1 to 10 years. Computing the demand for redistribution across time and for varying policy lengths then follows the development above. At any point in historical time, H , and for any degree of policy longevity, T , we calculate the fraction of the electorate supporting different policies as implied by our model:

$$\Pr(\text{Voter prefers } \tau = 1) = \tilde{F}_H \left([\hat{g}^T]^{-1} (\hat{\mu}^T) \right) \quad (\text{Forward Demand for Redistribution})$$

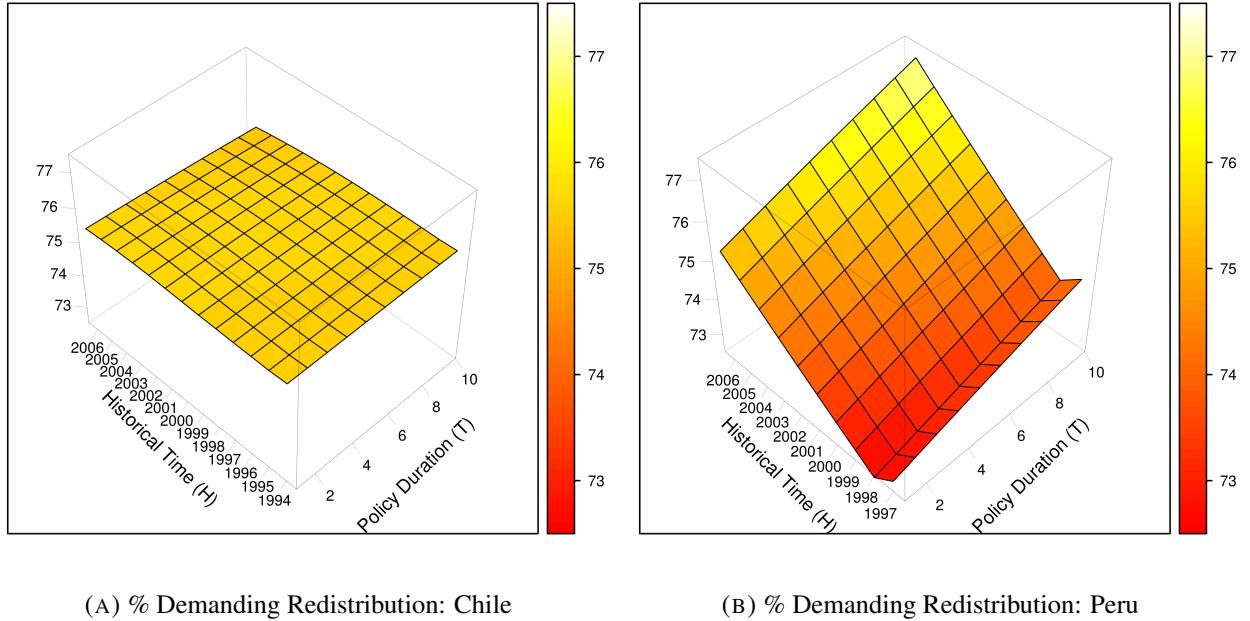
where $\hat{g}^T(y_{i0}) \equiv \sum_{t=0}^T \delta^t \hat{f}^{(t)}(y_{i0})$, $\hat{\mu}^T \equiv E_0 [\hat{g}^T(y_{i0})]$ and $\tilde{F}_H(y) \equiv \hat{F}_0 \circ \hat{f}^{(-H)}(y)$.

Figure V graphs the results of these calculations for Chile and Peru under the assumptions that redistribution incurs no dead weight loss ($D = 0$) and that $\delta = .95$. First, consider the myopic ($T = 1$) demand for redistribution in each country. Over time, Chile shows a fairly linear pattern in Figure IV(a), which implies fairly flat redistributive preferences over the period as calculated in Figure V(a). In contrast, reflecting the non-concavities in its calibrated income dynamics, Peru shows a pattern in which the myopic demand for redistribution increases over time.

Figure V also allows us to see what happens over time when voters are forward-looking (and as policy longevity increases). In the case of Chile, more forward-looking voters and longer-lasting policies barely perturbs the demand for redistribution at any point in time. Peru again presents

an interesting picture as more forward-looking voters support redistribution more strongly than do myopic voters, increasingly so over historical time.

FIGURE V. Evolving Demand for Redistribution



While the contrast between Chile and Peru illustrates the importance of income transition dynamics for political dynamics, the calculated level of support for redistribution is remarkable high for both countries, in all time periods and under any degree of forward-lookingness. Put differently, the full information voter model predicts that there would have been strong support for redistributive policies long before such support actually emerged. While there are many possible explanations for the tardy arrival of support for more aggressively redistributive policies, one is that voters perceived significant dead weight losses to redistribution. To explore this idea, we calculate the level of dead weight taxation loss that would have been necessary to provide majoritarian support for laissez faire policies in Chile and Peru under the assumptions used to generate Figure V. These levels are 45-48% in Chile and 43-47% in Peru, and are exceedingly high in comparison to existing estimates of dead weight loss (e.g. Olken (2006)), making it unlikely that dead weight losses explain the mismatch between model prediction and reality.

5. THE RIGHT-LEFT POLITICAL SHIFT IN LATIN AMERICA UNDER UNCERTAINTY

While the analysis so far is consistent with the left turn that took place in Latin America politics, it cannot account for the timing of that shift, throwing into sharp relief the question as to why so many voted for largely laissez faire policies prior to the early part of this century. The answer

cannot be found in the prospect of upward mobility as the recovered income transitions suggest that there were not prospects of upward mobility for important segments of the electorate. Indeed, forward-looking pocketbook voters with perfect information on the nature of income dynamics would have supported redistributive policies sooner and more forcefully than they actually did.

This section employs the imperfect information model of forward-looking, Bayesian voters to analyze the right to left political shift observed across contemporary Latin America. To do this, we first provide an empirically grounded approach for representing left and right political ideologies. Second, we argue that economic crises of the 1980s put the left in disarray, and at the time of reforms, voters adopted a POUM prior, since prior crises left no credible alternative to the emergent neoliberal model. Applying these assumptions to Peru, we show that voter learning over the course of a dozen years would be expected to generate up to a 27 percentage point shift in the electorate towards preferring redistributive to free market policies, with those preferring redistribution moving from a minority to a majority of the population.

