

# Parties, Time Horizons, and the Pursuit of Economic Growth through Technological Development

by

Joel W. Simmons

A dissertation submitted in partial fulfillment  
of the requirements for the degree of  
Doctor of Philosophy  
(Political Science)  
in The University of Michigan  
2008

Doctoral Committee:

Professor Robert J. Franzese Jr., Co-Chair  
Assistant Professor Allen Hicken, Co-Chair  
Professor Elisabeth R. Gerber  
Professor John E. Jackson

© Joel W. Simmons  
All rights reserved.  
2008

To Mom, Dad, Julia, and Niall

## Acknowledgements

While only my name is listed on the title page of the dissertation, the contents within are the product of the support of my family and friends and the many wonderful interactions that I have had with the professors and graduate students at the University of Michigan over the years. My dissertation committee, Rob Franzese, Allen Hicken, John Jackson, and Liz Gerber has been invaluable. Their advice and suggestions greatly improved the project and their constant encouragement was all-important—especially at those moments when it was not clear whether the proverbial “light at the end of the tunnel” was, in fact, the end of the tunnel, or a train racing toward me. Rob Franzese is a dedicated advisor and terrific scholar. From the project’s inception, he provided sharp, insightful commentary and turned my often confusing ramblings into coherent theoretical propositions. The project would not be what it is without him. I owe a large debt to Allen Hicken, who was not only a great advisor on my dissertation, but who also graciously allowed me to work with him on other research projects and, in so doing, gave me first-hand experience in the process of turning an idea into a publishable work. He has the patience of a saint and his guidance throughout my graduate career is greatly appreciated. John Jackson’s advice was always extraordinary and he had a knack for keeping me focused on the dissertation’s big picture instead of getting so bogged down in small details that I lost sight of the project’s larger goals. Going to University of Michigan hockey games with John also reminded me that, sometimes, there is more to life than work. Liz Gerber was a late addition to the committee, but her comments and suggestions were incisive and strengthened the project greatly. I owe her a debt for stepping in at the

last minute. While at the University of Michigan, I also benefited from interactions with and courses taken from Bill Clark, Don Kinder, Jake Bowers, Jude Hays, Doug Lemke, Michael Ross, and Jennifer Widner. Working with Ken Kollman has been a wonderful experience and one from which I have learned much.

One of the things that makes Michigan a special place is the collegiality among the graduate students. Harwood McClerking, Mike Minta, Tasha Philpot, Jae-Jae Spoon, Devra Coren Moehler, Ismail White, Lester Spence, and Brian McKenzie have been outstanding role models. They showed me the ropes, humbled me when I needed it, and provided great examples of the dedication and work ethic it takes to finish the dissertation and be successful in this field. I owe them a large debt and am still trying to emulate them and their successes. I also found great friends in Brian Grodsky, Amit Ahuja, Michelle Allendoerfer, Andrea Benjamin, Grace Cho, Kate Gallagher, Michael Robbins, Tiffany Howard, Shanna Kirschner, Leanne Powner, Laura Potter, Antoine Banks, Dominick' Wright, Jana von Stein, and Rob Salmond. It wasn't easy, but I also managed to make a few friends outside of the political science department. Ryan Jusko and Ian Hall deserve credit for listening to me talk endlessly about political science. During my first year as an Assistant Professor at SUNY Stony Brook, I've benefited from the friendship of Brandon Bartels and Rene Lindstaedt.

I am especially grateful for the friendship of Dan Corstange, Sarah Croco, Tom Flores, Karen Jusko, Gil Quincy Krakowsky, and Irfan Nooruddin. To say that my experience at Michigan would not have been nearly as fun without them is a huge understatement. Katie Drake gives me perspective and deserves credit for sticking with me—despite all the highs and lows of graduate school and the dissertation process.

My family's continual support of me was vital in helping me finish the dissertation. I am thankful for and deeply humbled by the numerous sacrifices my parents have made for me over the years to make this possible. My sister was a constant source of inspiration, despite her claim that she would always be the only "real" doctor in the

family because only she actually “saves lives” on a daily basis.

## Table of Contents

Dedication	ii
Acknowledgements	iii
List of Figures	vii
List of Tables	ix
Chapter 1. Introduction	1
Chapter 2. Theory: Parties and Technological Development	41
Chapter 3. OLG Parties and Human Capital Formation	81
Chapter 4. OLG Parties and Total Factor Productivity	126
Chapter 5. Conclusion	158
References	168

## List of Figures

### Figure

1.1 Growth in total factor productivity and output per worker growth	19
1.2 Growth in capital per worker and output per worker growth	20
1.3 Secondary school attainment: Latin America and the Caribbean	21
1.4 Secondary school attainment: Sub-Sahara Africa	22
1.5 Technological Capabilities Index: Latin America and the Caribbean	23
1.6 Technological Capabilities Index: Sub-Saharan Africa	24
2.1 Savings in Singapore and world average 1960-2000	51
2.2 Strategies of growth and the immediacy-sustainability tradeoff	52
2.3 The immediacy-sustainability tradeoff with a period of political evaluation	54
2.4 Timing of technology policy deployment	78
3.1 Education spending and secondary education attainment	84
3.2 Party age and education spending	87
3.3 Party age and secondary education attainment	87
3.4 Party age and tertiary education attainment	88
3.5 Time since formation for the ruling party	95
3.6 Theoretical expectations	109
3.7 Marginal effect of party age modified by 5-year seat share average	121
3.8 Marginal effect of party age modified by 3-year seat share average	122
3.9 Marginal effect of party age modified by investment share of GDP	124
4.1 Capital stock, productivity, and output per worker	129
4.2 Distribution of total factor productivity (1981-2000)	136



4.3 TFP, capital per worker, and per worker output (1981-2000)	136
4.4 Party age and TFP by panel	141
4.5 Distribution of party age by panel	148
4.6 Partial regression plots for Panel 2	151
4.7 Marginal effect of party age modified by 3-year seat share average (1991-2000)	152
4.8 Marginal effect of party age modified by 3-year seat share average (1981-1990)	154
4.9 Marginal effect of party age modified by 3-year seat share average (Pooled sample)	155

## List of Tables

### Table

3.1 Regression Results: Baseline model	112
3.2 Regressions Results: Secondary education models excluding outliers	113
3.3 Regressions Results: Tertiary education models excluding outliers	115
3.4 Regressions Results: Bounded-influence and and “robust” estimation	117
3.5 Regression Results: Party age modified by 5-year seat share average	119
3.6 Regression Results: Party age modified by 3-year seat share average	120
3.7 Regression Results: Party age modified by investment share of GDP	123
4.1 Regression Results: Party age and TFP (Pooled panel)	142
4.2 P-values from comparison of means tests evaluating the age of the largest government party by region.	143
4.3 Regression Results: Party age and TFP by panel	145
4.4 Countries included in Panel 2 only and summary statistics by panel	147
4.5 Regressions Results: Marginal effect of party age on TFP modified by 3-year seat share average	150

# Chapter 1

## Introduction

Why some countries are richer than others and why income in some countries grows more rapidly than in others are questions that have long been at the very center of the economics and political science disciplines. Indeed, few questions receive the attention as those related to economic prosperity as Nobel Laureate Robert Lucas' often-quoted passage reflects:

Is there some action a government of India could take that would lead the Indian economy to growth like Indonesia's or Egypt's? If so, *what*, exactly? If not, what is it about the 'nature of India' that makes it so? The consequences for human welfare involved in questions like these are simply staggering: Once one starts to think about them, it is hard to think about anything else (1988, p.5 emphasis original).

We have yet to uncover all the variables that affect economic performance of course, but some factors are becomingly clear. In particular, we have learned that gaining purchase on the development question requires a more thorough understanding of the productivity of inputs in the production process. Many would agree with Paul Krugman's observation that "Productivity isn't everything [for economic growth], but in the long run it is almost everything" (1992, p.9). On this point, Hall and Jones (1999) cite some revealing statistics:

In 1988, output per worker in the United States was more than 35 times

higher than output per worker in Niger. In just over ten days, the average worker in the United States produced as much as an average worker in Niger produced in an entire year. . . . Different capital intensities in the two countries contributed a factor of 1.5 to the income differences, while different levels of educational attainment contributed a factor of 3.1. *The remaining difference—a factor of 7.7—remains as the productivity residual* (p.83, emphasis added).

These statistics indicate that most of the differences in per worker output lies in a “productivity residual” as opposed to the stocks of capital and labor. And, as other scholars have argued and shown empirically, technological capacity comprises a large share of the productivity residual (Easterly and Levine 2001; Mokyr 1990; Grossman and Helpman 1997; Prescott 1988). Thus, technological progress is vitally important for economic development.

But what underpins the observable variations in technological capacity and the pace of technological progress? What explains variations in the pace of which economic actors in different national economies innovate or adopt new productivity-increasing technologies and processes? Growth economists have answered these questions with a focus on how various aspects of the economic environment, particularly the level of competition, affect incentives for firms to engage in innovation and adopt existing technologies (Aghion and Howitt 1993; Aghion 2004; Grossman and Helpman 1997; Knot and Posen 2003). A second literature studies the content and comprehensiveness of countries’ “national technology systems”, the set of existing public policies (e.g., government R&D funding schemes, public education spending) and institutions (e.g, the efficiency of physical and intellectual property rights and linkages between the state and industry) that affect the likelihood that economic actors will engage in innovation and technology adoption (Lall and Pietrobelli 2002).

While economists have developed many important and useful insights, the political underpinnings of technological progress are not particularly well-understood. Even as the evidence becomes increasingly clear that technological progress is the “lever of riches” (Mokyr 1990) and we gain insight into the kinds of public policies that fuel economic innovation and imitation, we know little about the conditions in which incumbent politicians, who after all have the means, motive, and opportunity to manipulate the economy, will deploy these policies. Therefore, while understanding how policies can catalyze technological progress by, say, reducing the costs and risks of private research activities and minimizing the salience of market failures is a useful addition to our knowledge, we need to push further if we are to understand if some government will actually deploy the kinds of policies in question. Political scientists have not paid much attention to the topic of technological progress however and as a result, we know little about its political determinants. This dissertation seeks to provide a clearer understanding of the issue by investigating the conditions in which politicians are likely to make a concerted effort to promote technological progress.

### **1.0.1 A role for politics?**

How might politics matter? Many will argue that the best thing a government can do to promote technological development is to stay out of the economy altogether and allow markets to operate freely. A common argument is that “state failure” is the largest hindrance to technological development and economic growth generally speaking. Many political economists have taken this argument to heart and in their studies of technological development they study constraints on government predation and institutions that produce credible (read: stable) economic environments. The crux of credibility models is that states are notoriously predatory and they seek rents whenever possible. Thus, if such actions are utility-increasing, agents of the state will have no qualms about capturing profits produced by investments in technological

development or renegeing on policy promises. However, an institutional environment that constrains the government's "grabbing hand" and provides incentives for leaders to keep their policy commitments will increase the returns to economic investments, including those into innovation and technology adoption.

Rivera-Batiz (2002) is a good example of the credible constraints argument. He models an economy in which profits from new technologies are subject to a tax, collected by state bureaucrats, who also have an opportunity to demand bribes on top of the official license. The value in creating new technologies or adopting existing ones decreases with the size of the bribe such that in the extreme case where officials capture all the profits from a successful innovation or adoption, the expected value of research is zero and technological development stalls. The author contends however, that bureaucrats' have some known probability of being punished for their rent-seeking behavior that is a function of existing rules and institutions.<sup>1</sup> In environments with institutions that constrain profit-capturing behavior, bureaucrats' incentives to seek bribes diminish. Hence, countries with institutions and rules that provide strong restraints on the state's predatory instincts—that is, states with "good governance", to use the author's somewhat problematic terminology—will also have firms that can expect to reap the financial rewards of technological development.<sup>2</sup>

McMillian and Masters (2003) develop another credibility model of technological progress. In their model, technological development requires that economic actors allocate funds to innovation or technology adoption over a series of years; one-off public investments and policy commitments will not produce the gains in productivity for which they are intended. Accordingly, a serious hindrance to technological development is a time inconsistency problem in which politicians find it difficult to

---

<sup>1</sup>The size of the bribe itself is also important in this regard.

<sup>2</sup>For similar arguments see (Hall and Jones 1999 and Olson, Sarna, and Swamy 2000).

credibly commit to maintaining economic conditions that rewards economic actors' investments in technology development for a sufficiently long period of time. Where incumbents are not credible, say because of political instability or a lack of incentives to commit to advertised policy promises and platforms, firms have few incentives to invest in technological development projects. McMillan and Masters conclude that the inability to commit to policies over a number of years is one reason why many African countries, which often have unstable and weakly-institutionalized political regimes, have too little technological development. Leaders in African countries cannot credibly commit to the continued deployment of policies that catalyze technological progress and the national economy reflects this commitment problem.

Both Rivera-Batiz and MacMillan and Masters construct models in which the key political dimension is the degree of government credibility. The roots of models like these lie in neoclassical economics where it is assumed that economic behavior of all sorts, including investments in technological development, respond frictionlessly to relative prices. If only politicians can credibly commit to refrain from predation and commit to sustaining technology-oriented policies over time, technological progress will surely follow. Even as there is much support for arguments like those discussed above, I take a different approach, one that gives more attention to the likelihood that political leaders will deploy certain policies thought to catalyze technological progress such as education spending and subsidies and tax credits for firm level research and design spending. I depart from the credibility model, even as it has much support, because limiting the role of politics to credibility has the important weakness of underestimating the seriousness of several market failures that requires public policy to resolve. Lall and Pietrobelli, for example, write:

It cannot be assumed that over time enterprises will move automatically and efficiently into more difficult technologies (or taking on more complex tasks) in response to changing prices and factor endowments. Techno-

logical upgrading and deepening requires enterprises invest in more advanced—and so costly uncertain and prolonged—learning processes. *In the presence of externalities and deficient factor markets, such investment will be deficient in free markets. Policy interventions are then needed to overcome market failures—to tackle learning costs, promote externalities and linkages, coordinate factor market improvements with needs, and develop institutions. In the final analysis, therefore, national technology systems depend on the effectiveness of industrial policy* (2002, p. 10; emphasis added).

To see their point, consider one especially important market failure: the supply of human capital. Undoubtedly, technological development progress requires a critical mass of labor with sufficiently high human capital, which increases the success rate of research and imitative endeavors (Mani 2002; Papageorgiou 2002; 2003; Mayer 2001; Arrow 1962; Lucas 1993). That said, strong theoretical arguments exist that indicate that the supply of human capital will be far below that which is optimal absent productive public policy. Crucially, political credibility alone will not alter this conclusion.

Consider a polity with one industry and two competing firms and where educating the work force is left entirely to the firms. In this economy, inevitably some portion of the education a worker receives is general knowledge that is applicable in either firm. In this environment, an appropriability problem produces a systematic undersupply of education investments. The problem is that firms cannot ensure that they will recoup the returns to their education investment. Competing firms have an incentive to wait until the other firm educates its workers and then “poach” those workers, thereby gaining all the economic benefits of human capital without having to invest the financial resources associated with supplying education. Absent some factor that would prohibit workers from moving to another firm, neither has a strong incentive



to invest in education; free-riding is the dominant strategy.

Note that political credibility does not resolve this dilemma. Adhering to the rule of law, reigning in predation, and committing to sustain a given policy over time may make research spending more profitable, but these acts do not ensure that firms will recoup their education investments should they make them. Credibility cannot remedy the fact that poaching is the dominant strategy. What would increase the supply of human capital in this environment is the presence of some third party that supplies education, thereby reducing the firm-level costs of education. To understand the supply of education spending, we need a clearer understanding of the role of the state beyond credible constraints and commitments.

Nor is a focus on political credibility sufficient to help us understand how firms cope with the considerable economic costs and risks associated with innovation and technology adoption. As Metcalf (1978) writes, inherent to the processes of technological development is the nontrivial probability that “the unexpected might occur, relative prices might change, technical barriers may prove greater than anticipated and competitors may leapfrog a firm’s line of development with a superior technology” (56). In fact, Metcalf’s study reveals that 60% of all R&D projects fail in the sense that they do not produce a viable (i.e., productivity-increasing) technology. Rostow (1975) concurs writing, “[A]n act of innovation by an entrepreneur, public or private, involves risk. He must decide to invest his own or borrowed capital in a new form of production or service. He may or may not receive the higher profit for which he hopes” (134).<sup>3</sup>

---

<sup>3</sup>Game theoretic and simulation-based approaches to the process of technological development explicitly incorporate such uncertainty into their models. Aghion and Howitt (1993), for example, model the arrival of new ideas as an exogenously specified Poisson process in an attempt to capture the stochastic nature of idea creation. Several scholars have also conceptualized innovation as a process akin to biological evolution and, again, at the center of the process is uncertainty as it is never clear which “adaptations” will succeed and which will fail (Mokyr 1990; Nelson and Winter 1982).

That “[t]here is nothing preordained about innovation. . . there are 100 ways that this process could go wrong” (Mokyr, quoted in Mandel 2004 p.96), means that economic actors that consider investing in technological development take on considerable risks. Absent some sort of risk-sharing agreement with owners of capital, firms will invest in levels that are below optimal. While it need not be the case that firms turn to the state for capital—firms can, of course, turn to financial markets—there are sound reasons to believe that the state can be an important source of risk sharing. In many less developed and transitioning countries for example, domestic capital markets are not suitably developed to finance efforts at technological development and so the state may well be the best source for risk sharing (Gerschenkron 1967). Even when financial markets are developed however, public policies that offset these costs and risks are still important tools for technological development. Economists have shown that government-issued R&D tax credits, and subsidy schemes, act as complements to private R&D spending (Hall and van Reenen 2000). In a sample of 17 OECD countries for example, Guellec and von Pottelsberghe (2003) for example, find that “among the major instruments of government policy, both fiscal incentives and direct funding stimulate business-funded R&D” (237).

In summary, a role for politics exists beyond the degree of political credibility; public policy also matters. As the mantra of William Easterly’s book, *The Elusive Quest for Growth* goes, “people respond to incentives” (2001). This is undoubtedly true and for the economic actors on whom technological progress relies, some of the most important incentives stem from the policies deployed by governments.

Accordingly, I investigate the conditions in which politicians are likely to promote technological progress as a source of economic growth. An important point to recognize, however, is that a policy portfolio designed to stimulate innovation and technology adoption is only one way an incumbent can stimulate growth. Governments can instead, or in some combination, use policies that encourage the accumulation of

capital and labor to generate growth (Acemoglu, Aghion, and Zilibotti 2004; Pinto and Timmons 2005; Przeworski, Alvarez, Cheibub and Limongi 2000). To see the distinction, recall the Cobb-Douglas production function

$$Y = A(K^\alpha L^{1-\alpha}), \tag{1.1}$$

where  $Y$  represents output for country  $i$  at time  $t$  (subscripts removed),  $K$  represents the stock of capital,  $L$ , the stock of labor,  $0 < a < 1$ , and  $A$  represents the level of technological knowledge. Now, arranging Equation 1.1 in terms of growth rates (logging each term in equation 1 and taking the derivative with respect to time), we arrive at

$$\frac{\dot{Y}}{Y} = \alpha \frac{\dot{K}}{K} - (1 - \alpha) \frac{\dot{L}}{L} + \frac{\dot{A}}{A} \tag{1.2}$$

There is reason to believe that the accumulation mechanisms (increasing  $K$  and/or  $L$ ) and the technology mechanism (increasing  $A$ ) are manipulable by distinct government policy portfolios. Examples of policies associated with increasing  $A$  might be government fiscal incentives that encourage firm-level R&D spending to innovate and imitate frontier technologies and post-primary education spending to develop a cohort of engineers, scientists and business managers that are vital for the success of such research programs. Included in the accumulation strategy (increasing  $K$  and/or  $L$ ) are policy options such as compulsory savings programs and low tax regimes to mobilize savings and wage repression as well as primary education spending.<sup>4</sup> The presence of distinct mechanisms means that an incumbent facing an obligation to pursue growth can fulfill that obligation by initiating policies that encourage the accumulation capital and labor, that promote technological progress, or some combination of these

---

<sup>4</sup>Later in this chapter and in Chapter 2, I discuss the representative policies of each strategy in more detail.

options.