5.1. Empirical Approximation of Left and Right Ideologies. In order to arrive at plausible left and right ideological models of income dynamics, we construct two functions (f_R and f_L) that surround and exaggerate the true empirical income transition function, $\hat{f}(y)$. We begin by characterizing the right income transition model as one that offers greater prospects for upward mobility and implies less demand for redistribution than does \hat{f} . For a given f_R , we then residually construct f_L so that the true function can be expressed as a linear combination of the left and right ideologies as specified in Equation (5.1):

$$(5.1) \quad f_\lambda(y) = (1 - \lambda)f_L(y) + \lambda f_R(y).$$

We now describe the construction of f_R and f_L from the empirical income transition $\hat{f}(y)$. First define $\bar{f}(y)$, the upper envelope of $\hat{f}(y)$ (which is necessarily concave, thereby inducing POUM dynamics). Now consider the income transition $C(y) \equiv \bar{f}(y) - \kappa \cdot y$ where $\kappa \equiv E[\bar{f}(y)]/E[y]$. $C(y)$ has the same curvature as $\bar{f}(y)$ since $C''(y) = \bar{f}''(y)$, yet implies no change in mean income as $E[C(y)] = E[\bar{f}(y)] - E[\kappa \cdot y] = 0$. We conceptualize the “Right Ideology” $f_R(y)$ by adding a multiple of $C(y)$ to the empirical income transition $f(y)$ and subtracting the same multiple from $f(y)$ to arrive at the “Left Ideology” $f_L(y)$. We denote the constant that multiplies $C(y)$ by ρ , giving the following expressions for $f_R(y)$ and $f_L(y)$:

$$(5.2) \quad f_R(y) \equiv f(y) + \rho [\bar{f}(y) - \kappa \cdot y], \quad f_L(y) \equiv f(y) - \rho [\bar{f}(y) - \kappa \cdot y].$$

Increases in the constant ρ generally decrease the demand for redistribution under $f_R(y)$, in line with the intuition that as ρ increases, more of the curvature from $\bar{f}(y)$ is present in f_R . To illustrate this formally, note that for moderately large ρ , $f_R(y) \approx \bar{f}(y) + \rho [\bar{f}(y) - \kappa \cdot y]$ so appealing to

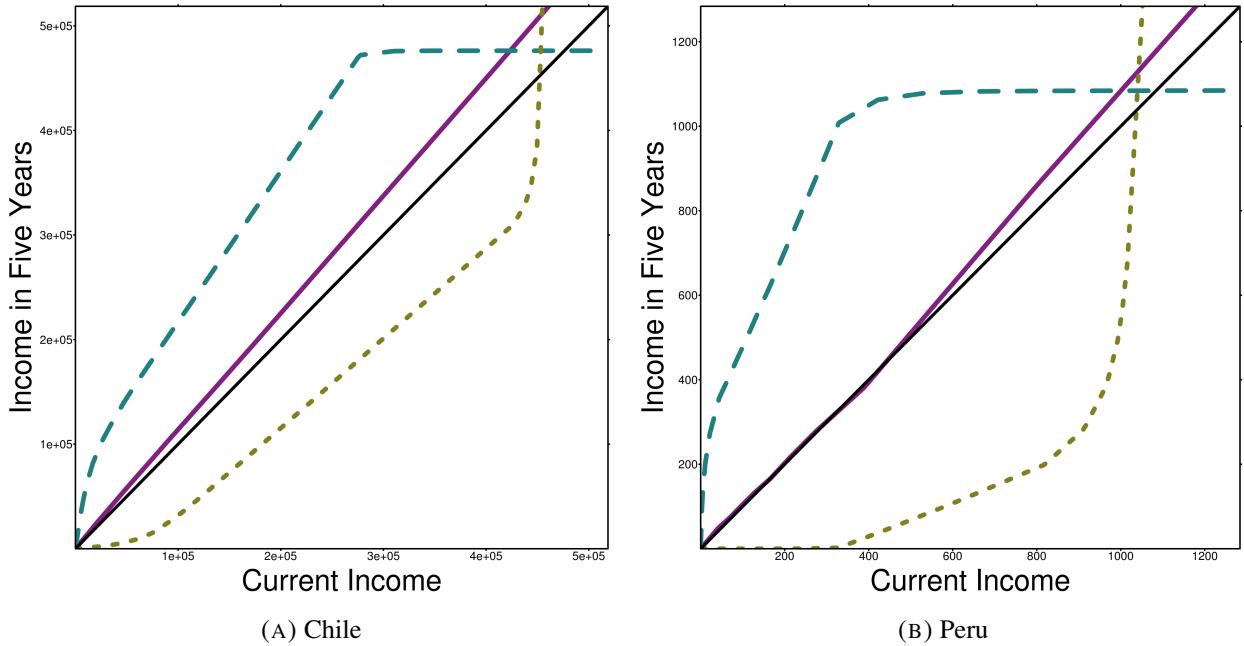
Proposition 4 we see

$$\begin{aligned} \frac{\partial}{\partial \rho} \frac{\partial}{\partial y} \ln \frac{\partial}{\partial y} f_R(y) &\approx \frac{\partial}{\partial \rho} \frac{\partial}{\partial y} \ln \frac{\partial}{\partial y} (\bar{f}(y) + \rho [\bar{f}(y) - \kappa \cdot y]) \\ &= \left\{ \bar{f}''(y) \kappa \right\} / \left(\bar{f}'(y) + \rho [\bar{f}'(y) - \kappa] \right)^2 < 0. \end{aligned}$$

Therefore our definition of f_R implies lower demand for redistribution as ρ increases; a higher ρ implies a more powerful POUM effect under f_R .²⁸

Figure VI illustrates the application of this approach of constructing $f_R(y)$ and $f_L(y)$ in Chile and Peru. The uppermost curve is $f_R(y)$, representing the effect of adding the curvature term $\rho \cdot C(y)$ to $f(y)$, while the bottom curve is $f_L(y)$ with the same term $\rho \cdot C(y)$ subtracted from $f(y)$. Referring back to Equation (5.2), the parameter ρ determines the spectrum of possible income transitions between $f_R(y)$ and $f_L(y)$ by making both of these bounding transitions more extreme. Using the empirical income transition functions of Figure IV, we fix the constant ρ to be the large as possible to capture the widest range of possibilities, subject to the constraint that both $f_R(y)$ and $f_L(y)$ are increasing. These maximal values of ρ are 28.4 (Chile) and 43.2 (Peru). While these values for ρ may seem large, any values used should allow for a large degree of ignorance about actual income dynamics. In any case, we next introduce Bayesian learning dynamics, so that beliefs in these maximal values of ρ will be adjusted in line with voters' observed income dynamics.

FIGURE VI. Stylized Right and Left Income Ideologies



²⁸Alternatively, one may define $f_R(y) \equiv \bar{f}(y) + \rho [\bar{f}(y) - \bar{g} \cdot y]$ and f_L such that $1/2f_R + 1/2f_L = f$ to arrive at this result analytically. This makes no numerical difference in practice, but burdens the notation.