Inasmuch as politicians can manipulate these distinct growth mechanisms through the policies they initiate, the pursuit of growth via technological progress is best conceptualized as an explicitly political choice incumbents make in their effort to retain power. Accordingly, my dissertation studies what choices incumbents make regarding how to encourage growth. *What is the mix of accumulation and technology policies that leaders deploy? What is the premium that government place on technological progress?* These are the central questions of the dissertation. In focusing on these questions, I take an important departure from the existing literature on the politics of growth, much of which asks *whether* incumbents will pursue growth. This is certainly an important issue, but nested within it is another question: what strategies of pursuing growth are the most politically profitable? Models investigating whether incumbents will pursue growth leave open this important dimension and, as I discuss later in this chapter, such an omission is quite important for our understanding of development.

This introductory chapter charts the course for the rest of this dissertation. It begins with a discussion of the importance of technological progress for economic development, drawing from Schumpeter and Robert Solow and other growth economists. Subsequently, I discuss the puzzle observation that motivates the research. From there, I briefly outline the theoretical framework. I conclude with an outline of the dissertation's chapters.

## **1.1 Technological Progress and Economic Development**

The question that begs asking is what precisely is the significance of understanding the mechanisms that drive a national economy's growth experience? If indeed both accumulation and technological progress can generate increases in income as Equations 1.1 and 1.2 show, what is the value-added of distinguishing between them? A

useful place to start a response to this question is with the growth experience of a handful of East Asian economies.

As has been recounted numerous times, the latter half of the twentieth century witnessed the extraordinarily rapid development of several East Asian countries. The development experience there inspired scholars to investigate what fueled such rapid improvements in economic conditions. Paul Krugman (1994) set in motion an important debate, arguing that the development path of those countries was not nearly as “miraculous” as others had deemed it, but rather was due to a process of Soviet-style investment in physical capital and efforts to mobilize the labor force (1994). As in the Soviet-Union, massive state-led investment and “forced savings” programs spurred accumulation in physical capital, while those same governments went to great lengths to mobilize labor through a variety of different policy instruments, including wage suppression and primary education spending. It is not surprising then, that rapid economic growth followed.

Krugman’s analysis continues, however, with the dispiriting proposition that because those countries failed to experience substantial gains in factor productivity as a function of technological development, their growth trajectory is neither miraculous nor sustainable. Accumulation-driven growth, he argues, suffers from diminishing returns such that the marginal effect of accumulation ultimately falls to zero and increases in income stop. Krugman’s conclusions regarding the sources of East Asian growth are disputable (Chen 1997), but his logic regarding the general implications an absence of productivity growth has for the prospects of sustained economic growth receives strong support. Krugman reaches his grim conclusions with a reliance on Solow’s papers of the mid 1950’s (1956; 1957), which have since become the cornerstone of present understanding of the growth process. One takeaway conclusion from these papers is that absent technological progress, countries simply cannot sustain per capita income growth indefinitely. The inherent drawback of accumulation-driven

growth is that diminishing returns ensures that growth is destined to stall and the economy tends toward a “steady state.” Aghion (2004) summarizes the conclusion well and is worth quoting at length here. He writes:

In the absence of . . . technical progress. . . an economy cannot grow faster at a positive rate. Indeed, because of diminishing returns to capital, [national income] does not grow as fast as the capital stock, which in turn means that savings cannot grow as fast as [the rate of capital’s] depreciation. Eventually, depreciation catches up with savings and at that point the capital stock stops rising and the economy stops growing (2-3).

Stiroh (2002) states the implications of this line of thought as follows. “The striking implication of the neoclassical model is that, in the long run, per capita output and productivity growth are driven entirely by growth in exogenous technical progress and they are independent of other structural parameters like the savings rate” (39). As Romer (1992) shows, this dilemma is not resolved even after modeling the role of human capital. He writes, “But to explain productivity growth through these increases in human and physical capital begs the question of where the increased value of the capital originates. *The increased value is in new ideas*” (71, emphasis added). In short, the implication of “Solow’s Surprise” as Easterly (2001) calls this line of argument, is that long-term, continuous per capita income growth cannot arise from mobilizing the inputs to production. Rather, something else is needed—namely technological progress, Romer’s “new ideas”, which can increase the productivity of these inputs and as far as we can tell, does not experience diminishing returns.

These arguments are reminiscent of Schumpeter’s seminal works on economic development (1934). For Schumpeter, the significance of technological progress is hard to understate; its importance lies in its ability to break the “circular flow” of economic activity, a theoretical equilibrium during which economic development is wholly absent and national economies have little opportunity to move beyond the status quo

level of economic prosperity. Indeed, for Schumpeter, the concept of economic development itself is linked inseparably to the process of innovation. In his formulation, achieving development requires the efforts of profit-seeking entrepreneurs who have conceived new products, processes and business models, all of which can increase the productivity of factor inputs. These innovations, which are likely to occur as a function of the “creative destruction” dynamic, spur forward economic development. Absent these innovative and imitating entrepreneurs, technological progress stalls and so too does economic development.

Mokyr (1990) expands on the importance of technological progress, so-called the “lever of riches” because it provides a ‘free lunch’, “an increase in output that is not commensurate with the increase in effort and cost necessary to bring it about” (3). A basic, albeit incomplete definition of economic development is the process of expanding the production capacity of an economy. Development is the process by which an economy is able to produce (1) an increasing amount of products by, say, increasing the productivity of capital and labor, (2) an increasing array of available products, such as moving from an agricultural economy to an industrial one, and then broadening the scope of the industrial sector and, (3) an increase in the quality of existing products (Grossman and Helpman 1997). Mokyr details, technological progress is an essential part of all these processes. It is exactly that process in which actors create altogether new products, new production techniques, and improve product quality. By contrast, mobilizing physical capital and labor can move an economy nearer the existing technological frontier, but it cannot extend the frontier itself, which means that whatever development does occur ultimately must end.

In summary, studying economic development requires that we take serious the role of time. As Robert Bates writes, “Development . . . highlights the temporal, rather than the spatial, element of human societies. The study of development must therefore take into account the passage of time” (quoted in Nooruddin 2003 p.15). Significantly,

it is precisely the temporal dimension that gives salience to the distinction between accumulation- and technology-driven growth. *How* a country experiences growth has implications for sustained improvements in welfare. Technological progress provides an escape from diminishing returns and therefore allows the possibility of sustained increases in per capita income over time. As North puts it, “the stock of knowledge and the stock of technology set upper bounds to human well being” ( 1981, p.17). None of this is to say that accumulation is unimportant. On the contrary, accumulating capital is a critical aspect of the process, as scholars have shown (Gerschenkron 1967; Mankiw et. al., 1992; DeLong and Summers 1991, Krugman 1994; Collins and Bosworth 1996; Bosworth and Collins 2003). The central conclusion however, is that growth *only* through accumulation is destined to stall and that long term growth requires the productivity growth that emerges from technological progress. According to Romer:

[I]deas are extremely important economic goods, far more important than the objects emphasized in most economic models. In a world with physical limits, it is discoveries of big ideas (for example, how to make high-temperature superconductors), together with the discovery of millions of little ideas (better ways to sew a shirt), that make persistent economic growth possible (1992; 64).

### **1.1.1 Technological development in developing countries**

Given this focus on sustaining growth over time, one might reach the conclusion that technological progress is a concern only for those countries that have already achieved high levels of wealth. After all, wealthy countries are capital abundant and have high levels of investment as a percent of their GDP and so increasing the productivity of investment is of the highest priority. The inverse of this statement is that low-income countries have little need for technological progress and so the



issues in question in this dissertation are moot for these countries. While it may be the case that countries at earliest stages of development can gain much from resource accumulation and mobilization, Acemoglu, Aghion and Zilibotti (2004) show that as they reach middling levels of wealth, continued growth and gains in economic competitiveness demand improvements in technologies that increase the productivity of capital and labor and also broaden the array of goods produced in the economy and their quality. Countries unable to make such a transition fall into development traps in which they fail to sustain growth and the development progress stagnates at some middling level of prosperity. Technological progress enables sustained growth, however.

Governments in less developed countries understand these points. Consider the following passage from the Kenyan government regarding its plan to achieve substantial development by the year 2020, thereby entering the group of newly-industrialized countries (NICs).

The vision to transform Kenya into a NIC by the year 2020 . . . calls for a critical re-examination of the country's [research and design (R&D)] policies and strategies . . . Kenya's industrial enterprises are characterised by obsolete technologies and inefficient machinery, often over 20 years old . . . Moreover, domestic engineers have had little success in adapting imported technologies to the domestic environment. There is little evidence of technology deepening or adapting foreign technologies to produce improved or new products. Kenya today lacks well-developed capacities to provide advice and information to technology users, has inadequate capacity to screen foreign technologies and is unable to formulate adequate technology-related policies or plans. There will be need for significantly increased skills at the enterprise level and in government institutions to address these shortcomings (Republic of Kenya 1997; quoted in Lall and

Pietrobelli 2002, p. 54- 55).

The Kenyan economy's distance from the technological frontier serves as a serious hindrance to its prospects of achieving greater economic prosperity. An economy characterized by obsolete and inefficient technologies and lacking incentives for economic actors to upgrade technologies will find it increasingly difficult to stay competitive relative to other national economies. Accumulating more capital may partly mitigate this concern, but its effect will be minimal if the accumulated capital is as obsolete and inefficient as the existing stock. Absent a concerted effort to upgrade production technologies, either through economic innovation, or, as is more likely in a developing economy like Kenya's, the adoption of frontier technologies and processes, this economy has little chance of experiencing further gains in prosperity.

This brings us to another important issue: whether a study of technological progress and development should address both outright innovation and the imitation or adoption of frontier technologies. A common notion is that the process of adopting such frontier technologies is relatively easy by comparison and as such, one should not combine innovation and imitation in the same theoretical and empirical analyses. Some have taken this position based on Veblen's (1915) scholarship on "catching-up" and the Gerschenkronian proposition that "Industrialization always seemed the more promising the greater the backlog of technological innovation which the backward country could take over from the more advanced country" (1952; p.8). Gerschenkron's point in this statement is not that technology adoption is itself an easy task, but rather that the prospects of development are considerable if follower countries can adopt those existing technologies. A more accurate reading of the Gerschenkronian view of "backwardness" is that taking advantage of lagging behind is arduous and while frontier technologies present opportunities for lagging countries, absorbing them into one's own economy requires a concerted effort on behalf of both economic and political actors. Indeed, often technology adoption demands the devel-

opment of “institutional instruments for which there was little or no counterpart in the established industrial country” (Gerschenkron, quoted in Fagerberg and Godinho, 2003). Moreover, scholars have documented that adopting frontier technologies in such a way to increase productivity in the lagging country is associated with many of the same costs and risks as outright innovation. According to Grossman and Helpman (1997), “the process of assimilating existing technologies in the less developed countries is not unlike that of creating entirely new technologies in the developed world. In each case, learning requires an allocation of resources and investments”(12). Pack and Westphal similarly write:

Important elements of the technology appropriate to particular circumstances can only be acquired through effort to apply existing knowledge to those circumstances. Effort is required in using technological information and accumulating technological knowledge to evaluate and choose technology; to acquire and operate processes and produce products, to manage changes in products, processes, procedures, and organizational arrangements and to create new technology. *This effort takes the form of investments in technological capability . . .* (p.105; emphasis added).

The investments in technology adoption and diffusion are not unlike those necessary for outright innovation. Both are costly in financial terms and expose the firm to risks. Just as no guarantees exist that investments in innovation will produce a viable technology, no assurances exists that a follower firm will successfully and efficiently adopt and adapt existing technologies in a way that increases their own productivity and competitiveness. In short, technological progress matters in less developed countries too.

## 1.1.2 Empirics on Technological Development

Econometric models support and reinforce the importance of technological progress for development, allowing Schmookler to write in 1966 that “the creation and diffusion of technological knowledge is at the heart of modern economic growth is now widely accepted” (1966; p.vii). Much of our empirical results come from “growth accounting” models that estimate the importance of capital, labor, and a residual for levels of output and the pace of output growth. The received wisdom from these models is that the residual—the proxy of technological progress, (variously called the “Solow residual” or total factor productivity (TFP))—plays a significant role in explaining economic output and its rate of growth.<sup>5</sup> Easterly and Levine (2001) argue for example that the residual accounts for some 60 percent of output. Solow’s own estimate is approximately 88 percent (1957). Klenow and Rodriguez-Clare (1997) conclude that TFP accounts for 90 percent of the cross-national variation in output during 1960-1985.<sup>6</sup> Figure 1.1 shows the relationship between output growth and growth in TFP using Klenow and Rodriguez-Clare’s data. The figure plots the average rate of output growth between the years 1960 and 1985 and the average rate of total factor productivity growth for a number of developing and OECD countries. The relationship is strong and positive suggesting that higher rates of TFP growth are correlated highly with faster rates of economic expansion.<sup>7</sup>

By implication, the data should suggest that accumulation plays a smaller role

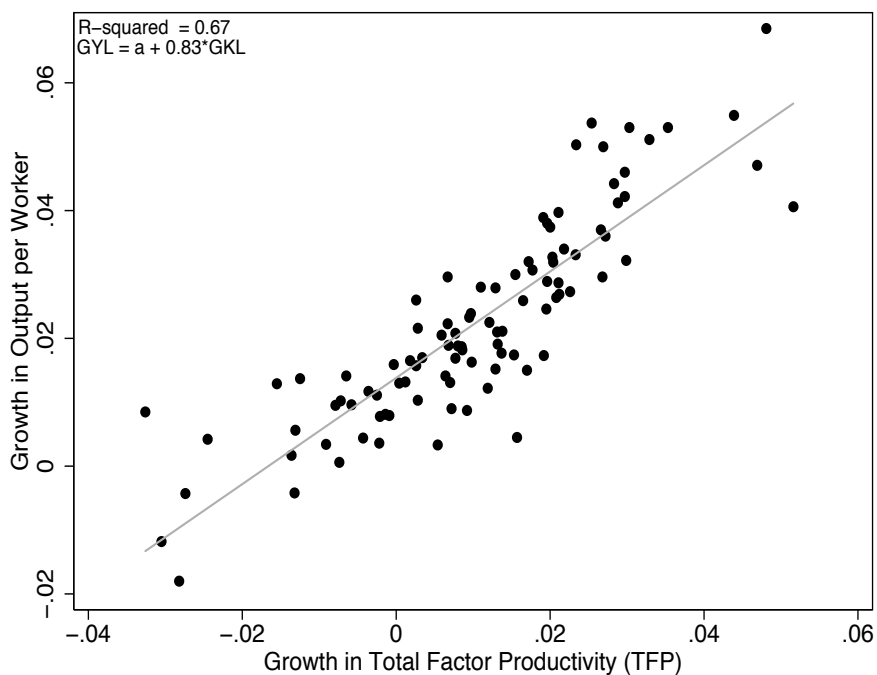
---

<sup>5</sup>Griliches (2000) comments that the Solow residual is a bit of a misnomer as Solow was not the first scholar to propose this indicator as a measure of technological capacity and progress.

<sup>6</sup>See Hall and Jones (1998) and Prescott (1998) for similar conclusions. See Mankiw, Romer and Weil (1993) however for a dissenting opinion on this topic. Note that, while the critics find that TFP accounts for a smaller share of output and output growth in comparison to the cited works, TFP’s share is nonetheless still sizable.

<sup>7</sup>The relationship was also plotted (not shown) for samples of OECD and developing countries separately, and the relationship did not change. Similar results were obtained using data from Hall and Jones (1998).

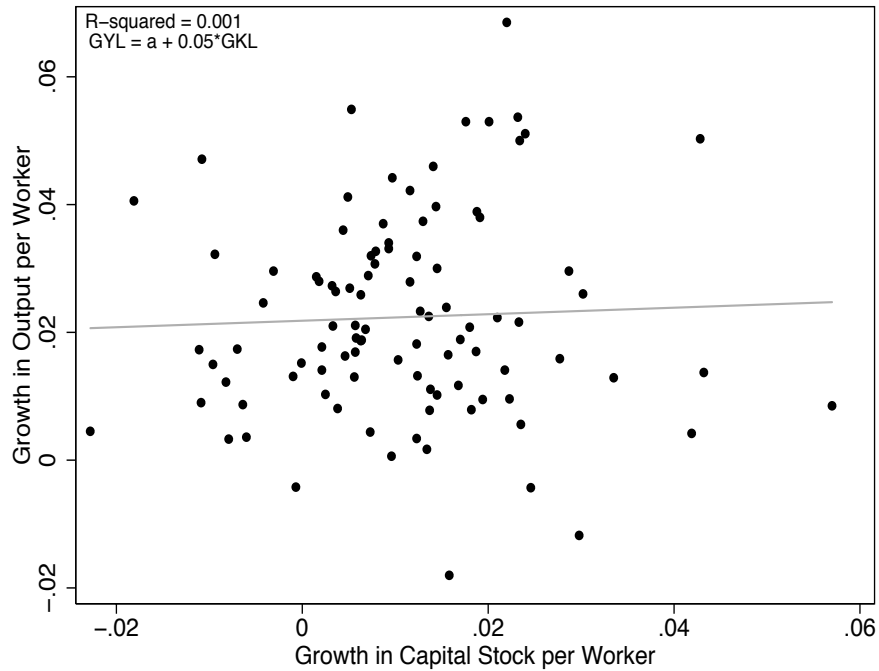
Figure 1.1: Growth in total factor productivity and output per worker growth



in explaining output growth. We see evidence of this weaker relationship in Figure 1.2, which plots total output growth by growth in the per worker capital stock. The effect of capital on output growth is positive as expected, but the relationship is considerably weaker implying that something else seems to drive the cross-national variation in output growth. This “something else” seems to be TFP.

Not surprisingly, the data also reveal very large variations in both the levels of current technological development and the pace at which those levels change over time. Unfortunately a single unassailable measure of technological development does not exist but we can gain a sense of the variations by relying on a series of indicators. Consider first, *human capital formation*, measured according to the percent of the population with some secondary education. There is little doubt that education is essential for technological progress. It increases the success rate of R&D (Arrow 1962; Lucas 1993) and, according to Papageorgiou (2002), the prospects of engaging in successful technology adoption depend on the level of human capital in

Figure 1.2: Growth in capital per worker and output per worker growth



a country. Furthermore, Papageorgiou (2003) finds that human capital at the level of post-primary education is a better predictor of the level and pace of technological development than human capital at the level of primary education.

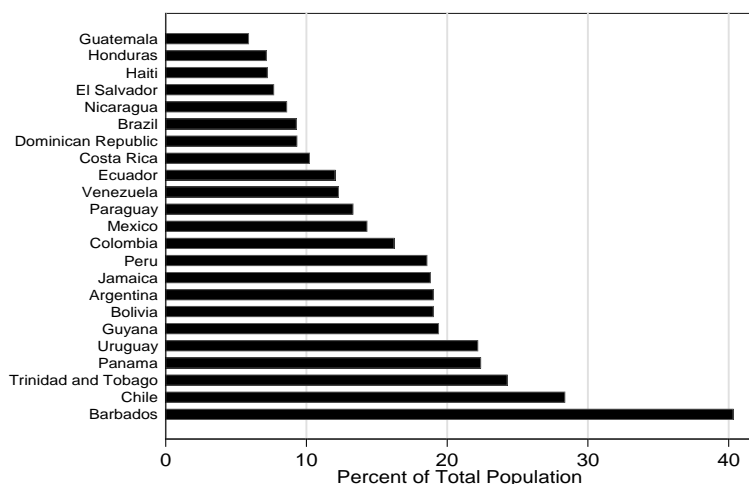
We can get a sense of the likely variation in technological capacity and prospects for technological development, then, from education statistics. Figures 1.3 and 1.4 show data on the percent of a given country's total population above 25 years of age that have some secondary education for a host of countries, with data averaged between the years 1960-1999.<sup>8</sup> The graphs are ordered by region for presentational purposes only. The cross-national variations in the figures are stark. In Latin America and the Caribbean (Figure 1.3), the variations ranges from about 5% of the adult population with some secondary education in Guatemala and Honduras to over 25% for Chile and even higher in Barbados. Similar variation exists in sub-Saharan Africa

---

<sup>8</sup>The data come from Barro-Lee 2000.

(Figure 1.4).<sup>9</sup>

Figure 1.3: Secondary school attainment: Latin America and the Caribbean

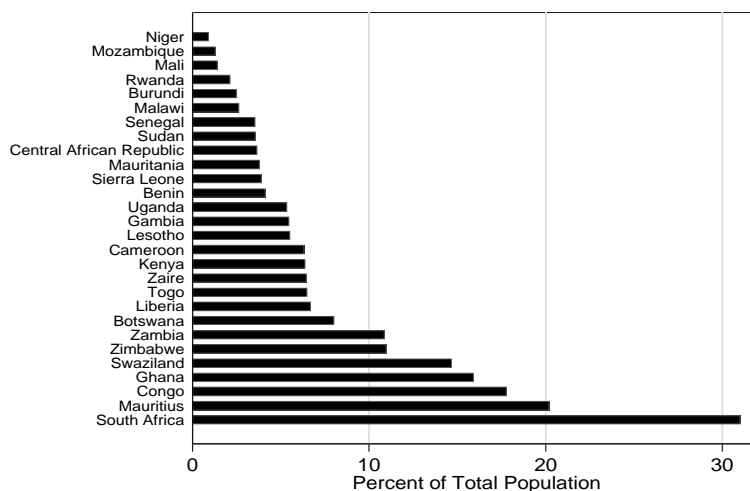


Another useful indicator is Archibugi and Coco's (2003) Technology Capabilities Index. The index is composed of three dimensions that the authors contend indicate a country's level technological development and its capacity to experience further technological progress. The three dimensions are (1) country *i*'s capacity and proven ability to create new technologies; (2) the quality of country *i*'s technological infrastructure; and (3) its stock of human capital. The authors collect data on eight variables, each of which fit into one of the three dimensions. The variables are as follows (text in parentheses indicates the dimension in which the variable is included): patents technology (technology creation), scientific articles (technology creation), internet penetration (infrastructure), telephone penetration (infrastructure), electricity consumption (infrastructure), tertiary science and engineering enrollment (human

---

<sup>9</sup>Graphs for the other regions in the world show the same trends. They are not presented here to preserve space. Graphs for the excluded regions are available from the author upon request.

Figure 1.4: Secondary school attainment: Sub-Sahara Africa



capita), mean years of schooling (human capital), literacy rate (human capital).<sup>10</sup>

For each of the eight variables, country  $i$ 's score is calculated as  $(X_i/X_{max})$ , where  $X$  is the variable in question and  $max$  represents the best score in the population of cases. For example, Finland has the highest percent of total university students enrolled in science and engineering related subjects at 32.6%. As such, Finland's score on that particular variable is 1.000, while Lebanon, with about 11% of all university students in science and engineering courses receives a score of 0.338. Thus, each country is coded according to how near it is to the technological "frontier". The authors then calculate scores for each dimension by averaging the scores of the

---

<sup>10</sup>Variable definitions: *Patents*: invention patents registered at the U.S. Patent and Trademark Office normalized by the country's population. Patents taken out in the United States by the inventor's country of residence were considered; *Scientific articles*: Number of articles published in any of 8,000 journals included in the Scientific Citation Index, normalized by the country's population; *Internet penetration*: Number of internet users normalized by population; *Telephone penetration*: Number of telephone users normalized by population; *Electricity consumption*: Electric power consumption(kilowatt per hour per capita); *Tertiary Education*: Percent of total university students enrolled in science and engineering related subjects *Mean years of schooling*: the average number of years of school completed in the population over 14; *Literacy rate*: the percentage of people over 14 who can, with understanding read and write short,m simple statements about their everyday life.

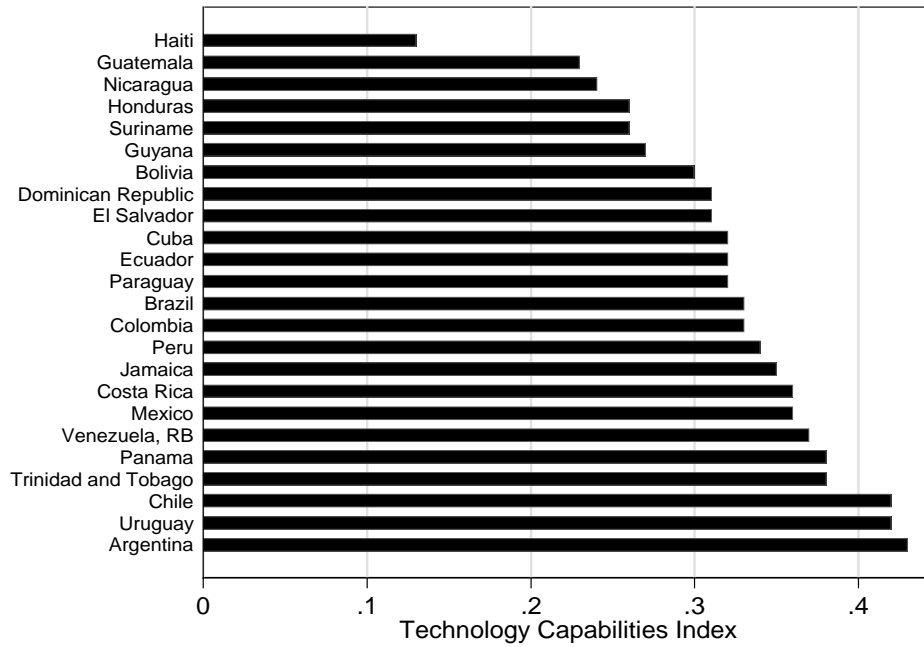


variables included in each dimension. Finally, the authors create the technological capabilities index score (denoted  $ArCo$ ) as follows:

$$ArCo = \sum_{i=1}^3 \lambda_i I_i, \quad (1.3)$$

where  $I_i$  represents the three dimension scores and  $\lambda_i$  the constants  $1/3$ . Cross-national variations in the next are stark as we see in Figures 1.5 and 1.6.<sup>11</sup>

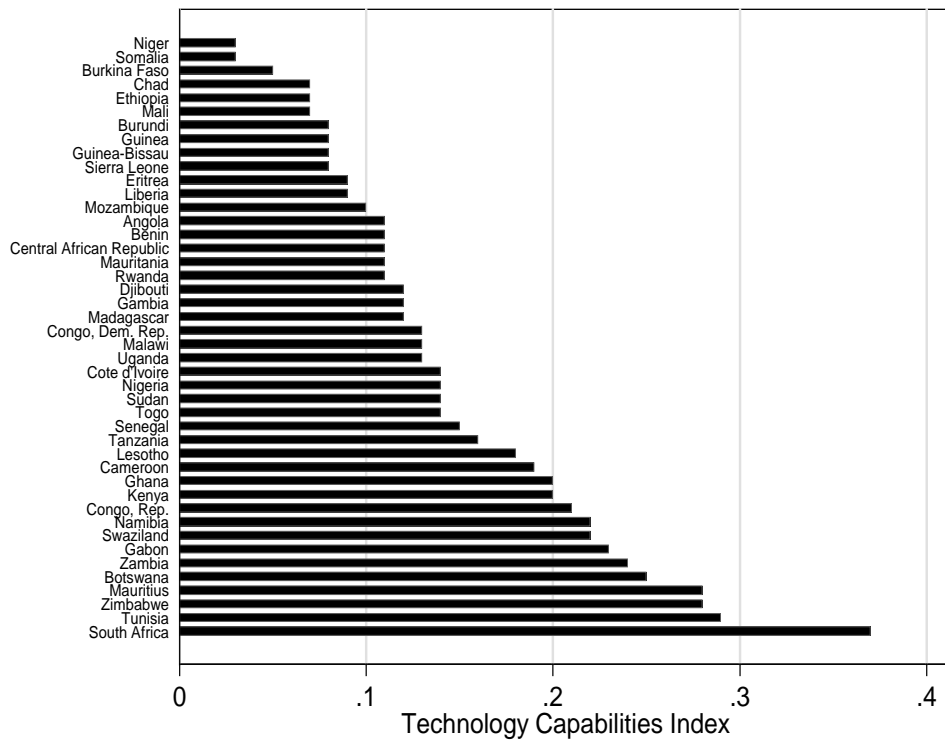
Figure 1.5: Technological Capabilities Index: Latin America and the Caribbean




---

<sup>11</sup>Graphs for the other regions in the world show the same trends. They are not presented here to preserve space. Graphs of the excluded regions are available from the author upon request.

Figure 1.6: Technological Capabilities Index: Sub-Saharan Africa



## 1.2 Motivating Observation

When will incumbents deploy technology-oriented economic policies is not clear. In fact, the time horizons leaders have seem wholly incompatible with the time horizons they would need to place some nontrivial value on technology policies. Politicians are notoriously shortsighted. In democracies, institutionalized election periods oblige office-seeking politicians to set policy with an eye toward the most immediate election period. In non-democracies, the *absence* of any institutionalized political selection mechanism also shortens horizons since in such conditions political evaluation is a continuous ongoing process and political survival is an ever-present concern (Olson

1993; 2000).<sup>12</sup> Short horizons are incompatible with incentives to value technology-oriented policies precisely because the economic policies in question have returns that are delayed substantially from the point of policy initiation, but still require large upfront financial costs. A leader considering a package of public policies designed at increasing the stock of human capital can expect a substantial lag between the date of policy initiation and the timing of the positive economic returns produced by those policies to exist. Producing a cohort of workers with sufficiently high human capital quite literally takes years. Additionally, a lag exists between developing that cohort and the point at which the returns of their innovative and technology adoption efforts arrive. Similarly, a leader that opts to subsidize or grant tax breaks for private R&D will not observe immediate economic returns. A substantial time is required for R&D projects to result in gains in productivity. Regardless of how politicians stimulate technological development, the positive and observable growth effects of their policies are deferred well into the future. Such delays are far too long to be politically profitable. Additionally, the accumulation mechanism have more immediate growth effects and delayed costs. Given this, it seems that leaders will eschew technology policies.

Why then, do politicians sometimes initiate policies designed to catalyze technological development? Consider a portfolio of policies initiated in South Africa in the late 1990s.<sup>13</sup> In 1993, the South African government commissioned a study of its technological infrastructure and prospects for future and sustained technological development. Among the conclusions were that South Africa required a substantial restructuring of its Science and Technology Ministry to allow for a more focused and

---

<sup>12</sup>When nondemocratic leaders do have long time horizons, often it is due to a complete absence of political contestation, which undermines any incentives legislators may have to care about positive economic performance at all (Lake and Baum 2001).

<sup>13</sup>The following discussion draws heavily from Mani (2002).

coherent approach to technology development and that the country needed to re-energize public R&D spending, which had begun to stall over the years. Finally, the report found that the country's stock of human capital was dire, due in large part to decades of apartheid rule.

In response, the South African government approved a set of policies intended to remedy these concerns. There were a variety of dimensions to the government's new technology direction but some particularly notable aspects of the new policy portfolio were the following:

**The Innovation Trust** A government-issued set of grants in which funds are distributed for use in large-scale projects that have a significant R&D component and that generate new knowledge of products. Examples of funded projects included grants to the biotechnology and telecommunications industries and grants to value-added in general manufacturing.

**The Technology and Human Resource for Industry Programme** A government grant program targeted at increasing "the number and quality of people with appropriate skills in the development and management of technology for industry" (38). The program does so by generating interactions between researchers in higher education, with firm managers. The program also gives incentives for high-skilled laborers to move to industries with the greatest potential for substantial technology development.

**The Support Programme for Industrial Innovation** A program oriented toward helping firms develop new technologies. Accepted applicants are awarded funds from the government to use in conducting feasibility studies for the development of new technologies. The program can also be used to fund feasibility studies for technology adoption. Through this program, firms could also receive government grants matching up to 50% of firm investments allocated toward

developing new technologies.

Why did South Africa deploy these policies. Why too, did leaders in the United States initiate the “Protecting America’s Competitive Edge Through Education and Research” (PACE) Act, which legislates increases in spending on science and mathematics teachers at all grade levels and provides numerous incentives to encourage students to study these fields in high school and college? The act also calls for “federal research agencies to allow eight percent of [their] R&D budgets to be devoted to high-risk, high payoff research.” The bill would also double “the current R&D tax credit (20% to 40%) and expands the credit to allow 100% of the cost of all research conducted by consortium, small businesses, federal laboratories and universities (current law limits the 100% cost inclusion to energy research). The entire R&D tax credit would also be made permanent” (Domenici, Bingaman, Alexander, and Mikulski 2006 p.1).

If leaders are shortsighted and if the policies in question are associated with returns that are delayed substantially, under what conditions are governments likely to place a nontrivial premium on policies designed to stimulate innovation and technology adoption? There is little research in comparative political economy that directly addresses these issues, but some existing arguments regarding the politics of economic growth might prove useful first approximations. One explanation turns our attention toward the state bureaucracy and the degree to which bureaucrats can be conceptualized as autonomous and embedded agents of the state (Evans 1992, 1995). The “embedded autonomy” argument recognizes that economic policymaking requires legislators engage in risky endeavors and initiate policies that may not have immediate results. Elected officials may not have the political flexibility or capacity to prioritize these kinds of policies given societal pressures and veto players, but autonomous bureaucrats have more freedom from popular accountability and those segments of society able to overcome collective action dilemmas to demand policies in their favor.

If bureaucrats have such autonomy, they may be able to make the tough choices and take the risks necessary to spur development forward. The argument continues however, proposing that officials need to embed themselves in the web of industry and business associations to gain the information about the various needs, capacities, and opportunities that exist in various business sectors to get a sense of how they can calibrate policies best.

There are some important deficiencies with the embedded autonomy rationale, however. Addressing the state's capacity to make politically-difficult choices is a useful aspect of the model, but the fact that the embedded-autonomy thesis does not address political *preferences* and incentives is a critical weakness. While it is possible that autonomous and embedded bureaucrats will use their flexibility and special knowledge to establish an environment that is good for economic performance, an equally plausible possibility is that embedded autonomy is a recipe for bureaucratic corruption and collusion between state officials and owners of capital. Where political accountability is weak and state officials have strong linkages with business groups that give them special knowledge of economic opportunities, what prohibits these officials from engaging in large scale rent-seeking and corruption rather than setting policies that encourage long-term economic growth? Indeed, if these officials seek to increase their own disposable income, it seems reasonable that lax accountability and specialized knowledge provide a greater incentive for rent-seeking than it does for setting "good" economic policy. This possibility is precisely what Rivera-Batiz's model identified as a hindrance to development. In short, a serious principal-agent problem exists in the embedded autonomy thesis that is not addressed. There can be little doubt that a quality bureaucracy matters, but without some framework with which we can understand why autonomy is good for growth rather than good for

corruption, the autonomy thesis is left underdeveloped in an important way.<sup>14</sup>

Other scholars have turned their attention to the role of regime type to understand the political economy of technological progress and development. Przeworski, Alvarez, Cheibub and Limongi (2000) for example, uncover the observation that “the factors that differentiate wealthy dictatorships from wealthy democracies are the patterns, not averages [of growth]” (167). In particular, they find that among a sample of “wealthy countries” dictatorships tend to achieve growth primarily through mobilizing labor and accumulating capital. Only a very small portion of growth in these regimes stems from gains in productivity and technological development. By contrast, their democratic counterparts tend to benefit more from technological progress and the productivity gains it brings and they rely less on mobilizing labor and physical capital. Evidence of this is that the dictatorships in the sample have labor force growth that is faster than in democracies (on average of 2.03% compared with 1.32%) but the productivity of that labor in dictatorships is much lower. Democracies, it seems, offer opportunities and access to better, more efficacious education and production technologies to workers.

Pinto and Timmons (2005) push this line of argument further, contending that regime type influences the degree to which an economy will experience technological progress by way of the pressures regarding taxation and redistribution that elected officials experience. The electoral connection provides incentives for incumbents to redistribute wealth in way consistent with Meltzer and Richard (1981). Because the median voter’s income is less than the average income in society, that citizen demands redistribution and elected officials respond accordingly. The redistribution obligation slows investment due to higher taxes on capital, but at the same time

---

<sup>14</sup>Nor is it clear under what conditions we should expect to observe sufficiently embedded or autonomous bureaucracies. The experiences from which these kinds of organizations emerged in countries like Japan are unlikely to be repeated and it is not clear that these experiences are generalizable.

redistribution in the form of education spending helps to forge human capital, which in turn increases the amount of innovation in the economy and the ease with which frontier technologies are adopted and applied efficaciously in follower economies. The redistribution obligation is absent in many dictatorships with the consequence that taxes on capital are less burdensome. While this encourages savings and investment, the absence of any redistribution obligation corresponds with lower levels of education spending, lower levels of human capital in the country, and hence less innovation and technology adoption.

One concern with the line of argument is the proposition that redistribution takes the form of spending on education. Even given the reasonable proposition that democratic rule supplies incentives for politicians to redistribute wealth, it is not evident why education spending would be the redistributive policy of choice. After all, spending on education does not actually redistribute wealth in the present period or even the immediate future. Other redistributive options exist for governments and why a government would opt to redistribute wealth through education spending as opposed to social insurance (for one example) is not clear from their model.

### **1.3 Summary of Theory**

The starting point for the theory is the recognition that attributes of the national economy are the aggregated results of the behavior of firms and individuals. This is perhaps an obvious point, but it is worth noting because the theoretical framework relies on arguments about the relationship between government policies and the behavior of these firms. Firms are profit-maximizing actors and to increase competitiveness and profit margins versus other firms in an industry, firm managers make choices over how to allocate scarce resources. One option is to invest in research projects that raise competitiveness through technological developments. Another option is to allocate resources toward increasing the stock of labor or the per worker



capital stock.