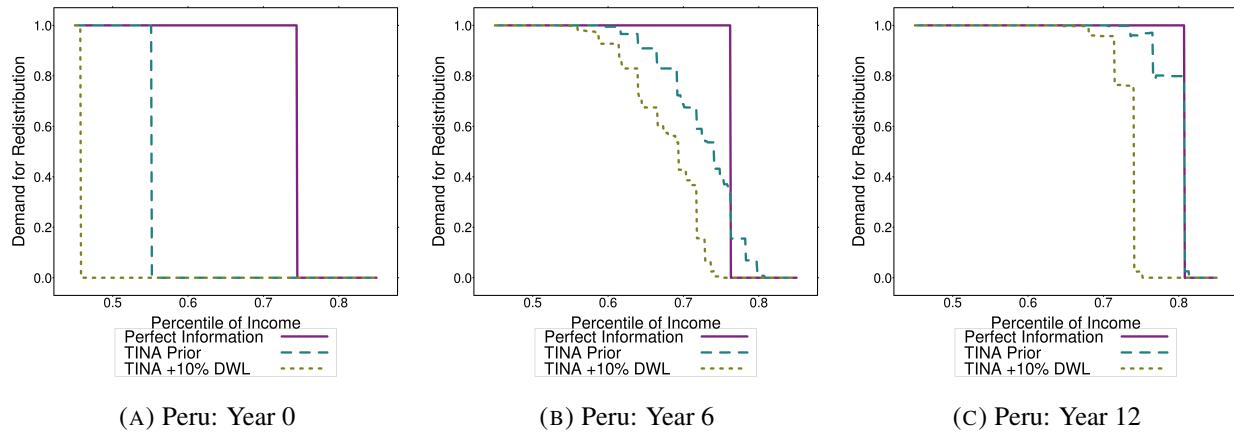
5.2. Learning and Political Dynamics under a POUM Prior. The final element needed to permit analysis of Latin American political dynamics is a specification of voters' initial beliefs about income dynamics and the prospects for upward mobility at the beginning of the 1990s. To illustrate the implications of our model, we take seriously the then common observation that there was an exhaustion of credible political alternatives to a liberal economic regime. As Margaret Thatcher famously intoned: "TINA–There Is No Alternative" to free markets. Thatcher's statements motivate what we call the TINA or POUM prior, meaning an initial set of beliefs, $\pi_{i0}(\lambda)$, that heavily weight the right perspective on the income process and its promise of upward mobility. In the numerical analysis that follows, we use a simple prior form which places exponential weight on Right beliefs for voters in the initial period, namely $\pi_{i0}(\lambda) = 10e^{10\lambda} / (e^{10} - 1)$. Although this is one particular prior, the results are fairly robust to any prior highly weighted to the Right ideology.

With the POUM prior in hand, and the empirically grounded representations of Left and Right ideologies in Figure VI, we are now in a position to numerically simulate political dynamics in Chile and Peru. For the simulations, we assume that income process is noisy with an idiosyncratic income shock parameter $\sigma = 1/2$, and that voters look forward ten years and have a discount rate of 95%.²⁹ Figure VII shows the simulated evolution of political preferences for Peru in the initial period, six years later and twelve years later. The y-axis shows the percentage of the electorate preferring redistribution by income percentile. The solid line in each figure is the full information benchmark, showing what political preferences would have looked like had voters had perfect information on the true income dynamic. The dashed line shows political preferences by decile under imperfect information (and when voters begin with the POUM prior) and when there are no dead weight losses associated with redistribution. The dotted line shows the same imperfect information scenario but assumes that redistribution is associated with a 10% dead weight loss.³⁰

²⁹Necessarily, the variance recovered from our fitting of income transitions to country decile data is a lower bound for the variance of idiosyncratic income shocks, since the decile data has been aggregated across individuals. $\sigma = 1/2$ satisfies this lower bound and is close to known estimates: see Musgrave (1979).

³⁰Given the new insights above regarding the asymmetric effect of dead weight loss on Right versus Left voters, modeling uncertainty about dead weight loss (e.g. Roemer, 1994) could produce even larger swings in the electorate.

FIGURE VII. Demand for a 10 Year Redistributive Policy by Income Percentile



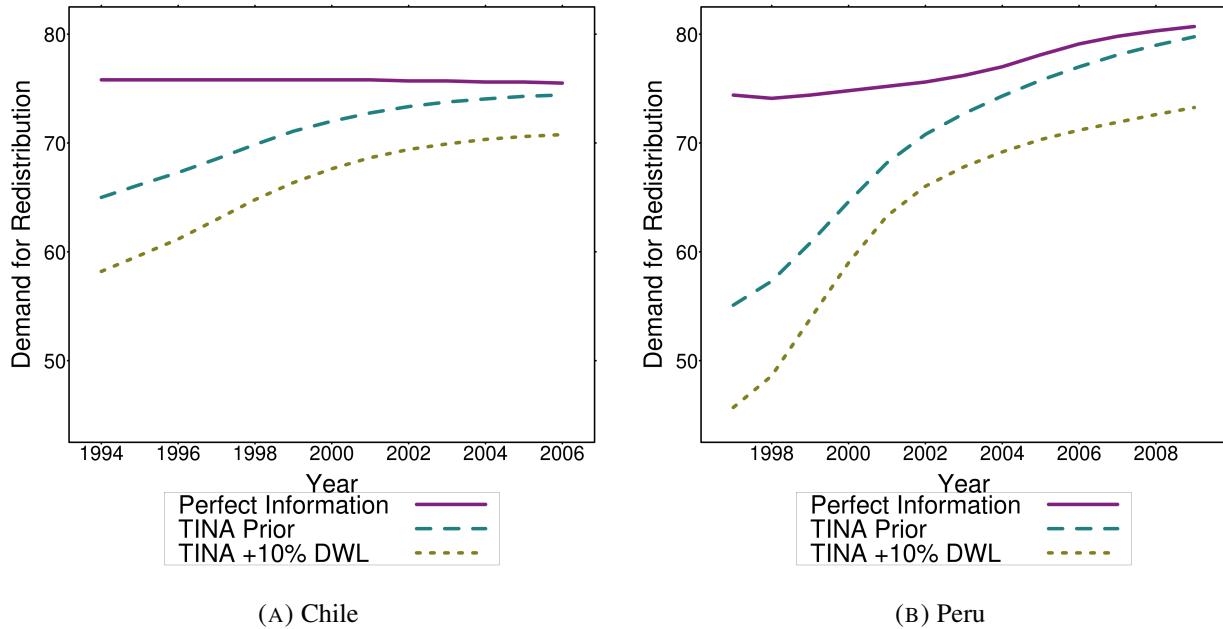
As can be seen, the preferences of fully and imperfectly informed voters are quite different, although absent any dead weight loss the median voter would have preferred redistribution from the outset. However, with a 10% dead weight loss, the median, forward-looking voter would have initially voted against redistribution under the TINA prior.³¹ However, after six years of living and learning from the actual income distribution process, the median voter, and most voters in the lowest seven deciles of the income distribution would have favored redistributive policies. After a dozen years, the preferences of most voters approach those that would hold under full information, implying a major political shift from minority to majority support for redistribution.