But what shapes the firm manager's precise allocation decision? Relative prices certainly matter, but the prices themselves are endogenous to a host of policies and programs implemented by the incumbent government. Incumbents have a number of policy instruments at their disposal to manipulate the economy and they have every incentive to employ those instruments to that end. They can, for example, shape the content of property rights and the extent to which those rights are enforced (North 1981) and/or affect the economy's supply of human capital through education spending. Rulers can also increase the intensity of efforts at innovation and imitation through subsidy schemes, tax credits and public-private partnerships (Mani 2002, Hall and Van Reenen 2000; Guellec, Dominique and van Pottelsberghe 2003 ).

These policies shape firm managers' expected value of allocating funds to research programs or toward the accumulation activities. We would expect for instance, that a typical firm would invest less in research activities if profits of successful innovations are heavily taxed, intellectual property rights are *de facto* or *de jure* weak so that competitors can free ride off the innovative efforts of other firms, and if human capital is undersupplied, thereby lowering the probable success rate of research endeavors. In such an environment, the firm is likely to hold technological development in disfavor and will instead prioritize the accumulation mechanism. By contrast, policy improvements will increase the expected returns of firm-level research and we would expect firms to act accordingly. It follows that the extent to which "perspiration or inspiration," fuels growth depends on the kinds of policies government deploy. The goal of this dissertation is to understand better the conditions in which incumbents supply the kinds of policies that stimulate research and the adoption of frontier technologies and the conditions under which they fail to do so and pursue growth through accumulation instead.

Importantly, politicians must consider that their available economic growth op-

tions are not perfect substitutes for each other but rather entail a tradeoff. For its part, even as it can produce results more immediately compared to the alternative, an accumulation strategy is unable to sustain growth over time (consistent with Solow's model recounted earlier). That accumulation suffers from decreasing economic returns is important because the effort to reinvigorate mobilization in the face of decreasing returns exhibits *political diminishing returns*. One can spur forward growth in the presence of diminishing returns by "ratcheting up" mobilization-oriented economic policies: lower the tax rate further, increase the rate of compulsory savings, further suppress wages, or some combination thereof. Each of these actions carry very real political risks however. Politicians can lower taxes only so far before reaching a budget constraint that forces them to make difficult choices about what items in the budget receive long-term funding reductions or whether the government should instead borrow and run a deficit. Nor can governments set compulsory savings at any rate they see fit. In the presence of a too-high compulsory savings rate workers may exit the formal economy altogether or engage in labor unrest. The same is true with respect to heavily suppressed wages.

The politician in such a circumstance faces a complicated dilemma. On one hand, failing to try to reinvigorate growth risks eviction from office as the rate of economic growth will fall below that which is necessary to win reelection. But further mobilization policies may be politically unpopular too. That said, there are two advantages to a mobilization-oriented growth strategy. The strategy produces observable rates of positive growth relatively immediately. And secondly, these economic and political diminishing returns may be deferred into the future. Decreasing returns do not emerge immediately, but set in over time.

Policies that spur innovation and the adoption of frontier technologies do not face the same kind of diminishing returns. In fact, as I will argue more fully in Chapter 2, these policies may have increasing returns. The tradeoff is that these policies require

substantial upfront costs that must be sustained over time even as the returns to those policy initiatives will not produce observable gains in economic performance immediately. How do politicians navigate this *immediacy-sustainability tradeoff*? I focus on the role of institutions, specifically political parties, in affecting the length of time horizons. Few institutions have the wide-ranging effects on the politics of a country as its parties and we might expect that if any institution shapes the length of time horizons, it might well be political parties.

Scholars have recognized, at least as early as Huntington (1969), that parties differ substantially in the degree to which they are institutionalized (Mainwaring and Scully 1995; Mainwaring 1999). Weakly-institutionalized parties often are fragile, poorly-organized organizations without coherent ideologies and strong roots in society. Not surprisingly, these parties fail to persist over time and tend to dissolve with the declining popularity of the party founder. By contrast, well-institutionalized parties are overlapping generations organizations—organizations that are long-lived despite the relatively short lives of the members of the organization. This is due to these parties' legitimacy among the citizenry and political elites, strong societal roots, and organizational structures that allow them to recruit new members, mobilize support, and persist beyond the political life of the founder.

That parties differ in the degree of “overlapping-ness” is useful distinction because scholars have produced valuable insights regarding the relationship between organization composition and time horizons. Scholars of organizations have found that intra-organization, inter-generational bargaining can produce outcomes in which no member of an organization has an incentive to take actions that harm the organization over the long-term, but benefit a specific cohort in the short term. That is, a set of institutions can be in place that reduce incentives for individuals to engage in behaviors that increase their personal utility of one individual at the expense of the organization as a whole over some longer period. In firms, managers can pay retiring

employees to not seek rents and sully the firm's reputation, which harms those that remain in the firm for years to come. In parties, junior members can bribe their senior colleague with monetary payments or services rendered to persuade retiring members to not engage in corruption or defect from campaign promises (Alesina and Spear 1988). I use these insights to show the nature of parties shapes how leaders will navigate the immediacy-sustainability tradeoff.

Within an overlapping-generations (OLG) party, one in which members of the same party are politically active over different periods of time, a cohort of "party leaders" exists that has been in the party for some time but do not expect to be in the party for much longer due to exogenously-determined retirement. A second cohort, the "party deputies", are more-recently recruited members who, upon the retirement of the current set of leaders, take over the party's leadership positions. Party leaders have few incentives to deploy technology policies due to set the long-deferred returns and high upfront costs, since they will not be able to claim credit for these returns when they arrive. Conflict arises because the exclusive accumulation-driven growth strategy leaders prefer produces a highly disproportionate burden-sharing scheme. Deputies expect that an exclusive short-term strategy ultimately will stall due to decreasing returns and they may also expect to face increasingly stiff opposition to efforts at reinvigorating mobilization. Importantly, because these conditions take time to emerge, it is period  $t$ 's deputies that will be forced to shoulder the weight of these concerns while period  $t$ 's leaders avoid paying those costs altogether. They will retire long before the costs of accumulation arrive. Thus, a highly disproportionate burden-sharing scheme exists wherein the current generation of leaders is willing to mortgage the future for their own political gain by failing to supply policies designed to catalyze technological development. Crucially, *the future that current party leaders mortgage is precisely the future of the party's upcoming leadership*. It will be the upcoming generation of party leaders that will be in charge when the diminishing

returns set in and they will be forced to rule in the face of decreasing economic and political returns to the accumulation strategy.

What the deputies want is some minimal priority on technology policies to avoid this unfavorable distribution of costs. They have an incentive to propose a bargain with party leaders to obtain a higher premium on technology policies. The bargain requires that deputies offer a utility transfer of some sort to party leaders. While any number of bargains are plausible, I propose one in which the outcome that we observe is the solidification of *seniority* within parties. In exchange for their support for policies that do not tie their hands down the road, the upcoming generation of party leaders credibly commits to a seniority system by giving their unconditional support for leaders' preferred policies and projects, thus strengthening seniority and leaders' agenda setting powers.

A similar bargain is unlikely to occur in non-OLG, weakly-institutionalized parties. The main reason for this is that, in such parties, power is already concentrated in the hands of the party leader(s) and there is nothing of value deputies can offer leaders. In fact, in weakly-institutionalized parties, the political prospects of the rank-and-file membership turn almost exclusively on the political popularity of the party leader. In such circumstances, deputies need the support of the party leader much more than the reverse. Deputies simply do not have the political clout within the party to establish a bargain. Accordingly, the party leader has little reason to bargain with them and move from her most preferred policy position.

## **1.4 Alternative Explanations and Potential Critiques**

Before concluding it is worth discussing one plausible alternative to the argument and one critique of it. The alternative theory would turn our attention away from parties and toward interest group politics. It would argue that the premium governments place on technological progress is a function of lobbying on the part of firms

and industry associations. Different firms and industries place differing premia on technology policies and when those sectors or groups that prefer technology policy prevail in the lobbying battle, we will observe governments deploying the associated kinds of policies.

This argument is certainly plausible and we should be surprised if lobbying on the part of firms did not affect the policymaking calculi of governments. That said, this argument does not explain the variations here fully. The problem is that it is unclear at this juncture what kinds of firms and industries will be more inclined to value technology policy and the conditions in which those firms will seek to influence legislators accordingly. Firms face the same temporal dilemma that leaders do. The assumption that firms are profit-maximizers does not necessarily mean they want technology policies from governments. In fact, firms can increase their profit margins and market shares in other ways that are far less expensive to them financially and do not incur any of the risks associated with innovation and technology adoption. Firms can, for example lobby governments to protect them from foreign competition, they can press political leaders to pass legislation that would make it easier for firms to lower their employment costs such as legislation reducing the minimum wage and legislation reducing the health care coverage firms are obliged to supply. All of these policies can help firms become more competitive and all of these policies may act as substitutes for technology policy. The unanswered question is under what conditions will firms and industries value technology policy and when will they value the alternatives? We do not have very good answers to these questions at this point, which makes a seemingly simple and compelling lobbying story of technology policy less persuasive.<sup>15</sup>

One critique of my theory might be that it implicitly assumes a retrospective

---

<sup>15</sup>This is not to say the argument is entirely *unpersuasive*. It is at this point, however, an incomplete argument, but worth pursuing further.

economic voting model. If we assume instead that voters are forward-looking individuals—“bankers” in the parlance of MacKuen, Erikson, and Stimson (1992)—it might be the case that voters prefer that legislators initiate policies that do not suffer from diminishing returns, but deploy instead policies with increasing returns over time and long-term positive economic benefits.

There are two responses for this critique. First, if we take the argument here at face value, it should stand to reason that politicians will deploy technology policies far more frequently and to a much greater extent than they actually do. Office-seeking politicians routinely fail to deploy these kinds of policies, which they should not do if the critique is accurate. Secondly, and more importantly, the assumption of prospective voters does not explain why governments would deploy technology policies because prospective voters are not infinitely forward-looking; they rationally discount the future. If, as I have proposed briefly here and develop further in Chapter 2, the returns associated with technological progress are deferred well into the future, even forward looking voters will discount those returns and favor instead returns with more immediate results. Mobilization-oriented policies would still seem to be preferred by voters and hence by politicians interested in retaining power.

## **1.5 Conclusion and Implications**

This chapter has put forward two central propositions. The first is that understanding the role of politics in development requires that we identify more clearly which sources of growth are triggered, which muted, and the extent to which the political variables in question have these effects. Too often our theoretical and empirical models have vague and even contradictory hypotheses regarding the role of some variable, say regime type, on the specific sources of economic growth. For example, a simple theoretical model might suggest that democracies facilitate growth because of the accountability mechanisms associated with the electoral connection. Since positive

economic growth is popular with voters, and since political tests hold politicians accountable to the demands of voters, we should see office-seeking leaders in democracies initiating policies with the intention of increasing economic growth. However plausible such a model might be, the argument is uncomfortably vague with reference to the mechanisms by which growth is generated. This admittedly simplistic accountability model tells us little about whether the specific growth-stimulating policies in question come in the form of those that operate by providing incentives to accumulate capital and labor, those that stimulate growth via advances in factor productivity arising from economic innovation and imitation, or both. As such, our understanding of the relationship between politics and development is necessarily limited. As Pinto and Timmons (2005) point out, “If the same institution affects these sources differently . . . then jumping from institutions to growth can be misleading” (27). The omission becomes even more problematic because how a country achieves growth in a very real way dictates the extent to which that growth is sustainable.<sup>16</sup>

The second proposition is a tension exists between the goals of retaining office and the tasks associated with promoting technological progress. Leaders are shortsighted, but the economic and political returns to their efforts to stimulate technology development are long deferred. That tension, however seems to vary cross-nationally and temporally as politicians do indeed take concerted efforts to stimulate technological progress.

The implications of this dissertation project should be of interest to a variety of scholars. On one hand, it contributes to our understanding of technological progress. Economic historian Ross Thomson quips rather caustically that technological development is like God: “It is much discussed, worshiped by some, rejected by others,

---

<sup>16</sup>The reader should note that I do not use the phrase “sustainable growth” in the way common to popular environmental movements that seek to ensure that the development process does not lead to serious environmental degradation. I use the term to refer to the extent which increases in per capita income can continue indefinitely over the long-term.



but little understood” (quoted in Mokyr 1990; 6). While the present work makes no claim of developing a complete explanation of the level of technological development in countries or the pace of its process (I do not, for one example, delve deeply into the determinants of individual creativity or firm-level factors that shape their innovative prospects), it can shed some light on the underpinnings of technological progress by providing a lens through which we might better understand the costliness of R&D programs for firms and the severity of the market failures that mute R&D intensity. Insofar as economic actors respond to the incentives supplied by national economic policies, where governments take steps to ameliorate these failures, the level of technological knowledge will be higher and the pace of its change faster than where governments do not take such actions. This project pushes forward our knowledge of the political underpinnings of economic development by explaining when governments will be more or less inclined to set these kinds of policies. Accordingly, to the degree that technological progress is the lever of riches and is necessary for sustained prosperity, this research agenda speaks to the political processes that influence whether a given country can avoid development traps and experience sustained prosperity instead.

The project also sheds light on a variety of issues relevant specifically for scholars of political parties. Much scholarly literature is dedicated to understanding the nature and effects of political parties and party systems. Scholars have linked political parties to a host of outcomes of interest to political scientists, including democratic accountability and responsiveness (Downs 1957) and the stability of modernizing societies and new democracies (Huntington 1969; Mainwaring and Scully 1995; Mainwaring 1999). The conceptualization of political parties as organizations that may overlap generations of politicians is one that scholars of comparative politics do not often make, but it is one that can be fruitful in understanding a host of political phenomena. And in general OLG models of parties can provide purchase on the length of

political time horizons. Alesina and Spear (1988) for example, have used this conceptualization to explain when legislators' platforms designed to appeal to the median voter are credible even in absence of a formal commitment mechanism, which would otherwise make any campaign promise incredible. They argue that the overlapping generations framework "captures the potential tension between the short time horizon of an individual candidate and the longer horizon of the party" (p. 376). Such a framework can help understand how this tension is resolved in such a way as to allow for the initiation of policies which have positive returns that are oriented toward the medium to long term future rather than purely toward the immediate future. This dissertation builds on the overlapping generations concept to develop an argument linking political parties and variations in their institutionalization with time horizons, thereby providing insight into the length of the future's shadow, the likelihood that rulers will deploy technology-oriented economic policies, and ultimately the prospects for technological progress in a national economy.

## **1.6 Outline of the Chapters**

The dissertation presents these ideas as follows. Chapter 2 accomplishes several tasks. First, I articulate more completely what policies governments may use to catalyze technological development and what policies coincide with the mobilization strategy. Second, I develop more completely the details of the immediacy-sustainability tradeoff mentioned only briefly here. Third, Chapter 2, shows that in the presence of economic voting, regardless of whether citizens are retrospective or prospective, technology policy is undersupplied. From there, I develop the main theoretical propositions and show that the severity of this undersupply depends on the degree to which ruling parties are well-institutionalized. Chapter 3 presents the research design and the first round of empirical tests. Chapter 4 continues to confront the theory with the data. Chapter 5 concludes.

## Chapter 2

### Theory: Parties and Technological Developmentt

This chapter provides a theory to explain when and why politicians might endeavor to promote technological development despite seemingly incompatible time horizons. Before delving into the theory however, I specify the policies I include in a technology-oriented growth strategy and those in the accumulation strategy.<sup>1</sup> Next, I discuss the details of the immediacy-sustainability tradeoff that exists between these strategies. The theory and its implications follows.

#### 2.1 Strategies of Growth and their Tradeoffs

At the level of the national economy, technological progress occurs through two related, but distinct processes: *innovation* and *technology adoption*. Innovation is the process of creating some new technology, process, or product. Technology adoption is the endeavor lagging firms make to employ frontier technologies in their own production processes. Adoption may well require modifications be made to the existing technology, thus improving it in some fashion. Therefore, in some ways, adoption is not unlike outright innovation. Throughout this and subsequent chapters, I will refer to research and development (R&D) spending as spending on efforts on either innovation or technology adoption.<sup>2</sup>

---

<sup>1</sup>To avoid repetition, I will use “accumulation” and “mobilization” interchangeably.

<sup>2</sup>The technologies themselves can take a variety of forms, but for our purposes, it is sufficient to categorize technologies as follows: new intermediate capital goods that produce final goods more

### 2.1.1 The Technological Development Strategy

Innovation and technology adoption suffer from important market failures that, in combination with the risks and financial costs inherent to the processes, slow the pace of technological progress. With that in mind, the government policies I include in the strategy to fuel technological progress are those designed to improve the technological infrastructure, ameliorate market failures, mute firms' risks, and offset their costs. Two categories of policies are useful in catalyzing technological development. The first are those policies designed to develop a stock of human capital at the post-primary education level. Technological progress occurs when individuals create and adopt viable technologies or find ways to implement and modify existing technologies. A large stock of human capital is essential for both of these processes to occur at a reasonable rate. Arrow (1962) shows that human capital facilitates "learning-by-doing," which in turn adds grease to the wheels of technological progress by increasing the likelihood that workers will uncover new ways of increasing productivity as they gain experience in the production process. Nobel Laureate Robert Lucas (1993) makes a similar claim. He argues that long-run growth happens when there is a critical amount of human capital in the workforce. More exactly, he contends that a "growth miracle" can occur when governments and enterprises foster continued development of human capital.

---

efficiently, altogether new types of consumer, new cost-saving business models and organizational strategies, such as "just-in-time" inventory systems. There exists a seemingly infinite number of way to categorize technologies. Schumpeter categorizes new technologies into five types: new products, new methods of production, new sources of supply, exploiting new markets and new business organizational strategies. Schmookler (1966) categorizes them according to whether they can be exploited generally across members of an industry or the economy writ large or whether the technology and the productivity it brings are firm specific. Hall and Soskice (2001) categorize technologies according to whether the new technology is a radical departure from existing technologies or an incremental development. Grossman and Helpman (1997) differentiate between those technologies that expand the product variety and those that serve principally as instruments to improve the quality of existing products (Grossman and Helpman, 1997). I note these typologies only to give a sense of the breadth of technology categories under consideration here, but I do not distinguish between them in the theoretical framework.

The stock of human capital is similarly important for technology adoption as it enables lagging firms and countries to understand better the workings of frontier technologies (Mokyr 1990; Hall 2004). This in turn increases the probability that frontier technologies will be efficiently adopted and adapted. Papageorgiou (2002) presents the concept of “contiguous knowledge” and argues that, contrary to the conventional wisdom that the pace at which lagging countries can reach the frontier is solely a function of their relative backwardness, lagging countries can catch up only if they have a level of knowledge contiguous with that of wealthier countries. If it is not, technology adoption fails to occur and the laggard does not catch up. He writes:

... the technology adoption capacity of a country depends crucially on how familiar is the frontier technology to the adopting country. This seems to be consistent with evidence indicating that virtually all high-growth developing countries have been exposed to technologies that are at least related to the cutting-edge technology (363).