Figure VIII provides another look at the political dynamics implied by our model of forward-looking, Bayesian voters. The vertical axis now displays the fraction of the electorate at each point in time that is expected to vote for redistribution. Absent dead weight losses, over the 1997 to 2009 simulation period in Peru, the fraction voting for redistribution rises by some 22 percentage points, again approaching the levels that would be expected under full information by 2010. With dead weight losses, politics become even more volatile with a 27% shift over this 12-year period.

These sharp swings in policy preferences are largely driven by swing voters' reevaluation of their prospects for upward mobility as they learn from the actual operation of the Peruvian economy. An interesting contrast to these results is provided by undertaking a similar exercise for the Chilean economy. The estimated Chilean income transition function of Figure VI(a) is one that shows absolute upward income mobility for all classes, though not much relative improvement for the initially lower income deciles. While simulated preferences for redistribution in the Chilean case are strong, they remain quite stable over time, offering a vision of much more stable politics in Chile than in a country with a polarizing income distribution process.

³¹It is difficult to ascertain what the level of dead weight loss is for these countries for this period. As a benchmark, Olken (2006) estimates a dead weight loss of redistribution of 18% in Indonesia. As higher levels of dead weight loss amplify our results (as shown theoretically above), we have chosen a conservative assumption of 10%.

FIGURE VIII. Aggregate Demand for a 10 Year Redistributive Policy



6. CONCLUSION

Adopting the perspective that voters are forward-looking and pay attention to income dynamics, not just to their place in the contemporaneous income distribution, this paper has explored the left-right-left shift in the politics of Latin American countries over the last three or four decades. Two analytical innovations are key to this exploration. The first is a generalization of earlier work on forward-looking voters. We here model political preferences under general families of income distribution dynamics, not just under concave dynamics that offer prospects of upward mobility. This generalization, motivated by empirical evidence of polarizing, non-concave dynamics that offer no prospects of upward mobility for segments of the population, shows that preferences for redistributive policies may increase, not decrease over time when voters are forward-looking. The key message is that unlike a world which offers upward mobility to low income voters, the dynamics of demand for redistribution are not a foregone conclusion and may manifest in volatile political patterns. This points to evaluating the relationship between income dynamics and political choices in light of the conditions voters face on a country-specific basis.

However, detailed analysis of the case of Peru suggests that there would have been initially strong support for redistribution had voters been fully informed about the nature of the income distribution dynamics, making it extremely hard to account for the elections in Peru and elsewhere in Latin America in the 1990s that brought conservative candidates to power. This observation motivates this paper's second innovation, namely its modeling of voters as Bayesian learners who update their understanding of income distribution dynamics based on their own lived experience.

Given that most voters in Peru (and other countries which saw a transition to a market economy in the late 1980s and early 1990s) had little prior experience with the new economic model, we assume that they initially adopted a prior probability distribution that put substantial weight on an ideological position that attached strong prospects for upward mobility to the region's new economic model. Numerical simulation of political preferences as voters received noisy draws from the true (calibrated) income distribution process shows that a substantial shift from strong right political majority to a strong left political majority over the course of about a dozen years. Somewhat surprisingly, political volatility is actually increased when the electorate believes that redistributive policies carry dead weight losses. We show that the additional political volatility created by dead weight loss is to be expected under fairly weak assumptions.

Latin America of the 1990s is not only the region to have transitioned to a market economy. While there can certainly be no claim that the precise voting dynamics derived here for Peru apply to other countries, the information deficit and voting dilemma confronted by the Peruvian electorate has had its reflection in a much larger number of countries that have transitioned to political democracy and market economies. Modeling the evolving political preferences of voters in these regions as forward-looking, Bayesian learners offers insights into the complex and often unstable voting patterns observed in these other regions.

REFERENCES

ACEMOGLU, D. AND J. A. ROBINSON (2006): *Economic Origins of Dictatorship and Democracy*, Cambridge University Press.

ADATO, M., M. R. CARTER, AND J. MAY (2006): "Exploring poverty traps and social exclusion in South Africa using qualitative and quantitative data," *The Journal of Development Studies*, 42, 226–247.

ALESINA, A. AND D. RODRIK (1994): "Distributive Politics and Economic Growth," *Quarterly Journal of Economics*, 109, 465–90.

AZARIADIS, C. AND J. STACHURSKI (2005): "Poverty Traps," *Handbook of Economic Growth*, 1, 295–384.

BANERJEE, A. V. AND A. F. NEWMAN (1994): "Poverty, Incentives, and Development," *American Economic Review*, 84, 211.

——— (2000): *Occupational Choice and the Process of Development*, MIT Press, vol. 1.

BATES, R. H., R. U. I. DE FIGUEIREDO, AND B. R. WEINGAST (1998): "The Politics of Interpretation: Rationality, Culture, and Transition," *Politics & Society*, 26.

BECKMAN, S. R. AND B. ZHENG (2007): "The Effects of Race, Income, Mobility and Political Beliefs On Support For Redistribution," in *Inequality and poverty: papers from the Society for the Study of Economic Inequality's inaugural meeting*, JAI Press, vol. 14, 363.

BENABOU, R. AND E. A. OK (2001): “Social Mobility and the Demand for Redistribution: The Poum Hypothesis,” *The Quarterly Journal of Economics*, 116, 447–487.

BOIX, C. (2003): *Democracy and Redistribution*, Cambridge University Press.

BOUCHER, S. R., M. R. CARTER, AND C. GUIRKINGER (2007): “Risk Rationing and Wealth Effects in Credit Markets: Theory and Implications for Agricultural Development,” *American Journal of Agricultural Economics*, 90, 409–423.

CARTER, M. R. AND C. B. BARRETT (2006): “The economics of poverty traps and persistent poverty: An asset-based approach,” *The Journal of Development Studies*, 42, 178–199.

CHECCHI, D. AND A. FILIPPIN (2004): “An Experimental Study of the POUM Hypothesis,” *Research on Economic Inequality*, 11, 115–136.

EDWARDS, S. (1995): *Crisis and reform in Latin America: from despair to hope*, World Bank.

ESTEBAN, J. M. AND D. RAY (1994): “On the Measurement of Polarization,” *Econometrica*, 62, 819–851.

FEENSTRA, R. C., H. MA, J. P. NEARY, AND D. S. RAO (2012): “Who Shrunk China? Puzzles in the Measurement of Real GDP,” Tech. rep., National Bureau of Economic Research.