He also finds that technological progress depends on post-primary education rather than primary education (2003)

As an example of the importance of post-primary education, consider the case of South Africa as discussed by Mani (2002). South Africa is clearly an outlier in sub-Saharan Africa in terms of overall wealth and development, but even so, Mani finds that the country’s effort to catalyze technological development begun in the mid 1990s has failed to live up to expectations due to a severe shortage of technically skilled personnel to engage in R&D (27). He argues that the undersupply of human capital is evident in the decline in the density of research scientists and engineers in R&D over time. The statistic was 33 scientists and engineers in R&D per 10,000 workers in the labor force in 1990 but declined to 16.3 by 1997-1998 (27).<sup>3</sup>

---

<sup>3</sup>Similar conclusions hold for India and Brazil.

Despite its importance, human capital might be undersupplied if left to private markets. Governments can remedy the undersupply and often do through education and retraining programs and programs designed to use human capital for more efficiently by providing incentives for workers to move from sectors with low average returns to R&D to a higher return sectors.

The second class of government policy included in a growth strategy that emphasizes technological progress comprises those policies that give incentives for firms to increase the intensity of their R&D efforts. By subsidizing private firms' R&D efforts, governments can both raise the probability of the success rate of such endeavors and increase their number. Governments can also establish programs that encourage joint ventures that facilitate technology transfers, governments might also establish public-private partnerships that facilitate cooperation in the creation of new technologies (Mani 2002; Nelson 1993).

Fiscal policies can be quite effective. Hall and Van Reenen (2000) for example, find that a dollar in R&D credit from the government stimulates about a dollar of additional R&D spending by firms. They conclude that government R&D initiatives complement rather than crowd out private efforts. In a study of OECD countries, Guellec and van Potbolsberghe (2001) find similar results and conclude that government subsidies and tax breaks increase R&D spending on the part of firms, although the business response to tax breaks is quicker relative to subsidies and grants.<sup>4</sup>

---

<sup>4</sup>A brief note about the exclusion of intellectual property rights (IPRs) from the analysis is warranted here. The conventional wisdom is that promoting technological progress demands that governments set efficient IPRs. It is well-established that new ideas and technologies have aspects of public goods. Property rights grant innovators at least temporary monopoly rents on their innovations and therefore close the gap between the social and private returns to technological developments (North, 1981). Recently, scholars have begun to find that the role of IPRs differs for developing and developed economies (Chen and Puttitanun, 2005) While IPRs certainly promote innovation, they may well slow the diffusion of those innovations, which can be a critical concern for developing countries that tend to imitate more than they innovate. Helpman (1993) expresses this possibility, writing "Who benefits from tight intellectual property rights in less developed countries? My analysis suggests that if anyone benefits, it is not the South" (p.1274). Because this debate is ongoing, I do not examine the allocation and protection of IPRs here.

### **2.1.2 The Accumulation Strategy**

The accumulation or mobilization strategy involves mobilizing labor and raising the per worker capital stock. This strategy would make no attempt to remedy the market failures that reduce R&D intensity. Rather, the goal here is to catalyze the growth process by creating what Gerschenkron (1962) refers to as “industrial labor, in the sense of a stable, reliable, and disciplined group that has cut the umbilical cord connecting it with the land and has become suitable for utilization in factories” (9). Going hand-in-hand with mobilizing labor is increasing the stock of capital per worker to increase their productivity. Several different tools are available to accomplish these goals. Governments can, for example, use compulsory savings schemes like Singapore’s Central Provident Fund, forcing citizens to save a specified percentage of their earnings, thereby mobilizing household savings and stimulating investment. Alternatively, or in combination, leaders can lower taxes on households incomes and firms’ profits and capital investments. Leaders can mobilize labor by forcing citizens to leave the farm for the factory, lowering the tax rate on on firms’ employment expenditures, suppressing wages, and through primary education spending, the latter of which is important as basic literacy and numeracy are important qualities of a national labor force.

### **2.1.3 The Return Structures of the Strategies**

Choosing a growth strategy involves a tradeoff between policies that face decreasing economic and political returns on one hand and those that avoid decreasing returns but are saddled with delayed returns and require upfront financial costs on the other. To illustrate this, what I will call the *immediacy-sustainability tradeoff*, consider the following stylized economy. Assume a national economy with a sufficiently large stock of human capital at the post-primary education level. Let a Schumpeterian “creative destruction” dynamic operate whereby firms, in the effort to increase productivity

and hence their market share, allocate resources to innovation. New technologies increase productivity such that the developing firm becomes the “industry leader” consistent with the models of Aghion (2004), Aghion and Howitt (1992), Grossman and Helpman (1997). Firms in the same industry that lag behind the innovator scramble to develop their own technologies and to adopt those at the frontier in an effort to regain lost market share or, at the very least, avoid being competed out of the marketplace altogether. Finally, let some non-zero percent of all newly-developed technologies be applicable in more than one industry and hence can diffuse throughout multiple industries in the economy.

Since firm survival depends on the ability to innovate and efficiently adopt frontier technologies, R&D spending receives a premium. But upon the development of a new technology, however, several other processes are activated that catalyze *further* productivity gains. First, some portion of new technologies may be generally applicable and some technologies will diffuse throughout the economy. As they do, productivity gains spread as well. Beyond that however, diffusion commonly produces “feedback effects”, where adopting firms make further improvements to existing technologies thereby further increasing the value of the technology. Another important attribute is that some new technologies will generate spillovers, whereby the creation of a new technology decreases the costs and risks of other R&D endeavors thereby increasing the likelihood of further innovation. The value of feedback and spillover effects should not be underestimated. Hall (2004) writes that:

it is safe to say that without diffusion, innovation would have little social or economic impact ... diffusion is not only the means by which innovations become useful by being spread throughout a population, it is also an intrinsic part of the innovation process, as learning, imitation, and feedback effects which arise during the spread of a new technology enhance the original innovation (2-3).



Now, consider the effects of a government program intended to encourage technological development, say a set of fiscal instruments to subsidize firm-level R&D. The most direct effect of this policy will be to raise R&D intensity on the part of firms and increase the success rate of private R&D spending. The economic implications of the subsidy scheme go beyond this direct effect, though. In this stylized economy, the diffusion, spillovers, and feedback processes act as a sort of multiplier effect, magnifying the economic utility of any one innovation and amplifying the economic importance of the underlying subsidy scheme. The initial fiscal instrument has economic benefits that extend beyond its direct effect.

The same is true for a policy to forge human capital at the post-primary level. Again, the most immediate effect of government education spending is to increase R&D intensity and the success rate of R&D projects, as well as the likelihood that existing technologies will be efficiently transferred, adopted, and modified. But since there appears to be no limits to the number of new ideas a cohort of skilled workers can have except the length of their physical lives, the initial education policy can have long-lasting and wide-ranging effects on the prospects of sustained economic growth. And again, diffusion, feedbacks, and spillovers also act as multipliers to the value of the underlying government policy.

The downside is that all these benefits accrue only with a substantial lag from the point at which the policies were deployed. Scientists, engineers, and firm managers all require time to turn available resources into viable technologies and so we should expect a lag between the initial fiscal incentive and returns to any specific R&D program. Rouvinen (2002) estimates the lag structure between the start of a given private R&D program and gains in firm-level productivity that result from that program to be about 4 or 5 years. Ravenscraft and Scherer (1982) reach similar results. Many projects take considerably longer though with the “adoption of a new technology [often] coming more than a decade after the initial research is be-

gun” (Cohen and Noll 1991; p. 48). Accordingly, any piece of legislation intended to stimulate R&D spending almost certainly will not see returns in the near future and what returns do occur may be delayed over a decade or more. Nor does diffusion happen quickly; “in the history of diffusion of many innovations, one cannot help being struck by...its apparent overall slowness” (Rosenberg, quoted in Hall 2004) . Economic barriers, institutional and budget constraints, and path dependencies all mean that adopting productivity-increasing technologies is often is a slow, arduous process (Parente and Prescott 2000; Mokyr 1990). And most obviously, it literally takes years to educate a cohort of scientists and engineers to conduct the underlying innovative and technology adoption programs.

Not only is there a temporal lag, but the policies governments would deploy to fuel innovation and imitation require large financial costs upfront. Legislators have to allocate resources upfront to build and expand schools, establish retraining programs, hire teachers, and provide incentives for workers with sufficient human capital to transfer into sectors with higher expected returns to R&D before technological development occurs. In the same way, stimulating private R&D virtually by necessity demands that legislators distribute the subsidies before research projects are underway and well before those projects begin to bear fruit. The fact that the financial costs are large and upfront while the economic returns are delayed is damaging to politicians operating in a world with rather short planning horizons.

In contrast, the accumulation strategy has relatively more immediate results. One reason for this is that the relevant policy instruments to encourage accumulation of capital and labor do not require the same kind of R&D endeavors necessary for innovation and adoption. The mobilization strategy does not operate through public or private R&D programs to develop new technologies or modify new ones and so there is no delay associated with “searching” and “re-searching” for new technologies as there is with innovation and technology adoption. Nor does mobilization rely on

diffusion, feedback effects, and spillover processes to increase gains in productivity throughout the economy. Accordingly, mobilization-oriented policies do not suffer from the delays inherent to technological development-driven growth.

The benefits of relatively more immediate returns are counterbalanced by the fact that the accumulation strategy results in an income path that cannot sustain positive gains in economic performance indefinitely. As I summarized briefly in Chapter 1, the neoclassical growth model shows that capital accumulation experiences economic decreasing returns that make it difficult for accumulation to sustain gains in income over time. Solow writes that, “A developing economy that succeeds in permanently increasing its saving (investment) rate will have a higher level of output than if it had not done so, and must therefore grow faster for a while. But it will not achieve a permanently higher rate of growth of output” (1988, p.308-309).

Economic diminishing returns may not be all that serious if politicians in power when diminishing returns set in can reinvigorate growth with further mobilization-oriented policies. The government unfortunate enough to be in power with the returns to previous accumulation policies begin to diminish might institute policies that would reduce taxes further, increase the rate of compulsory savings to mobilize investment, or repress wages further to encourage labor accumulation. Governments, however, are constrained in their ability to employ these strategies and this fact constitutes mobilization’s most serious drawback. Not only does an exclusive mobilization strategy experience economic diminishing returns, the strategy also experiences diminishing *political* returns as well. Each of the policies designed to mobilize resources carries its own political cost. Governments can lower taxes only so far before reaching the budget constraint at which time the government is forced to make difficult choices about long-term budget cuts or persistent deficit spending, each of which can be costly politically. In the same way, governments can repress wages only so far before workers stop engaging in productive activities altogether and either start producing only

for subsistence, exit the formal economy, and/or engage in labor unrest. So-called compulsory savings programs face similar political constraints.

Two quick examples illustrate such political constraints. The first occurs in France in the spring of 2006. In March, Prime Minister Dominique de Villepin announced the First Employment Contract (CPE), a labor initiative that “allows employers to end job contracts for under-26s at any point during a two-year trial period without having to offer an explanation or give warning” (BBC News Online March 18, 2006). At a time where one out of five young people in France was unemployed, the program was designed to mobilize labor. What the program produced in actuality however was popular discontent. Not long after the CPE was announced, thousands of young people in some 35 cities took to the streets in protest (March 18, 2006).<sup>5</sup> At the center of this response was anger at the increased insecurity such a policy would place on the youth. The protests had their intended effect; after several days, the initiative was withdrawn from consideration. The French case is suggestive of the point that politicians often face stiff opposition to their policies designed to mobilize labor.

As another example of the political constraints to an exclusive input-driven growth strategy, consider the case of Singapore. By most accounts, Singapore’s astonishing growth since the 1960s was driven by exceptionally high rates of savings and investment. (Young 1992, 1995; Collins and Bosworth 1996; Bosworth and Collins 2003; Krugman 1994). Figure 2.1 shows the trend in savings as a percent of GDP for Singapore (the solid line) and compares that to the average for all countries (the dashed line) between 1960-2000. Singapore’s savings rate is exceptional by international standards, but scholars have noted that as “miraculous” as the Singaporean savings rate and corresponding investment rate was, much of the accumulated sav-

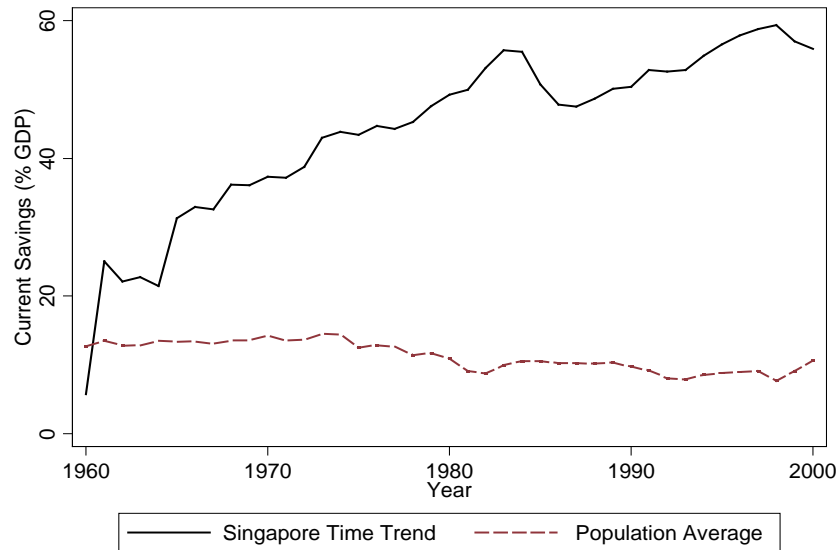
---

<sup>5</sup>Not surprising, there is wide variation in reports on the number of individuals engage in the protests. Unions reported the final tally was upwards of 1.5 million people, while the police report the number at 500,000.

ings was generated through demanding compulsory savings schemes like the Central Providence Fund (CPF), which are hard to replicate and increase. Krugman (1994) writes:

Singapore's growth has been based largely on one-time changes in behavior that cannot be repeated...an investment rate of 40% is amazingly high by any standard; a share of 70% would be ridiculous. So one can immediately conclude that Singapore is unlikely to achieve future growth rates comparable to those of the past (71).

Figure 2.1: Savings in Singapore and world average 1960-2000

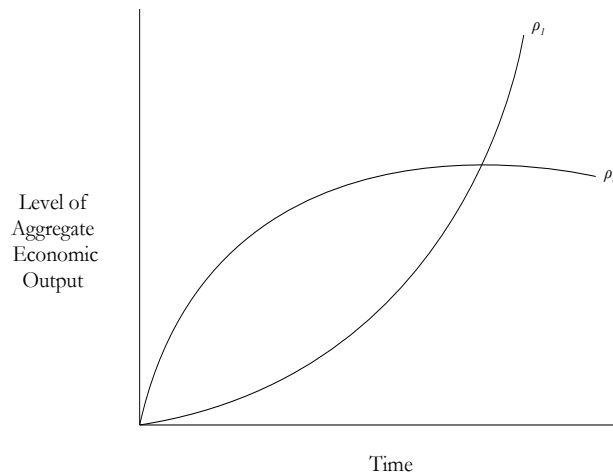


Presumably, one reason why a move to increase the investment rate from from 40% to 70% of GDP is “ridiculous” is because of the associated increases in compulsory savings likely needed to achieve higher rate of savings and investment.

The immediacy-sustainability tradeoff is illustrated in Figure 2.2 where line  $\rho_0$  represents a hypothetical accumulation-oriented growth path, while line  $\rho_1$  represents

a technology-driven path; the origin of the figure represents the beginning of an incumbent's tenure in office and therefore the time when the incumbent announces an economic policy package. The figure illustrates the main points from the above discussion. Initially, the returns to line  $\rho_1$  are small in absolute terms and especially in relationship to the returns to  $\rho_0$ . This represents the time during which firms engage in the innovative and imitative processes but have yet to produce viable technologies. Meanwhile, the accumulation strategy produces relatively high rates of economic performance. With time however, the utility of these strategies switches. After the development of new technologies, the diffusion, modification, and spillover processes run their course and the economic benefits of technological development begin to increase dramatically.

Figure 2.2: Strategies of growth and the immediacy-sustainability tradeoff



### 2.1.4 Disincentives for Technological Development

Political processes compel politicians to eschew promoting innovation and technology diffusion. One prominent force for example, is economic voting. Few would argue that the status of the economy is not a crucial factor in the ability of leaders to

retain power, but counter to intuition, one consequence of citizens caring about the economy is that leaders tend to de-prioritize technology policy. In the typical formulation of the retrospective voting model, voters evaluate the economy based on its performance over the past few years (or an even shorter period of time (Beck (1991)) and reward incumbents with reelection if the economy is well-performing and evict otherwise. Mapping the immediacy-sustainability tradeoff onto this model produces the conclusion that incumbents should stay clear of initiatives to improve the country's technological infrastructure and level of human capital. The fact that citizens use a "linear extrapolation of past economic performance to the future [to formulate] postures of support or opposition toward the government" (Stokes 2001, p.2) means that office-seeking politicians need to ensure that the economy is performing at a level sufficient to buy the support of citizens by the next election regardless of the longer-term effects of the initiated policies. Cohen and Noll (1991) state the political calculus at work thusly:

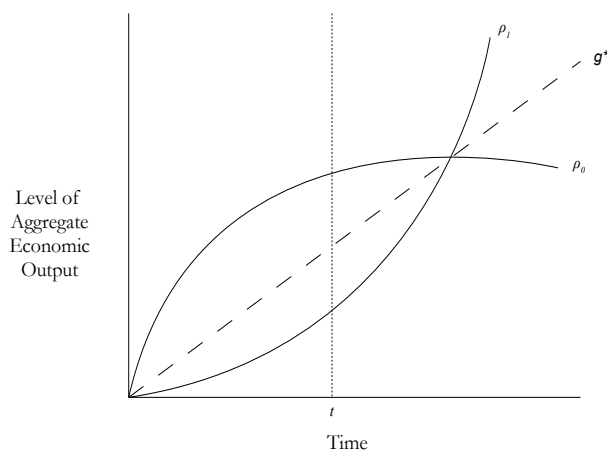
From the perspective of the elected official, the implication of retrospective evaluation is that, all else being equal . . . *a project with earlier realization of politically relevant benefits will be preferred to longer-term projects.* That is, to the extent that citizens heavily discount future plans of programs and engage in retrospective evaluation, they create an incentive for political officials to be too impatient in evaluating proposed programs. Because R&D projects are usually long term, they will normally face an uphill struggle in the battle for budgets with operating programs that provide current benefits. In general, political leaders will exhibit reluctance to adopt an R&D strategy . . . (62-63, emphasis added).<sup>6</sup>

---

<sup>6</sup>Since the initial statement of the retrospective voting thesis, scholars have made some useful advances with respect to the heterogeneity in the retrospective vote function. Holbrook and Garand (1996) find that the quality of economic voting depends on the voter's access to information, which

Figure 2.3 illustrates this point. Lines  $\rho_0$  and  $\rho_1$  are the same as in Figure 2.2 representing the returns of the mobilization and technology-oriented strategies respectively, but here line  $g^*$  represents the minimum level of economic performance over which an incumbent needs to preside to win reelection at any given point in time. If the origin of the figure represents the beginning of a politician's tenure in office when the incumbent must decide how to pursue economic growth and the vertical line  $t$  represents the point at which citizens evaluate their leadership, it is clear that the politician's best strategy is to produce policies that facilitate growth by stimulating accumulation rather than those policies that operate on growth through technological development.

Figure 2.3: The immediacy-sustainability tradeoff with a period of political evaluation



The accuracy of the retrospective model is debatable. Chappell and Keech (1985) for example, contend that citizens are more sophisticated than the retrospective model formulates and that citizens rationally form expectations of the future impact of

---

shapes their perceptions of economic realities. Others have argued that “clarity of responsibility” for policy and the associated outcomes influences the quality of retrospective voting (Powell and Whitten 1993; Powell 2000). Other extensions to explain heterogeneity in the vote function include the role of attitudes such as trust in government (Duch 2001; Duch, Palmer, and Anderson 2000) and the modifying influence of party identification (Fiorina 1981).



proposed and initiated economic policies and they use those expectations to inform their vote choice. MacKuen, Erickson, and Stimson (1992) suggest that voters are something more like “bankers” than “peasants,” using all information available to them to form expectations about what the economic future holds under different governments rather than past economic performance as their guide. Winning and retaining office requires candidates credibly promise and/or actually deploy policies that will have the economy performing well in the future.

If the prospective voting thesis accurately captures the relationship between the economy and political evaluation, it may be the case that politicians will prefer to promote innovation and technology adoption. Sophisticated, forward-looking voters, it could be argued, will understand the future costs and benefits of the technology/mobilization choice set and prefer some non-negligible premium be placed on policies that are good for growth over some substantial period of time. Office-seeking politicians respond accordingly.

Further investigation challenges this conclusion and shows that the prospective voting thesis does not ensure that politicians will prioritize human capital formation and the fiscal instruments that share private firms’ R&D costs and risks after all. At issue is the fact that prospective voters are not infinitely forward-looking, but rather they weigh the relatively immediate future more heavily than the more distant future. Doing so makes sense in a world where unforeseen and exogenous shocks can occur. As the expected date of returns to some policy recedes in the more distant future, the likelihood that unforeseen changes in conditions will alter the magnitude and distribution of the returns to government policies increases as well. The heightened sense of uncertainty that exists around long-deferred returns compels voters to discount those returns relative to those projected to arrive sooner. While prospective voters are sophisticated and use all available information to make predictions about future performance, when the returns are projected to arrive with a long delay, they lack

much of the important information they need to form useful expectations. Policy instruments with returns that accrue more quickly can still be affected by shocks, but the shorter time horizon means that such shocks are less likely and less likely to be *unforeseen* so voters can incorporate them into their analysis. Even prospective citizens will opt to favor policies with more immediate returns.<sup>7</sup>

Like economic voting, political competition may mute incentives to promote innovation and technology adoption. At first glance this proposition seems unlikely. It is a common and well-founded contention that political competition leads to better economic policies. Politicians aiming to fend off their competitors are more likely to work hard to produce good policies and good outcomes, forgo opportunities to seek rents and will instead pass along those rents to citizens (Lake and Baum 2001) and provide more public goods and services (Bueno de Mesquita, Siverson, Smith, and Morrow (2005)). But with respect to the strategies of growth and the tradeoff discussed above, political competition will not necessarily lead to policies that can sustain long term growth. Because competition lowers barriers to entry into the political arena, it raises the stakes of failing to appeal to the demands of citizens. This would suggest that, as long as economic voting determines political leadership, competition will suppress further the premium a government would give to policies with long-delayed returns

---

<sup>7</sup>The debate between whether voters are retrospective or prospective continues, but the empirical work seems to point strongly toward the usefulness of the retrospective thesis. In their thorough review of economic voting literature, Lewis-Beck and Stegmaier (2000) point out that both the prospective and retrospective arguments receive some support from statistical models but that the classic reward-punishment model appears sound. Voters, regardless of the democracy in which they live, assess national economic conditions and reward or punish the politicians responsible for those conditions (211-212). See also Norpoth (1996) and Fiorina (1981) for support for the retrospective model. Lewis-Beck and Stegmaier (2000) conclude that retrospection does not necessarily mean that voters are unsophisticated as proponents of the prospective model have argued. They find that voters are sophisticated enough to look at multiple indicators of economic performance to inform their evaluation of the economy and perhaps more importantly they try to discern when a party is more clearly responsible for the observed outcomes and adjust their vote accordingly.

and that economic inefficiencies will exist due to domestic political competition.<sup>8</sup>

The rather disconcerting conclusion of this line of thought is that politicians will almost always undersupply policies designed to fuel innovation and technology adoption. Anecdotal evidence supports this. Recently, the National Academies of Sciences in the United States released a 500-page document detailing what it calls “the gathering storm” in reference to the United States’ shrinking technological leadership relative to a handful of East Asian countries and India. The document cites the undersupply of scientists and engineers necessary to provide a reasonably high probability of success in research programs and rapidly obsolescing equipment as symptoms of the problem and the places blame for the gathering storm on risk averse and shortsighted politicians who fail to supply technology-oriented policies and programs (National Academies 2006). In a similar argument, *New York Times* columnist Thomas Friedman (2005) documents what he calls the “quiet crisis,” or the approaching economic malaise associated with a persistent undersupply of government incentives to stimulate innovation and technological upgrading. He takes members of Congress to task for being unwilling to place a greater premium on the future:

The way to avoid being caught in such a storm [of underwhelming economic performance and loss of national competitiveness] is to identify the confluence of factors and to change course...But this is not what has been going on in America in recent years. We are blithely sailing along, heading straight for the storm, with [politicians] insisting that no

---

<sup>8</sup>A caveat is worth noting here. The relationship between competition and technology’s premium is almost certainly nonlinear. If no contestation exists at all, economic performance is less likely to determine the survival of a government and so the issue of how to pursue growth is moot (Lake and Baum 2001; Bueno de Mesquita, Siverson, Smith, and Morrow 2005). To the extent that this argument holds, the possibility exists that a country can have too much of a good thing; while competition is sufficient for leaders to care about pursuing growth, assuming economic voting, too much competition suppresses incentives for officials to care about technological development and the long-term, sustainable growth it facilitates.

dramatic changes or sacrifices are required now . . . *History will show that when America should have been doubling the [National Science Foundation's] funding, its Congress passed a pork-laden budget that actually cut assistance for science and engineering* (255; emphasis added).

The “dramatic changes and sacrifices” to which Friedman refers include increases in education spending to raise the stock of human capital and increasing funding to inspire firms to increase their R&D spending to undertake technological development. We have seen however that politics compels leaders to eschew such policies.

But a puzzle still remains. We saw in Chapter 1 that governments do vary in the efforts they make to catalyze technological development. Indeed, in 2006 President Bush announced a plan to stimulate technological development in his State of the Union address and Congressional Democrats announced their own set of plans. How can we understand this?

In the next section, I present a theory rooted in the relationship between a country’s ruling parties and time horizons. Few institutions have as large and wide-ranging effects on the politics of a country as its parties do. Parties leave their footprints on virtually every aspect of politics and as Schattschneider put it, “the condition of parties is the best possible evidence of the nature of any regime” (1942, 5). The typical checklist describing the functions of parties includes aggregating and articulating societal preferences, nominating candidates for office, mobilizing citizens in support of those candidates, informing voters about what candidates stand for and the kinds of policies they are likely to implement if elected, and ultimately forming governments and setting policy. For Aldrich (1995), parties are essential in overcoming significant social choice and collective action problems that would otherwise make democracy “unworkable”. For Huntington (1968) the nature of political parties determines whether the country will experience political stability or devolve into civil violence. Below, I add to this, arguing that parties can be institutions through which

inter-temporal bargains obtain wherein governments set policies considering not just the most immediate future.

## **2.2 Parties, Time Horizons, and Technological Progress**

In the literature directed at classifying parties and party systems, Sartori's (1976) scheme based on the number of relevant parties and their ideological distance remains one of the most important. Even so, scholars have begun to argue that conventional typologies of parties and the systems in which they operate fail to incorporate an essential dimension: the degree to which the parties in question are institutionalized. Mainwaring (1999) and Mainwaring and Scully (1995) contend that as useful as Sartori's scheme is, the number of parties and the ideological distances between them do not capture some plainly evident variations in parties and party systems. In many democracies, the most salient aspect of the party system is the fragility, poor organization, and ideological vacuousness. For example, Coppedge (2001) uncovers the eye-opening statistics that of 166 elections in 11 Latin American countries in the twentieth century "approximately 1,200 parties competed. Of these, only 15 participated in all the elections held in their country, and only three contested as many as 20 elections. More than 80 percent ran in just one election before becoming defunct" (p. 174-175). Students of parties often contend that these traits are more important for understanding the system than Sartori's and other standard classifications. Party systems differ not just according to the number of parties and their ideological positions, then, but also in the degree to which ruling parties can be considered well-institutionalized. If Schattschneider is correct that characteristics of parties speak to the nature of politics in a country, then such variations should have import policymaking consequences. Mainwaring (1999) identifies institutionalized parties as those that regularly compete for office, have "strong roots in society" that endow the party with a stable base of political support over time, have strong and effective organizations,

are seen as legitimate by politicians and citizens alike. Based on these criteria, one crucial distinction between well- and weakly-institutionalized parties is the degree to which they approximate what economists and industrial organization scholars have called “overlapping generations” (hereafter OLG) organizations—organizations that outlive any given generation of its membership.<sup>9</sup> Institutionalized parties are OLG as a function of their legitimacy, more effective organizations, and roots in society, which allow the organization to effectively recruit new members and place those members in elected offices. The ability to recruit and mobilize electoral support for party members allows the party to persist well into the future even as individual members and cohorts of members have relatively short and finite lives. Weakly-institutionalized parties, by contrast, are short-lived organizations. The absence of societal roots, effective organization, and legitimacy means that ambitious politicians have little reason to join existing parties to win office as existing parties do not represent the only or even the most effective channels for obtaining office. Similarly, weak roots and organizations make identifying and providing support new party members difficult.

That weakly- and well-institutionalized parties differ in the degree to which they are OLG organizations is a valuable insight. Existing theories of OLG economic organizations like the firm have generated important conclusions regarding the relationship between organizations and time horizons. Crémer (1986) for example, recognizes the prevalence of agency problems in organizations and he models how these play out in OLG organizations. He models a firm composed of several different generations of employees in which actions that maximize the utility of members of older cohorts in the present period jeopardize the viability of the entire organization over some longer period of time and hence the utility of members of younger cohorts. Notably, in his theory, intra-organizational, inter-generational bargains that produce

---

<sup>9</sup>The firm is the quintessential OLG organization.

as an equilibrium an outcome in which members of the older cohorts do not engage in those activities can obtain..

A fuller description of the situation is useful here. Assume a firm in which workers remain for 3 periods and at the end of the third period are forced to retire. Assume also that the firm hires new employees at the same rate that the older employees retire such that the firm is infinitely-lived even as the workers live finite lives. We know from Kreps (1990) that firms have corporate cultures, the stability of which is invaluable for firms' profitability. Those with stable corporate cultures are able to convey expectations about their credibility and efficiency and this in turn facilitates contracting with other firms and luring finance from investors. Nevertheless, maintaining a corporate culture is easier said than done. Members in their last period have few incentives to keep the culture and work hard to grow the firm. Rather, their incentives are to defect from the culture and engage in corrupt or rent-seeking activities that quickly increase their personal incomes. After all, their retirement is imminent and once they retire, the firm's ability to punish them for their behavior evaporates.

Corrupt and rent-seeking behavior on a systematic basis however shatters the firm's reputation, reduces profits and jeopardizes the firm's future viability. Of importance to Crémer is the fact that *all of these costs are borne disproportionately by the younger employees*. Since those that defect retire soon after, it is the younger employees that will shoulder the costs of a tarnished reputation. They alone will be forced to operate in a firm that finds it more difficult to contract and gain investment even as they did not sully the firm's reputation in the first place.

In this firm, a burden-sharing scheme is in place that advantages older cohorts at the expense of the younger members. Crémer models a solution to the ensuing inter-generational conflict in which younger members bribe the older cohorts to not defect from the corporate culture. Younger cohorts take on the more difficult tasks that have

the most long term benefit and/or commit to an *ex post* utility transfer to their older counterparts of at least the size senior members could gain through corruption and rent-seeking. In exchange, older cohorts forgo activities that would sully the firm's reputation. The bargain, should it occur, resolves the inter-generational conflict and ensures the long-term viability of the firm.

Alesina and Spear (1988) construct a similar model of parties to address the dilemma that a "politician at the end of her career may have no incentive to follow policies which are beneficial to her party or to society as a whole. Instead, she may act selfishly to promote her own preferred policies" (p. 359). Alesina and Spear (hereafter, A&S) question why retiring politicians do not defect from advertised campaign promises and pursue rents rather than keep their promises. As in the firm, intra-party conflict grounded in heterogeneous preferences toward the future exists. A&S assume that voters choose leadership based on campaign promises and that only promises that are deemed credible receive popular support. That said politicians near their (exogenously-determined) term limit have little reason to be credible, since their retirement is imminent. They would instead prefer to renege on advertised platforms in the pursuit of greater rents.

Party reputations are meaningful and sticky, however, and such behavior on the part of retiring politicians imposes high costs for other party members that expect to be in the party for years to come. "Younger" (in political age) politicians that hope to run under the party's label in future periods need to preserve the party's reputation and to persuade their older counterparts to refrain from activities that would discredit the organization in the eyes of voters. A&S conclude that an intra-party bargain struck between the two cohorts wherein members of the younger cohort provide payments (e.g., monetary transfers or services to be rendered) to their older counterparts can buy retiring members' commitments to refrain from activities



that would ruin the party's reputation.<sup>10</sup>

That agency problems within organizations exist and can lead to a situation in which some share of the organization bears a disproportionate share of the costs resulting from the opportunistic behavior of other members is not especially new (Müller 2000, Weingast and Marshall 1988). What OLG models bring to the table is how these processes may play out in an organization where the salient intra-organizational divisions are *generational*. Models like these show how the cohort expecting to bear a disproportionate share of the costs to actions taken by another “older” cohort of members has an incentive and often the tools with which to persuade their counterparts to refrain from the actions in question. The upshot of both Crémer and A&S is that policies within OLG organizations and the behaviors of members of OLG organization may take into account periods of time beyond the immediate future.

These insights inform my theory about the premia different governments can be expected to place on the two strategies of pursuing economic growth. I build an informal model of economic policymaking in the presence of the immediacy-sustainability tradeoff and I show how variations in whether a ruling party is weakly- or well-institutionalized maps onto time horizons and hence the premium on technological progress and development. As in the Alesina and Spear approach, I consider a situation in which the utility-maximizing behavior of an older cohort, called “party leaders”, imposes costs shouldered disproportionately by members of a younger cohort of “party deputies”.

### 2.2.1 The Model

To start, the party of interest in the model is the ruling party. For reasons that become clear as we proceed, opposition parties will not play a role. For simplicity,

---

<sup>10</sup>For other models of political OLG organizations, see Soskice, Bates, and Epstein (1992), and Muthoo and Shepsle (2004).

I will assume a single-party majority government. Define “party leaders” as the set of members of the ruling party that reside in the executive branch and initiate legislation. They are “old” in the sense that they are near the end of the exogenously-determined political life. Period  $t$ ’s leaders are able to stand for reelection at the end of the period. Should they win that reelection bid, leaders rule until the end of period  $t + 1$ , when they are forced to retire. Let “party deputies” be the members of the ruling party housed in the legislature that either accept or reject policy initiatives proposed by leaders. Deputies are “young” in the sense that when leaders leave office, they take over the party’s leadership positions.<sup>11</sup>

For any ruling party, political survival turns on citizens’ sophisticated retrospective economic evaluations. When voters go to the polls they tally all the observed costs and benefits of initiated economic policies. Should the net effect of a portfolio of policies be positive, citizens reward the incumbent party with reelection, otherwise they evict.<sup>12</sup> Given this, political survival for members of a ruling party requires a well-performing economy that is fueled by policies that do not undermine any positive growth effects by imposing other more substantial costs on citizens. The survival function for members of the ruling party then can be represented as

$$S_{i,t} = \Phi(\beta(B_{i,t} - C_{i,t})), \quad (2.1)$$

where  $S$  represents the probability of winning reelection using growth policy  $i$ ,  $\Phi$  is the cumulative normal distribution,  $\beta$  some positive coefficient, and  $B$  and  $C$  represent

---

<sup>11</sup>The assumption of exogenously-determined political lives is consistent with the A&S approach, but see Muthoo and Shepsle (2004) for models with endogenously-determined political lives. This assumption of leaders as executives and deputies as individuals housed in the legislature is consistent with the model in Soskice, Bates, and Epstein (1992).

<sup>12</sup>That citizens are sophisticated and look at multiple effects of an economic policy does not mean they are “bankers” as in the MacKuen, Erikson, and Stimson (1992) model. Sophisticated citizens are not trained economists and hence unable to formulate useful expectations regarding the effects of a set of policies. They can however, assess the returns of initiated policies.

the benefits and costs of policy  $i$  on a representative citizen during period  $t$ .

Finally, the model assumes that politicians of all cohorts are interested in gaining and retaining office for instrumental reasons. Holding office is not an end in and of itself but it does allow individuals to achieve otherwise unobtainable ends and therefore provides utility indirectly. Leaders want policy and votes.<sup>13</sup>

### 2.2.2 Inter-Generational Conflict

Within a ruling party composed of leaders and deputies and where the status of the economy shapes political leadership, we should expect conflict rooted in varying perceptions of the importance of setting economic policies that have increasing returns over time to exist. For their part, time  $t$ 's leaders will prefer a policy portfolio that places virtually no importance on technology policy. Their aversion stems from a couple of sources. Deploying technology policies risks failing to sufficiently satisfy voters' demands for a well-performing economy. Deviation from a policy portfolio that is exclusively mobilization-oriented takes an unnecessary risk that citizens will go to the polls observing a government that failed to produce sufficient economic growth. Relatedly, leaders know that they cannot *use* any of the returns that accrue after their last reelection bid. Whether they win or lose reelection at the end of period  $t$  they are unable to take credit for any deferred benefits their policies may bring and reap the rewards for having initiated those policies. Accordingly, such returns are moot to them. Nor are leaders especially concerned about the decreasing economic and political returns to an exclusive mobilization strategy since they do not expect to have to manage those costs of decreasing returns. As long as the returns are sufficient to win election at the end of period  $t$ , they do not care if those returns begin

---

<sup>13</sup>Those in power can increase their utility by deploying policies that reflect more closely their ideology and partisan stances, initiating policies more in line with their ethnic and/or geographic bases of support, policies that will leave a positive legacy, and/or politicians can use their access to the policymaking apparatus to pursue rents and engage in corruption.

to diminish later on. Any returns to a policy portfolio that accrue after period  $t$ 's elections are irrelevant to the utility function of party leaders. Because of this, leaders prefer to initiate policies with immediately observable positive returns regardless of the long-term costs of these policies. Given the immediacy-sustainability tradeoff, accumulation-oriented policies will be their preferred option of stimulating economic growth.

But the future the leaders are willing to mortgage by such a policy portfolio is the future of period  $t$ 's deputies. The deputies are therefore concerned that, should leaders get their way, deputies stand to shoulder a disproportionate share of the economic and political costs incurred from a strict mobilization strategy while the leaders themselves do not pay any costs. Should it be the case that the returns to the leaders' mobilization strategy begin to diminish after the party leaders leave political life and that the political opposition to further mobilization is expected to be intense, it will not be period  $t$ 's leaders that are forced to rule in such circumstances, but instead period  $t$ 's deputies. But in such an environment, time leaders' in time  $t + 1$  hands are tied. Technology policies will not be any more palatable than in time  $t$ , but reinvigorating accumulation incurs political costs. Deputies hope to avoid this situation. If at all possible, deputies want a more equal burden-sharing scheme with party leaders. They prefer a portfolio that allows them to retain some minimal level of flexibility when they become leaders such that they possess tools of economic management in future periods that allow them to manipulate the economy to their advantage then as well. Period  $t$ 's deputies hope to establish an environment that allows the party to continue retaining government in future periods. A nontrivial premium on policies with increasing returns can facilitate this.