FERNANDEZ, R. AND D. RODRIK (1991): “Resistance to Reform: Status Quo Bias in the Presence of Individual-Specific Uncertainty,” *The American Economic Review*, 1146–1155.

FIELDS, G. S. (2007): “How much should we care about changing income inequality in the course of economic growth?” *Journal of Policy Modeling*, 29, 577–585.

FONG, C. (2001): “Social preferences, self-interest, and the demand for redistribution,” *Journal of Public Economics*, 82, 225–246.

GASPARINI, L., M. HORENSTEIN, E. MOLINA, AND S. OLIVIERI (2008): “Income Polarization in Latin America: Patterns and Links with Institutions and Conflict,” *Oxford Development Studies*, 36, 461–484.

GRAHAM, C. AND S. PETTINATO (2002): *Happiness and hardship: Opportunity and insecurity in new market economies*, Brookings Inst Pr.

GREENE, K. F. AND A. BAKER (2011): “The Latin American Left’s Mandate: Free-Market Policies and Issue Voting in New Democracies,” *World Politics*, 63, 43–77.

HERRERA, Y. M. (2005): *Imagined Economies: The Sources of Russian Regionalism*, Cambridge University Press.

JARVIS, R. (1973): “On the identification of the convex hull of a finite set of points in the plane,” *Information Processing Letters*, 2, 18–21.

KAUFMAN, R. (2009): “The Political Effects of Inequality in Latin America: Some Inconvenient Facts,” *Comparative Politics*, 41, 359–79.

LYBBERT, T. J., C. B. BARRETT, S. DESTA, AND L. D. COPPOCK (2004): “Stochastic wealth dynamics and risk management among a poor population,” *The Economic Journal*, 114, 750–777.

MELTZER, A. H. AND S. F. RICHARDS (1981): “A Rational Theory of the Size of Government,” *The Journal of Political Economy*, 89, 914.

MOENE, K. O. AND M. WALLERSTEIN (2001): “Inequality, Social Insurance, and Redistribution,” *The American Political Science Review*, 95, 859–874.

MUSGROVE, P. (1979): “Permanent household income and consumption in urban South America,” *The American Economic Review*, 69, 355–368.

NORTON, M. I. AND D. ARIELY (2011): “Building a Better America—One Wealth Quintile at a Time,” *Perspectives on Psychological Science*, 6, 9–12.

OLKEN, B. A. (2006): “Corruption and the costs of redistribution: Micro evidence from Indonesia,” *Journal of Public Economics*, 90, 853–870.

PERSSON, T. AND G. TABELLINI (1994): “Is inequality harmful for growth?” *The American Economic Review*, 600–621.

——— (2000): *Political Economics: Explaining Economic Policy*, MIT Press.

PIKETTY, T. (1995): “Social Mobility and Redistributive Politics,” *The Quarterly Journal of Economics*, 110, 551–584.

PRZEWORSKI, A. (1991): *Democracy and the Market: Political and Economic Reforms in Eastern Europe and Latin America*, Cambridge University Press.

PUTTERMAN, L. (1996): “Why have the rabble not redistributed wealth,” *Property Relations, Incentives and Welfare*. St. Martin’s Press. New York, 359–89.

ROCKAFELLAR, T. R. (1970): *Convex analysis*, vol. 28, Princeton, N.J.: Princeton University Press.

ROEMER, J. E. (1994): “The strategic role of party ideology when voters are uncertain about how the economy works,” *American Political Science Review*, 327–335.

——— (2001): *Political competition: Theory and applications*, Harvard University Press.

ROMER, P. M. (1994): “The Origins of Endogenous Growth,” *Journal of Economic Perspectives*, 8, 3–22.

SANTISO, J. (2006): *Latin America’s Political Economy of the Possible: Beyond Good Revolutionaries and Free-marketeers*, MIT Press.

SHORROCKS, A. AND G. WAN (2008): “Ungrouping Income Distributions,” *Arguments for a Better World: Essays in Honor of Amartya Sen*, 1, 414–435.

TUCKER, J. A. (2006): *Regional Economic Voting: Russia, Poland, Hungary, Slovakia, and the Czech Republic, 1990-1999*, Cambridge University Press.

VAN WIJNBERGEN, S. AND T. WILLEMS (2012): “Learning Dynamics and the Support for Economic Reforms: Why Good News Can Be Bad,” *Working Paper*.

WEYLAND, K. G. (2002): *The Politics of Market Reform in Fragile Democracies: Argentina, Brazil, Peru, and Venezuela*, Princeton University Press.

WILLIAMSON, J. (1990): "What Washington means by policy reform," *Latin American adjustment: how much has happened*, 7, 7–20.

WONG, W. K. (2004): "Deviations from Pocketbook Voting: Evidence and Implications," *Unpublished Manuscript*.

WRIGHT, E. O. (2000): *Class Counts*, Cambridge University Press.

APPENDIX A. EXTENSIONS TO STOCHASTIC FAMILIES OF INCOME TRANSITIONS

Consider a family of income transition functions $\{f_\theta(y)\}_{\theta \in \Theta}$, where for each individual i , an iid random draw $\theta_{it} \in \Theta$ determines the income transition $f_{\theta_{it}}$ faced each period.³² The implications for redistribution under the family $\{f_\theta(y)\}_{\theta \in \Theta}$ mirrors Proposition 2. For a family of income transitions to imply increased demand for redistribution under a one period policy, it is sufficient that the expected income transition $E_\theta[f_\theta(y)]$ has a domain of downward mobility, Y_N , that contains the mean income in period 1. When taxation policy instead lasts for T periods, the demand for redistribution will increase with policy length, so long as the mean income each period lies in the domain of downward mobility, Y_N , that corresponds to the mapping of expected incomes from period t to $t + 1$.

A special case of random income transitions is to consider aggregate shocks $\theta_t \in \Theta$ which occur simultaneously to all individuals in the economy. In this case, patterns in the demand for redistribution can again be characterized in terms of mean incomes and upper and lower envelopes. To illustrate this characterization, note that for any sequence of random draws $\theta^T \equiv \{\theta_1, \dots, \theta_T\}$ there are realized income transitions $f_{\theta_1}, \dots, f_{\theta_T}$ with corresponding average incomes $\mu_t(\theta^T) \equiv E[f_{\theta_t} \circ f_{\theta_{t-1}} \circ \dots \circ f_{\theta_1}(y)]$ and domains of downward and upward mobility $\{Y_N(\theta_t)\}$ and $\{Y_P(\theta_t)\}$. Now take any fixed history of aggregate shocks θ^T , and suppose voters knew this history ahead of time. By arguments similar to those above, the demand for redistribution would increase in policy longevity so long as

$$(A.1) \quad \mu_t(\theta^T) \in Y_N(\theta_{t+1}) \text{ for each } t.$$

Since the sequence of aggregate shocks θ^T is in fact random, a sufficient condition to characterize the demand for redistribution is to make Equation (A.1) hold for each history. This is implied by the following assumption:

$$\text{All Possible Mean Incomes} = \bigcup_{\theta^T} \{\mu_t(\theta^T)\} \subset \bigcap_{\theta \in \Theta} Y_N(\theta) = \text{Common Domain of Downward Mobility}$$

Therefore we have a result similar to those above, summarized as Proposition 3.