To be clear on an important issue, deputies are office-seeking politicians first and foremost. But subject to the goal of retaining office in the immediate period, deputies also prefer an economic regime that facilitates their goal of *continuing to win*

*elections* down the road. A strict mobilization strategy subjects period  $t$ 's deputies to the risk that they can win the most immediate reelection but then face an impossible situation in which neither mobilization nor technology policies can work to help them win further reelection bids. Mobilization may fail because of increasing opposition to mobilization policies and the costs policies like wage repression and compulsory savings place on citizens; technology fails for the reasons discussed at length already. Thus, deputies seek a way to extend their careers until they are forced to retire by term limits. A portfolio that can help in this regard is one that places some nontrivial premium on policies with increasing economic returns like those designed to improve technological infrastructure and human capital and those that stimulate innovation and imitation. Such a policy portfolio represents for deputies at period  $t$  a more equitable burden-sharing scheme and a way for deputies to increase the length of their political careers. To summarize, for deputies, the worst case scenario is that their party is ousted from the government in the immediate election cycle. But subject to the goal of retaining office, deputies also prefer that some share of policies have increasing rather than decreasing returns so as not to tie their hands upon taking control. We can represent the utility function of a representative deputy as

$$U_{dep} = \Theta[S_{i,t}, (\delta R_{i,t+n} | S_{i,t} \geq \bar{S})], \quad (2.2)$$

here  $\Theta$  is a positive coefficient,  $S_{i,t}$ , the political survival function in 2.1, and  $R_{i,t+n}$  represents the returns to policy  $i$  in the period when deputies take the reigns of power.  $R$  can be either positive or negative and is discounted by  $\delta$  and only enters the utility function if the deputy's party actually wins reelection (i.e., if  $S_{i,t} \geq \bar{S}$ , where  $\bar{S}$  is some threshold share of voters the incumbent party needs to retain control of government). Given their utility function, deputies are likely to be wary of a strict mobilization strategy as they will be well aware of its decreasing political and economic returns and the fact that, should those negative returns become manifest, they will be forced

to deal with them alone. In an effort to avoid bearing the full weight of the constraints to strict mobilization, period  $t$ 's deputies will aspire to find a growth policy regime that strikes a balance between helping them (and the party generally speaking) win office in the short term but that does not completely undermine their ability to manage the economy in a future period.

### **2.2.3 Conflict Resolution**

Having outlined the details of a likely inter-general conflict over economic growth policy, we can turn to how the conflict is resolved in weakly- and well-institutionalized parties. There are two related reasons to believe that in weakly-institutionalized parties, the premium on technological progress will be quite low. The first is that the very nature of weakly-institutionalized parties makes it unlikely deputies preferences will differ significantly from leaders'. As mentioned earlier, because weakly-institutionalized parties lack legitimacy, roots in society, and effective organizations they do not represent legitimate or even particularly effective avenues to power for politically ambitious individuals. They are fragile entities and their fragility is common knowledge among members. Political instability of this sort reduces incentives for deputies to consider the relatively distant future as they simply do not have sufficiently high expectations that the party of which they are a member in period  $t$  will exist in period  $t + 1$  let along some more distant future. Where a party's political prospects turn entirely on the leader's popularity, deputies have few reasons to plan for the future because there is too much uncertainty regarding what the popularity of the leader will be in the future and hence too much uncertainty regarding the likelihood that they will have the opportunity to take the reigns of the party's leadership positions.

But even if a cohort of deputies with preferences different from the leaders exists, it is still the case that the preferences of party leaders will prevail. The reason why is

that deputies have no bargaining leverage relative to the party leaders. To see this, consider the fact that one of the most notable characteristic of systems dominated by weakly-institutionalized parties is excessive personalism whereby politics is dominated by charismatic and popular individuals (Mainwaring and Scully 1995, Mainwaring 1999; Randall and Svåsand 2002). Clout within weakly-institutionalized parties lies almost entirely in the person of the party founder or current leader. The rank-and-file membership carries little weight and their support for the leader is neither necessary nor sufficient to affect the outputs of the policymaking process. The support of party deputies is of little relevance for party leaders and leaders are able to obtain the ends they seek irrespective of the preferences of the rank-and-file membership.

As an example of the personalistic politics that characterize weakly-institutionalized parties, take Peruvian politics between the years 1990-2000. This decade covered *Fujimorismo*—that period when Alberto Fujimori dominated the Peruvian political landscape. By all accounts this period hastened the decline of parties in Peru and set the course for a party system composed almost entirely of fragile, weakly-institutionalized parties and extreme personalism (Levitsky 1999; Levitsky and Cameron 2003; Coppedge 2001; Roberts 1996). Throughout the decade, Fujimori created four parties—*Cambio '90* (Change '90) *Nueva Mayoria* (New Majority) in 1992, *Vamos Vecinos* (Let's Go Neighbors) in 1998, and *Perú 2000*, each designed to mobilize support for either his or his cronies' candidacies for public office. But these loose organizations just barely deserve the label “parties”. They had no ideology, no societal roots, no lasting organization, and their success rested almost entirely on the popularity of Fujimori himself. Indeed at the time, the Peruvian populace considered parties inimical to the functioning of democratic politics and recognizing this, Fujimori relied entirely on his popularity rather than any features of the parties he founded.<sup>14</sup>

---

<sup>14</sup>Indeed, Fujimori actually worked to demobilize *Cambio '90* immediately after his election so as to consolidate power in himself and keep his public image as a populist anti-system, anti-elitist

Such personalism meant that members within these parties had little political leverage with which to bargain with and constrain Fujimori. The parties' "only [ideologies were] to back whatever Fujimori wanted to do without question" (Coppedge 2001, p. 193). But even in this role, the parties were not especially vital. The fact that *Cambio '90* was only the third largest party in the legislature with only 32 of 180 seats had little relevance to Fujimori as he was still able to achieve his policy preferences.<sup>15</sup> The clearest evidence of this is his ability to institute a set of harsh neoliberal structural adjustment programs during his presidency even as he campaigned vigorously against such programs and their proponent Mario Vargas Llosa in the 1990 election (Levitsky and Cameron 2003).

More often than not, deputies in weakly-institutionalized ruling parties are stuck in a situation in which they are nothing more than rubber stamps on the agenda of party leaders. The possibility that deputies might disagree with that agenda carries little weight in such personalized system. Often leaders simply do not need the support of the deputies to accomplish the goals in question. In the presence of such disproportionate power distribution, there is little reason to expect an OLG bargain to obtain. Rather, because deputies find themselves in weak bargaining positions, the preferences of the party leader will prevail.

Consider the effect of this sort of personalism in the context of the immediacy-sustainability tradeoff and the generational conflict described above. Assuming for the moment that period  $t$ 's deputies have sufficiently intense preferences for policies designed to stimulate technological progress, the personalism characteristic of weakly-institutionalized parties does not endow them with any leverage to affect the decisionmaking calculus of party leaders. Deputies have no clout within the party and nothing of value to offer party leaders. In such systems, power already is concentrated

---

politician.

<sup>15</sup>By comparison APRA controlled 53 legislative seats and FREDEMO controlled 62 seats.



in leaders and they have few party-oriented constraints on their behavior. In such an environment, there is no reason to expect any OLG bargain that will increase the premium on technology policies will prevail.

We have seen to this point that a cohort of deputies with incentives to plan for the future and with sufficient bargaining leverage must exist for an OLG bargain to obtain. Institutionalized parties are more likely to have both. First, the fact that well-institutionalized parties have legitimacy, roots, and organization makes them able to persist over time and survive changes in the political economic environment. This in turn makes it more likely that deputies will have an opportunity to become leaders in their current party, which is a necessary ingredient for deputies to value the future.

Secondly, in systems with well-institutionalized parties, personalism is relatively less important and this means that party leaders need the support of their deputies to a greater degree to pass legislation. In short, deputies have some degree of bargaining leverage. Recall the assumption that politicians value retaining office for instrumental reasons. Politicians may use the policymaking apparatus to seek rents or initiate other policies they deem valuable and utility enhancing. Where parties have strong roots in society, effective organizations, and legitimacy personalistic appeals from politicians are less effective the party leaders needs to work with other institutions and actors to achieve their goals. This has implications for how party leaders can be expected to interact with party deputies and vice versa. In weakly-institutionalized parties, party leaders can achieve the ends they seek irrespective of party deputies' preferences. Where the ruling party is well-institutionalized by contrast, party leaders are forced to rely relatively more on the consent of their party deputies to achieve the ends they seek.

Because their support is relatively more important, deputies are endowed with some degree of bargaining power, which they can use to increase their own utility by,

in effect, holding hostage the utility of party leaders. Deputies will be more inclined to withhold their support from policies that are utility increasing for the leaders if the strategy leaders take to win reelection at the end of period  $t$  is one that deputies find wholly unsatisfying because of the costs and constraints that strategy places on deputies' collective shoulders. The ability to manipulate the economy in politically profitable ways for some period of time is crucial for deputies and so they attempt to constrain leaders' incentives to increase their own utility at the expense of deputies'. There is then, a sort of tit-for-tat relationship between leaders and deputies wherein should leaders undermine deputies' utility by eschewing technology policies, deputies exercise their ability to constrain the leaders' abilities to increase their utilities by withholding their support for leaders' favored policies.

Herein lies the details of a bargain that resolves the conflict in such a way as to produce a policy portfolio that gives a nontrivial premium on more than just the immediate future. For a more equitable economic burden-sharing scheme, deputies offer (credibly, I assume) to increase leaders' *seniority* and *agenda-setting* powers of party leaders. Deputies offer their virtually unconditional support for the leaders' preferred set of policies if and only if leaders in turn set an economic policy regime that produces a more equitable burden-sharing scheme and that allows deputies to manipulate the economy in future periods when they become the party's leaders. As a result of deputies' concession, leaders can set the legislative agenda regarding the policies they favor and are virtually assured of obtaining their preferred outcomes.

Two conditions must exist for the agreement to hold however. First, it must be the case that leader's care about their pet projects to a degree sufficient for them to strike a bargain with deputies. If the leaders do not value other policies, then there is nothing that deputies can offer them to persuade leaders to move from their ideal point. It does not seem like too far of a reach however to assume that leaders care a good deal about what we might call their pet projects. As mentioned before, holding

power is not of much value in and of itself, but rather it is meaningful only insofar as it allows access to otherwise desired ends. Even for party leaders that expect to leave the political scene in the relatively near future, those ends are valuable and it should be the case that they will want to achieve those ends. Secondly, the deputies' commitment to back those legislative initiatives must be *ex post* for the bargain to be enduring. If deputies back the leaders' policies before technological development, they leave themselves no instrument to force the hands of leaders, should leaders renege on the bargain.

Along with seniority, it should also be the case that party leaders will control the distribution of all the pork elements to whatever technology policy they initiate. Technology policies have sizable tangible and distributable elements that can be of great value to legislators who retain the ability to target and distribute those elements. Legislators can, for example, target R&D subsidies to firms or industries in specific political districts or to firms with close relationships to politicians. Research parks have brick and mortar locations that must be constructed in some location and contracts must be allocated to do so. In the same way, legislators can target education spending to build universities or expand the capabilities of existing universities to particular geographic locations; tax credits and public-private partnerships have similar distributable elements. The distribution of that pork will be left to leaders, who can use their authority to increase their utility even further. Economic policies with steep upfront financial costs and deferred economic benefits will not be popular with citizens, but leaders can offset that dissatisfaction by targeting the pork to their districts, thus providing relatively more immediate benefits to the citizens. For leaders, agreeing to increase spending on R&D subsidies in the hope of fostering the development of new technologies in the future is more likely when whatever pork elements that arise from the project go to its own constituents. Technology policies are far more palatable when firms in one's own district receive the subsidies and

the education facilities in one's district receive large increases in funding. If assured some large share of the pork elements of technology policy, leaders are more easily persuaded to support their passage. Deputies recognize this and have incentives to incorporate this aspect into the OLG bargain.

Existing research lends credence to the proposition that pork barrel politics can enable the passage of general interest legislation (Alston and Mueller 2006; Evans 1994). Thurow goes so far as to argue that "if Congress insisted that research and development funds . . . be spent equally in each Congressional district, industrial policies [that promote technological progress] could not possibly work" (quoted in Cohen and Noll 1991, p5). My argument is consistent with Thurow's claim but also shows how we can expect pork to be distributed. The distribution of pork emerges from an OLG bargain and represents one reward leaders attain in an inter-generational, intra-organization burden-sharing scheme with party deputies.

#### **2.2.4 Modifying Conditions**

We might expect, however, that the effects of having a well-institutionalized party in power will be conditional. Deputies may not always choose to exercise their bargaining leverage. The effort to do so likely suffers from collective action dilemmas and presumably, withholding support is costly because leaders retain access to various tools useful in enforcing party discipline such as committee assignments, campaign funding, and candidate position on ballots. Under what conditions will party deputies overcome collective action dilemmas and work to force the hands of party leaders? I propose two conditions, both of which rely on the assumption that if a critical mass of deputies is mobilized on this issue, they can get their way since it would be self-defeating for leaders to sanction all of them simultaneously.

First, deputies must expect to be able to claim credit for the returns technology policies produce. This means that the party must be viable enough to expect to con-

trol some sizeable share of future governments. An important feature of policies that fuel economic growth is that they are in essence collective goods in the sense that any politician in power when the returns accrue can use the returns to its political advantage. This is true irrespective of whether that politician that claims credit for the returns initiated the policy that produced those returns. The collective nature of the returns to economic policy carries the disconcerting prospect for incumbents that the government that initiates some policy will receive none of the political rewards those policies create. Rather, some opposition politician or party may control government when the returns to technology policy accrue and reap the rewards the policy in question produces even though that politician did not set the initial policy.

In other words, an appropriations problem exists. In the economic sphere, a similar condition exists in that the new ideas that underpin new technologies are only partially excludable goods (Romer 1990a; 1990b; North 1981) and competing firms rationally seek to free ride off the research efforts of other and gain the productivity benefits of the new technology without paying the costs to discover and develop the technology itself (Scherer 1967; Loury 1979; Dasgupta and Stiglitz 1980; Aghion and Howitt 1992).<sup>16</sup> The crucial difference between the economic and political spheres however is that property rights do not exist for political incumbents as they do—albeit to varying degrees—for economic actors. Political incumbents have no legal ownership rights to the returns their policies produce. Hence, the kinds of protections that North (1981) argues are essential for innovation and technological progress in the economic sphere are wholly absent for politicians. Instead, reaping the political rewards to growth policies requires that politicians be in power when the returns accrue and claim credit for those returns.

Consequently, in assessing the value of policies with deferred returns, incumbents

---

<sup>16</sup>For modifying and contrasting views to this argument, see Knot and Possen (2002).

must assess the share of the returns to the policies they expect to receive, which in turn, is grounded in the share of future governments they expect to hold. When members of an incumbent party do not expect the party will control a sizable share of future governments—for example a single-party minority government in which the governing party has never been broadly competitive in national elections—those members have few incentives to set policies with deferred and increasing returns and run the risk that another party will use those returns for their own political advantage.

Note that the appropriations problem is less severe for accumulation-oriented economic policies. To be sure, the returns to these policies are also collective goods and the growth enhancing effects of these policies are exploitable by any ruler in power when they emerge. The essential difference is this strategy's relatively more immediate returns give a greater likelihood that an initiating government will also be in power when those returns arrive. Therefore, the prospects that the initiating government will capture the political rewards their economic policies produce is greater.

Secondly, the effect of a well-institutionalized party depends on the expected economic and political utility of further mobilization. If the theory to this point turns on deputies perceptions of having to bear a disproportionate share of the burden to short-term growth strategies, then it should be clear that as the intensity of the perceptions increase so too will deputies' likelihood of using their bargaining leverage to obtain a more equitable burden-sharing scheme. The details of the two strategies' economic and political return structures provides information on when the deputy cohort's preferences for technology policy will be intense and when their preferences will be more consistent with those of party leaders.

Recall that mobilization exhibits political diminishing returns. We should expect stiff popular opposition to further efforts to invigorate mobilization if the tax rate is already low (implying further mobilization will require further reductions in government spending on politically-sensitive items or a larger government deficit),

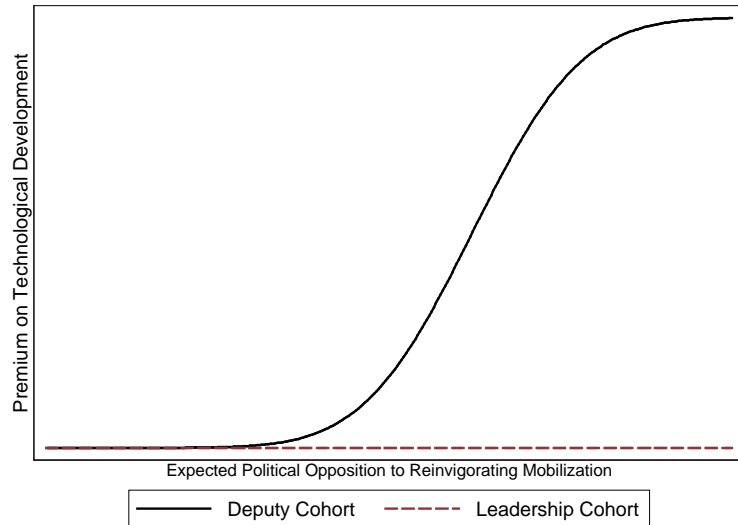
compulsory savings rates are already high, and/or wage repression extensive. In such conditions, the disproportionateness of the leader's proposed burden-sharing scheme (i.e., a scheme that defers all of the political costs to economic policy to a future period) is especially sharp. Deputies will seek to alter that scheme accordingly. Failure to do so means that deputies will be forced to take over the party's leadership positions in the face of hard political constraints that constitute an inability to manipulate the economy in a way that helps them continue winning elections. Under such conditions, deputies have the clearest sense that their hands will be tied in a future period. Accordingly, the value they place on policies that more equitably share burdens among cohorts of the same party and the likelihood that they will exercise their bargaining leverage increases.

In contrast when deputies expect opposition to further mobilization policies will be low, the intensity with which they care about technology policies is negligible. In this instance, party deputies' hands are not tied by the mobilization strategy. They can instead expect to have sufficient flexibility in the next period to continue pursuing growth through mobilization and they need not be concerned with shouldering a disproportionate share of the costs of the mobilization strategy. Here there is no salient inter-generational conflict and deputies will have little reason to prioritize technological development.

Figure 2.4 illustrates the relationship between the expected political opposition to reinvigorating mobilization and the premium on improving technological infrastructure. The solid line presents that relationship for deputies and the dashed line does the same for party leaders. At low levels of expected political opposition, the preferences of the two cohorts are indistinguishable. Here mobilization brings not just immediate returns, but it has the additional benefit of not carrying any serious costs for either leaders or deputies. When opposition is expected to be more vigorous, the two cohorts diverge and separate according to expected costs they expect to bear as

a result of popular opposition to further mobilization.