³²We additionally assume standard measurability and boundedness assumptions, e.g. $\sup_{\theta, t} E_y[f^{(t)}(y, \theta)] < \infty$, so that the definitions of the discussion above are well defined in this setting. Although of theoretical interest, we will not appeal to these assumptions in the rest of the paper, and minimize our treatment accordingly.

APPENDIX B. RECOVERY OF SIMPLE INCOME DYNAMICS

As developed above, we fit a class of income transitions $f_\beta(y)$ defined by piecewise line segments spanning each income decile. Specifically, these line segments span the midpoints between each income decile (with endpoints defined by incomes at zero and twice the tenth income decile). The years used to determine the midpoints are roughly in the middle of our data sample years: 2001 in Chile and 1998 in Peru. The values of β which maximize Equation (4.2) for each country are reported in Table B.1, while the 95% confidence band for incomes graphed in Figure IV are based on the likelihood maximizing values $\sigma_{\text{Peru}} = 0.0943$ and $\sigma_{\text{Chile}} = 0.0540$. The parameter values of ρ and \bar{g} which determine Right and Left income transitions are $\rho_{\text{Chile}} = 28.42$, $\rho_{\text{Peru}} = 43.16$ and $\kappa_{\text{Chile}} = 1.02$, $\kappa_{\text{Peru}} = 1.009$.

TABLE B.1. Income Transition Parameters

	Slope of Income Transition in each Decile									
	1	2	3	4	5	6	7	8	9	10
Chile	1.035	1.025	1.028	1.024	1.022	1.023	1.020	1.021	1.024	1.025
Peru	1.032	0.979	1.004	0.998	0.976	1.014	1.000	0.980	1.031	1.023

APPENDIX C. DEPENDENCE OF REDISTRIBUTIVE DEMAND ON INITIAL INCOME

C.1. Fragility of Redistributive Dynamics. Consider an income distribution F_0 composed of three equally sized groups with incomes Y_1, Y_2, Y_3 where $0 < Y_1 < Y_2 < Y_3 < \bar{Y}$. Then $\mu_t = \sum(1/3) \cdot f^{(t)}(Y_i)$ and so clearly depends on the initial distribution of income F_0 interacting with the evolution of group incomes $f^{(t)}(Y_i)$. Now also suppose f has three fixed points $Y_{\text{Trap}} < Y_{\text{Escape}} < \bar{Y}$ where for $y < Y_{\text{Escape}}$, $f^{(t)}(y) \rightarrow Y_{\text{Trap}}$ and for $y > Y_{\text{Escape}}$, $f^{(t)}(y) \rightarrow \bar{Y}$. In this case all groups are going to either Y_{Trap} or \bar{Y} . To fix ideas, assume $Y_1 < Y_{\text{Escape}} < Y_3$ so the Y_1 group converges to Y_{Trap} while Y_3 converges to \bar{Y} . Clearly Y_1 prefers the complete redistribution scheme r_1 while Y_3 prefers r_0 . This leaves open the middle class of “swing voters” Y_2 . If $Y_2 > Y_{\text{Escape}}$ then the middle class eventually climbs the income ladder to \bar{Y} and joins the (now majoritarian) voting block of Y_3 . Otherwise, if $Y_2 < Y_{\text{Escape}}$ there is a thinning of the middle class and swing voters eventually join with Y_1 , implying the median voter prefers redistribution. Note the fragility of the eventual voting outcomes: a small income difference δ in Y_2 can push $Y_2 + \delta$ to be greater or less than Y_{Escape} . This eventually results in a large fraction p_2 of swing voters to switch their vote as income evolves. Similar consequences can arise if voters lack perfect information about F_0 or f so that small changes in beliefs can give rise to large changes in redistributive preferences.

C.2. The Same Income Transition Often Can Imply Both Increase and Decreasing Redistributive Demand. A broad class of dynamics can exhibit either increasing or decreasing demand for redistribution. The deciding factor for redistributive dynamics, even for a fixed dynamic, is the

initial distribution of income. This emphasizes the interrelationship between “Upward/No Mobility” in the dynamic role of income transitions and the “existing order” in the role of the income distribution: political implications cannot be drawn without considering both:

Proposition. *Suppose f is bounded and define $f^{(\infty)}(y) \equiv \lim_{t \rightarrow \infty} f^{(t)}(y)$ as an individual’s income after an arbitrarily long period of time. Let $\underline{\mu}_\infty$ be the least possible per capita income under $f^{(\infty)}$ and let $\bar{\mu}_\infty$ be the highest possible per capita income under $f^{(\infty)}$.*

- (1) *(POUM Forever) If $[\underline{\mu}_\infty, \bar{\mu}_\infty]$ intersects the interior of Y_P , there is an initial distribution of income where the demand for redistribution always decreases.*
- (2) *(No-POUM Forever) If $[\underline{\mu}_\infty, \bar{\mu}_\infty]$ intersects the interior of Y_N there is an initial distribution of income where the demand for redistribution always increases.*

Proof. Formally, we have $\underline{\mu}_\infty \equiv \inf_{F_0} \int f^{(\infty)} dF_0$ and $\bar{\mu}_\infty \equiv \sup_{F_0} \int f^{(\infty)} dF_0$ where the infimum and supremum are taken over bounded, absolutely continuous initial income distributions. $\underline{\mu}_\infty$ and $\bar{\mu}_\infty$ are both in $[0, \infty)$ as for any fixed F_0 , f is bounded so $\int f^{(\infty)} dF_0 = \lim_{t \rightarrow \infty} \int f^{(t)} dF_0$ by bounded convergence, and clearly each $\int f^{(t)} dF_0 \in [0, \sup f]$.

We will consider the POUM case as the other case is similar. By hypothesis, there is some $\mu^* \in [\underline{\mu}_\infty, \bar{\mu}_\infty]$ and an open set V such that $\mu^* \in V \subset Y_P$. Fix $\varepsilon > 0$ such that $\mu^* \pm \varepsilon \in V$ and fix λ such that $\mu^* = \lambda \underline{\mu}_\infty + (1 - \lambda) \bar{\mu}_\infty$ (note this forces $\lambda \in [0, 1]$). Now define, for any initial income distribution G , $\mu_t^G \equiv \int f^{(t)} dG$. By definition of $\underline{\mu}_\infty$ and $\bar{\mu}_\infty$ we may choose initial income distributions F and \bar{F} where

$$\lim_{t \rightarrow \infty} \mu_t^F < \underline{\mu}_\infty + \varepsilon/2 \quad \text{and} \quad \lim_{t \rightarrow \infty} \mu_t^{\bar{F}} > \bar{\mu}_\infty - \varepsilon/2.$$

It follows that there is a T such that for all $t \geq T$, $\mu_t^F < \underline{\mu}_\infty + \varepsilon$ and $\mu_t^{\bar{F}} > \bar{\mu}_\infty - \varepsilon$. This implies $|\lambda \mu_t^F + (1 - \lambda) \mu_t^{\bar{F}} - [\lambda \underline{\mu}_\infty + (1 - \lambda) \bar{\mu}_\infty]| < \varepsilon$ for all $t \geq T$. Since $\lambda \underline{\mu}_\infty + (1 - \lambda) \bar{\mu}_\infty = \mu^*$ and $\tilde{F} \equiv \lambda F + (1 - \lambda) \bar{F}$ is an admissible initial income distribution, we see $|\mu_t^{\tilde{F}} - \mu^*| < \varepsilon$ for all $t \geq T$. By construction, this implies $\mu_t^{\tilde{F}} \in V \subset Y_P$, so by Proposition 1, the demand for redistribution is always decreasing when the initial distribution of income is $F_0(y) \equiv \tilde{F}(f^{(T)}(y))$. \square

APPENDIX D. DEMAND FOR REDISTRIBUTION UNDER IMPERFECT INFORMATION

In general, neither f_L nor f_R need reflect reality but rather idealized versions of what Left and Right ideologues might represent in a manifesto. Clearly the relative strength of a voter’s beliefs in these world views will influence voting behavior. In order to emphasize the role of beliefs $\pi_{it}(\lambda | H_{it})$ in deriving a voter’s expected income, we now illustrate the decisions of a pocketbook voter who is also a Bayesian learner.

If a voter knows the true value of λ , namely λ_0 , then beliefs $\pi_{i0}(\lambda)$ put a point mass of 1 on λ_0 . This is the perfect information case, and as above expected income in period 1 would be given

by $E[y_{i1}|H_{i0}, \pi_{i0}] = f_{\lambda_0}(y_{i0})$. However, each voter does not know λ_0 with certainty but has a non-degenerate prior density $\pi_{i0}(\lambda)$ over possible values of λ . Now consider a voter in period 0 with income y_{i0} . The voter's expected income in period 1 is a weighted average of expected income over plausible values of λ , namely $E[y_{i1}|H_{i0}, \lambda = \lambda_0] = f_{\lambda}(y_{i0})$ weighted by $\pi_{i0}(\lambda)$. Specifically,

$$E[y_{i1}|H_{i0}, \pi_{i0}] = \int_0^1 E[y_{i1}|H_{i0}, \lambda] \pi_{i0}(\lambda) d\lambda = \int_0^1 f_{\lambda}(y_{i0}) \pi_{i0}(\lambda) d\lambda.$$

More generally, at the end of periods 1 to t , a voter updates his prior $\pi_{i0}(\lambda)$ to a posterior $\pi_{it}(\lambda)$ using their history $H_{it} = \{y_{i0}, \dots, y_{it}\}$. Therefore expected income in period $t + 1$ is

$$(D.1) \quad E[y_{it+1}|H_{it}, \pi_{i0}] = \int \underbrace{f_{\lambda}^{(t+1)}(y_{i0})}_{\text{Expected Income}|\lambda} \cdot \underbrace{\pi_{it}(\lambda|H_{it})}_{\text{History Dependent Beliefs Over } \lambda} d\lambda.$$

Equation (D.1) highlights the two dynamic factors which influence a voter's beliefs about expected income. The first element, expected income given λ is the true state of the world, is deterministic as under perfect information. The second element, a voter's ideological beliefs, evolve as information is collected in the form of the idiosyncratic income history H_{it} .

Since each possible value of λ corresponds to an economy wide income dynamic, a voter's beliefs also impact expectations about mean income next period. Given that f_{λ} is the true income dynamic, mean income in period $t + 1$ is $\mu_{t+1}|\lambda \equiv \int f_{\lambda}^{(t+1)}(y) dF(y)$. Thus, a voter with an income history H_{it} and prior π_{i0} believes mean income in period $t + 1$ is

$$(D.2) \quad \begin{aligned} E[\mu_{t+1}|H_{it}, \pi_{i0}] &= \int_0^1 [\mu_{t+1}|\lambda] \cdot \pi_{it}(\lambda|H_{it}) d\lambda \\ &= \int_0^1 \left[\int f_{\lambda}^{(t+1)}(y) dF(y) \right] \pi_{it}(\lambda|H_{it}) d\lambda. \end{aligned}$$

After accounting for any dead weight loss D , a voter will prefer redistribution if and only if $E[(1-D)\mu_{t+1}|H_{it}, \pi_{i0}] \geq E[y_{it+1}|H_{it}, \pi_{i0}]$. From Equations (D.1) and (D.2) this means voters prefer redistribution when

$$(D.3) \quad \underbrace{\int_0^1 \left[(1-D) \int f_{\lambda}^{(t+1)}(y) dF(y) - f_{\lambda}^{(t+1)}(y_{i0}) \right]}_{\text{Expected Transfer}|\lambda} \cdot \pi_{it}(\lambda|H_{it}) d\lambda \geq 0.$$

Equation (D.3) shows that a voter prefers redistribution when, given their history H_{it} , they believe the expected transfer from redistribution will be positive. Note that two voters with the same initial incomes need not have the same redistributive preferences: whether Equation (D.3) holds depends on each voter's income history through their beliefs $\pi_{it}(\lambda|H_{it})$. This implies the popularity of redistributive policies varies in a nontrivial way across initial incomes. Preferred policies for each

voter over redistribution in period $t + 1$, conditional on their history H_{it} , are summarized as

$$\text{Prefer Redistribution: } \int \left[(1 - D) \mu_{t+1} | \lambda - f_\lambda^{(t+1)}(y_{i0}) \right] \pi_{it}(\lambda | H_{it}) d\lambda \geq 0,$$

$$\text{Prefer Laissez Faire: } \int \left[(1 - D) \mu_{t+1} | \lambda - f_\lambda^{(t+1)}(y_{i0}) \right] \pi_{it}(\lambda | H_{it}) d\lambda \leq 0.$$

A clear connection from ideological beliefs to demand for redistribution is given by:

Assumption. *Increases in λ imply expected income improves relative to transfers ($df_\lambda^{(t)}(y_{i0})/d\lambda \geq d(1 - D) \mu_t | \lambda / d\lambda$) for all swing voters defined as y_{i0} where*

$$y_{i0} \in \left[f_R^{(-t)}((1 - D) \mu_t | \lambda = 1), f_L^{(-t)}((1 - D) \mu_t | \lambda = 0) \right] \quad (\text{Swing Voters})$$

This Assumption says that as λ increases (moves to the Right), each voter believes his expected income $f_\lambda^{(t)}(y_{i0})$ increases *relatively more* than expected transfers $(1 - D) \mu_t | \lambda$. Furthermore, we only require this to hold for voters who might potentially change their vote: the votes of both destitute ($f_\lambda^{(t)}(y_{i0}) < (1 - D) \mu_t | \lambda$ for all λ) and well-to-do ($f_\lambda^{(t)}(y_{i0}) > (1 - D) \mu_t | \lambda$ for all λ) are unaffected by belief. Crucially, the expected transfer $(1 - D) \mu_t | \lambda - f_\lambda^{(t)}(y_{i0})$ is decreasing in λ . It follows that voter j tends to prefer less redistribution than voter i when voter j 's beliefs π_{jt} are “to the Right” of a voter i 's beliefs π_{it} . To make this precise, assume that π_j stochastically dominates π_i and i and j have the same initial incomes. Since for each fixed λ , $(1 - D) \mu_t | \lambda - f_\lambda^{(t)}(y_{i0}) = (1 - D) \mu_t | \lambda - f_\lambda^{(t)}(y_{j0})$ and this equation is decreasing in λ , the dominance of π_j over π_i implies

$$(D.4) \quad \underbrace{\int \left[(1 - D) \mu_t | \lambda - f_\lambda^{(t)}(y_{j0}) \right] \pi_{jt}(\lambda) d\lambda}_{\text{Expected Transfer} | \lambda} \leq \underbrace{\int \left[(1 - D) \mu_t | \lambda - f_\lambda^{(t)}(y_{i0}) \right] \pi_{it}(\lambda) d\lambda}_{\text{Expected Transfer} | \lambda}$$

(D.4) shows that the “Right” voter j believes they will receive a lower net transfer from redistribution than the “Left” voter i . Therefore voter j tends to prefers less redistribution than voter i . This result is summarized as Proposition 6.

Proposition 6. *Suppose the Assumption above holds. If voters i and j are identical except voter j 's beliefs π_{jt} stochastically dominate voter i 's beliefs π_{it} , then j prefers less redistribution than i .*

Proposition 6 shows that the further to the ideological Right a voter is, the less redistribution they prefer. In this framework, one would expect that the speed of learning would be related to both the variability of income signals and the gap between left and right predictions for an individual's future income position.³³ These expectations imply a rich set of testable implications about the evolution of political preferences and voting.

³³Voters may of course learn about additional aspects of the economy besides income mobility, which could influence political preferences. In particular, we have not modeled the effect of learning the level of dead weight loss present in any prospective redistributive policy, although Proposition 5 suggests the impact this added dimension would have.

APPENDIX E. PROOFS

Lemma. Suppose f and g are income transition functions. Then the myopic demand for redistribution implied by the income transition $f + g$ is between that implied by f and g .

Proof. Formally, we wish to show that

$$(E.1) \quad (f + g)^{-1}(\mathbb{E}[f + g]) \in [f^{-1}(\mathbb{E}[f]), g^{-1}(\mathbb{E}[g])].$$

Since f and g are strictly increasing, composing each side with $f + g$ shows (E.1) holds iff

$$(E.2) \quad \mathbb{E}[f] + \mathbb{E}[g] \in [\mathbb{E}[f] + g \circ f^{-1}(\mathbb{E}[f]), \mathbb{E}[g] + f \circ g^{-1}(\mathbb{E}[g])].$$

Subtracting $\mathbb{E}[f] + \mathbb{E}[g]$ from both sides of Equation (E.2) shows the equation holds iff

$$(E.3) \quad 0 \in [g \circ f^{-1}(\mathbb{E}[f]) - \mathbb{E}[g], f \circ g^{-1}(\mathbb{E}[g]) - \mathbb{E}[f]].$$

This always holds, since considering the two terms on the RHS of (E.2) have different signs, since

$$\begin{aligned} \text{sign}\{g \circ f^{-1}(\mathbb{E}[f]) - \mathbb{E}[g]\} &= \text{sign}\{f^{-1}(\mathbb{E}[f]) - g^{-1}(\mathbb{E}[g])\}, \\ \text{sign}\{f \circ g^{-1}(\mathbb{E}[g]) - \mathbb{E}[f]\} &= \text{sign}\{g^{-1}(\mathbb{E}[g]) - f^{-1}(\mathbb{E}[f])\}. \end{aligned}$$

□

Proposition 7. Let $\{f_\lambda(y)\}$ be a family of income transitions. Assume each $f_\lambda(y)$ is strictly increasing and twice continuously differentiable. Then demand for redistribution decreases in λ for all income distributions if and only if $\frac{\partial}{\partial y} \ln \frac{\partial}{\partial y} f_\lambda(y)$ decreases in λ .

Proof. We want to show that for all $\Delta > 0$

$$(E.4) \quad f_\lambda^{-1} \left(\int f_\lambda dF \right) \geq f_{\lambda+\Delta}^{-1} \left(\int f_{\lambda+\Delta} dF \right)$$

for all bounded distributions F , iff $\frac{\partial}{\partial x} \ln \frac{\partial}{\partial x} f_\lambda(x)$ decreases in λ . Let h be defined by $h \equiv f_{\lambda+\Delta} \circ f_\lambda^{-1}$ and since $f_{\lambda+\Delta}$ is strictly increasing, Equation (E.4) is equivalent to $h(\int f_\lambda dF) \geq \int h \circ f_\lambda dF$. It therefore follows from standard lines of argument (e.g. Rockafellar (1970)) that Equation (E.4) holds for all F iff h is concave. Direct inspection shows

$$(E.5) \quad h'' = f_{\lambda+\Delta}'' \circ f_\lambda^{-1} / (f_\lambda' \circ f_\lambda^{-1})^2 - f_{\lambda+\Delta}' \circ f_\lambda^{-1} \cdot f_\lambda'' \circ f_\lambda^{-1} / (f_\lambda' \circ f_\lambda^{-1})^3.$$

Therefore h'' exists and is continuous by inspection. We conclude h is concave iff $h'' \leq 0$. Equation (E.5) shows $h'' \leq 0$ iff $f_\lambda''/f_\lambda' \geq f_{\lambda+\Delta}''/f_{\lambda+\Delta}'$, i.e. $\frac{\partial}{\partial y} \ln \frac{\partial}{\partial y} f_\lambda(y)$ decreases in λ . □