Figure 2.4: Timing of technology policy deployment



In essence, this proposition concerns the timing of deployment of policies designed to improve technological infrastructure and human capital. One useful feature of the argument is that from it we can understand the tendency for governments to put off improving their national technology systems until the “quiet crises” about which Friedman (2006) and the National Academies (2006) write begin to find their voices. In fact, the argument here implies that there might be a kernel of truth to the old adage that “necessity is the mother of invention”, but here it is a *political necessity* rather than an economic one that drives the outcome.<sup>17</sup> The premia governments place on human capital formation and improving the national technology system is partly a function of the returns to mobilization strategy and the expected political

---

<sup>17</sup>At the level of the individual invention, it is rather clear that necessity need not and typically does not precede the innovative efforts of entrepreneurs. Mokyr actually suggests the opposite might more likely be the case; new inventions developed in the pursuit of profits engender altogether new necessities (1990, Ch. 7).



response to efforts at reinvigorating mobilization should the need arise (i.e., diminishing returns to some previously initiated portfolio of mobilization policies set in). In most instances, mobilization is likely to be any government's preferred strategy. When the economic and political returns to that strategy begin to diminish however, party deputies recognize the disproportionate burden-sharing scheme in place and they endeavor to promote innovation and technology diffusion. To the degree that innovation and technological adoption respond to government policy, technological development may be more energetic when politicians have exhausted all their other growth-stimulating alternatives but still need growth to retain power. Absent looming economic malaise and expectations of opposition to efforts at further mobilizing labor and savings to reinvigorate growth, no government will value the deferred returns and upfront costs associated with catalyzing technological progress.

### **2.3 Summary and Conclusions**

When and why do governments set technology policies when the returns to such policies are deferred, the financial costs are large and upfront, and other policies with a more politically palatable temporal return structure exist? The central argument of this chapter is that the inter-temporal distribution of the costs of economic policy to members of the same political party is a relevant dimension in understanding policy choice. Drawing from models of overlapping generations organizations, I have argued that governments systematically controlled by well-institutionalized ruling parties are organizations for which the future's shadow is comparatively longer as some share of such parties' membership has an incentive to avoid shouldering a disproportionate share of the costs incurred by an exclusive short-term accumulation-oriented growth strategy. That said, the effects of institutionalization are modified both by the party's short-term political position medium term viability and the expected utility of the short-term growth strategy itself.

The theory lends itself to several testable hypotheses and in the next chapter I develop a research design with which to test the theory. In Chapter 3 as well as Chapter 4, I confront the theory with the data.

## Chapter 3

### OLG Parties and Human Capital Formation

#### 3.1 Introduction

Chapter 2 argues that countries with well-institutionalized parties will have relatively higher premia on policies designed to improve the quality of technological infrastructure and the level of human capital. This chapter along with Chapter 4 constitute the empirical chapters of the dissertation. In this chapter I outline the research design and conduct the first round of empirical tests. Chapter 4 continues to confront the theory with the data.

#### 3.2 Research Design

For all of the statistical models, all party-oriented independent variables mentioned in the theory will be coded with reference to the ruling party, which in turn is operationalized as the largest party in the legislature in parliamentary systems and the party of the executive for presidential ones. I code the variable with reference to the ruling party to coincide with the theory's retrospective voting assumption, which implies that only parties crucial in setting economic policy are relevant in the theory. Opposition parties do not play a role in my argument. I define the ruling party in parliamentary systems as the largest government party following the literature on cabinet formation, which argues that the distribution of cabinet ministries is determined in large part by the size of government parties such that the most important and valuable ministries typically go to the largest parties. The economic ministries

are almost always the most prized and so will typically be controlled by the largest government party. In strong presidential democracies, the ruling party is clearer since the president has policymaking power and appoints the heads of the ministries.

All empirical tests will use a sample of democratic countries. I exclude dictatorships even though research shows that poor economic conditions correlate with changes in political leadership there just as they do in democracies because the mechanisms that operate in this relationship in autocracies differ from the relationship between the economy and political selection in democracies.<sup>1</sup> I use the PolityIV database to measure the level of democracy, categorizing an observation as democratic if its polity score is greater than 0 on a scale of -10 to 10.

### 3.2.1 Dependent Variable

This chapter uses human capital statistics on the left hand side of the empirical models even though education spending is not typically considered a "technology policy". Both theory and evidence conclude that human capital is a critical element for both innovation and technology adoption. Human capital improves the success rate of R&D projects, facilitates the efficient adoption of frontier technologies. Additionally, scholars have found recently that technological progress responds to the level and pace of change of human capital at the *post-primary* education level as opposed to primary schooling. In an empirical paper assessing the contributions of primary and post-primary education on the mechanisms of economic growth for a large cross-national sample of countries, Papageorgiou (2002) concludes that "The most important finding of the paper is that primary education contributes mainly to production of final output, *whereas post-primary education contributes mainly to*

---

<sup>1</sup>For literature on the relationship between economic conditions and leadership change in non-democracies see Haggard and Kaufman (1995) and Przeworski, Alvarez, Cheibub, and Limongi (2000).

*adoption and innovation of technology*” (14, emphasis added).

Beyond the fact that we have good reason to believe that human capital is an important source for technological progress, the stock of human capital is useful to test the theory because we can have confidence that human capital levels and rates of change are functions of government policy. This feature is crucial because my theory assumes that government policy shapes firm-level incentives to engage in innovation and imitation. A proper test of the theory should analyze policy domains where we have confidence that productive government investments will affect the outcome that we care about. Education policy is such a domain. Figure 3.1 shows some preliminary evidence to support this proposition. The figure plots the percent of the population with some secondary education on the Y-axis against public education spending as a percent of GDP on the X for democratic country-years between 1970 and 1999.<sup>2</sup> The figure reveals the positive relationship our priors would lead us to expect, suggestive evidence that human capital outcomes respond to government spending.

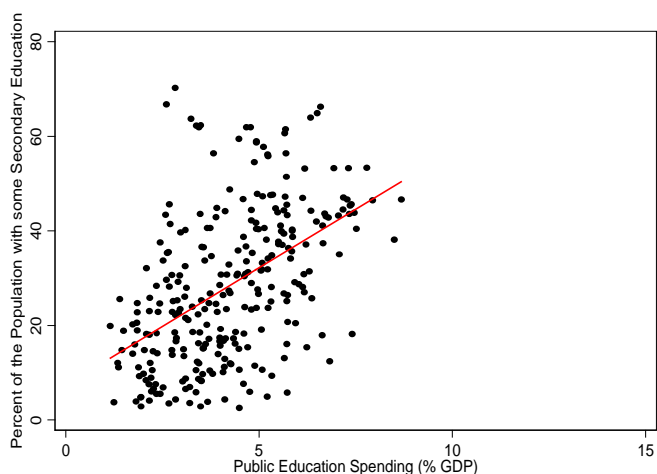
Education statistics are useful also because the temporal distribution of the returns to government efforts at developing post-primary human capital reflects closely the temporal distribution discussed in the theory in Chapter 2. There is simply no way around the fact that the largest share of economic returns to human capital-oriented public policies are deferred well into the future, even as the financial costs necessary to achieve those returns must be borne upfront. Governments must build and expand schools, pay teachers’ salaries, and subsidize the costs of education many years before the economic benefits of those policies emerge. This temporal distribution provides a tight relationship between the theory and the variables used to assess the theory.

Finally, education statistics are effective as dependent variables because human capital formation is likely to be the government’s preferred strategy to fuel innovation

---

<sup>2</sup>The temporal period reflects the extent of the education spending data. The attainment data are gathered in five-year intervals between 1960 and 1999 (Barro and Lee 2000).

Figure 3.1: Education spending and secondary education attainment



and technology adoption, should they be inclined to do so. Relative to many other policies governments could use, education initiatives have the benefit of being less risky from the perspective of incumbent politicians. Many of the available policy options governments have to catalyze technological progress require that politicians pick winners and losers. R&D subsidies and tax credits, for example, will require that governments assess the viability of prospective technologies and distribute funding according to those evaluations. Politicians are notoriously incompetent at such tasks and by using such policies, incumbents expose themselves to the possibility that their investments will fail to produce a viable technology. The complexities of innovation and technology adoption are many and there are any number of unpredictable ways the processes could go wrong. In a political-economic environment that prioritizes observed economic results, governments will want to minimize the risk their policy schemes will fail. Accordingly, politicians will seek out those strategies that can accomplish the goal in question with as little risk of failure as possible.

It may be, then, that education spending is the “technology policy” that minimizes the risks to which politicians expose themselves. While there are no assurances

that education policy will produce technological progress, assuming that reasonably well-functioning markets exist, the risks of policy failure are certainly much smaller compared to the alternatives. Governments do not need to play an active role in the economy to fuel technological progress as they may be forced to do using subsidy and tax credit schemes. Rather, they can create a cohort of individuals with sufficiently high human capital and let them engage in innovation and technology adoption according to market incentives.<sup>3</sup>

Even as we know that the stock of human capital responds to productive government education spending, we do not necessarily know the conditions in which governments are inclined to spend resources productively.<sup>4</sup> Recognizing this, I rely on education *outcomes* as dependent variables in the models rather than education *spending*. This choice makes sense given the nature of the theory. I assumed for analytic clarity, that economic policies are allocated with the intention of encouraging growth and development in the national economy. Essentially, this is an assumption that governments always allocate resources productively. While useful for analytic clarity in the theory, it is not an accurate description of actual politics. Firms com-

---

<sup>3</sup>Additionally, governments will prefer education spending as a strategy because it is a more efficient use of scarce government resources. That is, where governments seek to catalyze technological progress through subsidy schemes and programs that grant resources to qualifying firms, the costs of such programs are a function of the number of qualifying firms, the costs of the programs in question, and the generosity of the government subsidy. For any serious government-led effort to fuel the processes of technological progress, any subsidy or tax credit scheme will constitute a large drain on the state's financial resource. However, that governments may be compelled to increase spending in the pursuit of economic growth is not to say that they do not have other commitments that require government spending as well. Politicians will want to use their scarce resources efficiently. By endeavoring to forge human capital, governments can take advantage of the economies of scale associated with education spending, thereby maximizing the usefulness of their financial resources. Once a school is constructed or an education retraining program initiated, the costs of increasing the number of students that attend that school or program are rather low. The cost of adding thirty-first student to a classroom of thirty is very small. Because of this, governments will have more resources at their disposal, making human capital creation a more efficient way to catalyze technological development and progress.

<sup>4</sup>One example of research investigating the productivity of education spending is Hicken and Simmons (2008).

monly receive favorable policies for reasons that have little to do with promoting growth and politicians frequently distribute education spending with little regard to the degree to which that spending produces human capital (Hicken and Simmons 2007). That said, testing the theory requires that we know the degree to which governments *productively* invest their resources in technological development. Policy variables such as education spending as a percent of GDP do not capture productivity, but education outcomes do.<sup>5</sup>

Figures 3.2 - 3.4 show that the choice to use outcomes instead of spending is substantively important. Figure 3.2 plots the relationship between education spending and one common measure of party institutionalization, the age of the ruling party (logged), for a times-series cross-section sample of democratic country-years between 1975 and 1999.<sup>6</sup> Essentially, the trend line is flat, indicating no effect of party institutionalization on the stock of human capital. By this graph, my theory would seem incorrect. Figures 3.3 and 3.4 tell a different story however. In these, I plot the percent of the total population that has attained some secondary education (in Figure 3.3) and some tertiary education (in Figure 3.4). Both figures show a clear positive trend, preliminary evidence that institutionalized parties tend to perform better with regard to the actual stock of human capital than poorly-institutionalized parties do. Should these trends hold up to more rigorous statistical procedures, there would be strong support for my theory even though there is no evidence that institutionalized parties spend more on education. Taken together, these figures indicate that countries may differ in the productivity of their education investments.

---

<sup>5</sup>Another reason I prefer to use education outcomes as dependent variables in this chapter rather than education spending is because it need not be the case that governments have to increase spending to increase the stock of human capital in a country. Governments could reveal a high premium on technological development by minimizing the waste and inefficiencies in the current education spending regime and reallocate resources to programs believed or proven to have the greatest returns on the stock of human capital.

<sup>6</sup>The data reflect the coverage of the party age variable.



Figure 3.2: Party age and education spending

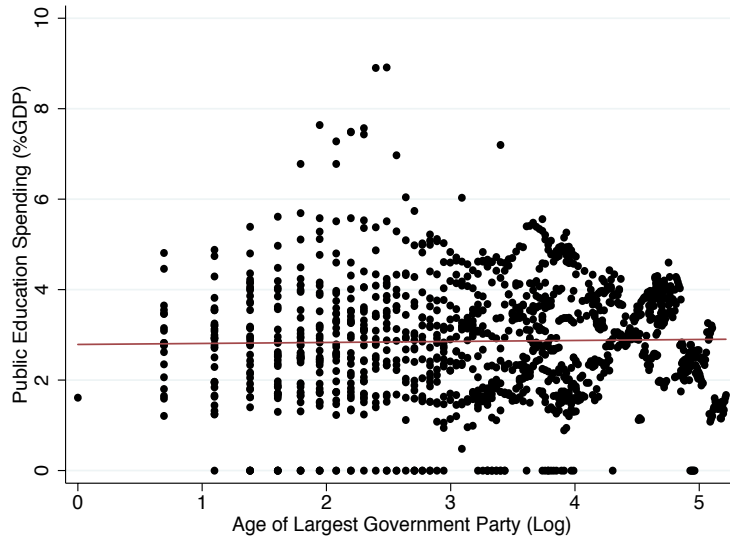


Figure 3.3: Party age and secondary education attainment

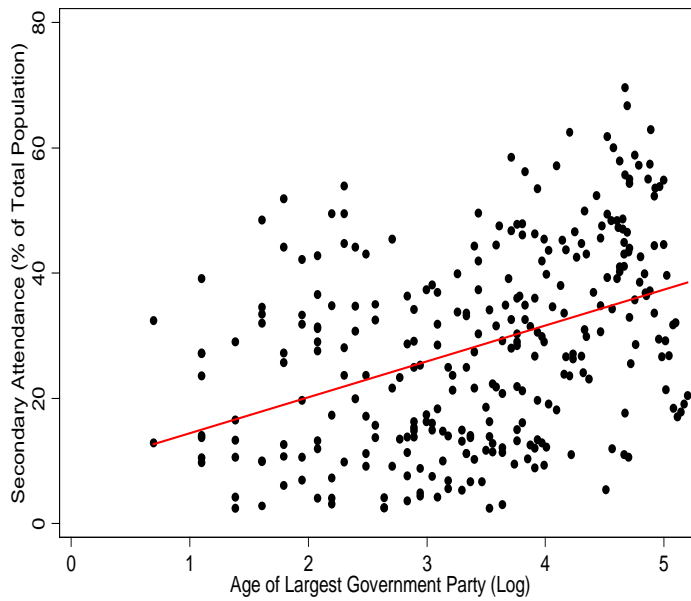
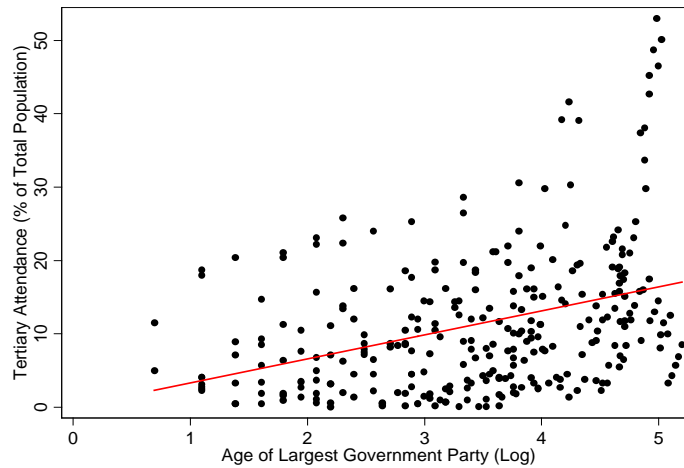


Figure 3.4: Party age and tertiary education attainment



With that in mind, I use two education attainment variables: (1) the percentage of the total population that has attained some secondary education and (2) the percent of the population that has attained some tertiary education. I obtained these data from the International Data on Education Attainment Database (Barro and Lee 2000), which collects education attainment statistics for over 100 countries for five-year intervals for the period 1960-1999.

### 3.2.2 Independent Variables

The central variable in the theory presented in Chapter is the degree to which ruling parties are well-institutionalized. We turn now to measuring that variable. Unfortunately, the extant literature on party institutionalization is not a very useful guide.<sup>7</sup> The difference between two prominent works on party institutionalization, Huntington (1968) and Panebianco (1988) is illustrative. Huntington defines insti-

---

<sup>7</sup>For that matter, even the concept of an institution itself varies among scholars. North (1990) for example, defines institutions as the formal rules and processes that impose constraints on actors, while March and Olsen (1984) take a broader view and include informal behaviors and aspects of culture.

tutionalization as the “process by which organizations and procedures acquire value and stability” (p. 12) evidenced by whether the organization in question exhibits four characteristics:

1. *Complexity*—the presence and differentiation of subunits within an organization,
2. *Autonomy*—the ability of the organization to “exist independently of other social groupings and methods of behavior” (p. 20),
3. *Coherence*—unity of purpose among members of the organization, and
4. *Adaptability*—the ability to adjust structures and modes of behavior to a changing environment.

Panebianco disagrees. While Huntington argues that “[t]he more adaptable an organization or procedure is, the more highly institutionalized it is; the less adaptable and more rigid it is, the lower its level of institutionalization” (p. 13), Panebianco contends that institutionalized parties may well *fail* to change. For Panebianco, when a party becomes institutionalized, it becomes more than just an instrument to accomplish some other goal. Rather, an institutionalized party is one that has “solidified” in terms of its general ideology, bases of support, and organizational structure. For such a party, change is hard to come by, even though the external environment may undergo change. For Panebianco, institutionalization may decrease adaptability of a party rather than stem from the ability of an institution to change over time.

Another source of confusion in the extant literature is whether party institutionalization fundamentally concerns attitudes of society and party members toward the organization or whether institutionalization concerns the behavioral attributes of the organization, the routinization of procedures and whether the current rules and procedures constitute a stable equilibrium. Here Huntington and Panebianco agree: both

dimensions are relevant. Both authors speak about the importance of routinized rules and structures and both also contend that a party is institutionalized when it becomes valued in itself rather than solely for its instrumental purposes. Others disagree however. An attitudinal dimension is conspicuously absent from North's general definition of institutions and for him institutionalization has more to do with routinization than attitudes.<sup>8</sup>

Not surprisingly, the multiplicity of concepts and meanings leads to muddled coding decisions and problems for causal inference (Levitsky 1998). One useful aspect of my theory is that it identifies specific aspects of institutionalization that matter for the economic policies under study in the dissertation. For my purposes, the relevant dimensions of party institutionalization are those that determine the degree to which an observed party resembles an ideal-type OLG organization.

Mainwaring's (1999) conceptualization of an institutionalized party as one that has strong roots in society, a capable organization, and is seen as legitimate by members of the organization and other actors is a useful framework to capture the relationship between institutionalization and "overlapping-ness". The various combinations of these three features indicate the prospects for a given party to be longer-lived than the individual members of the organization. Roots in society, for example, create a connection between citizens and the party that gives the organization a stable and dependable base of support on which it can rely over time and in multiple elections. Effective organizations are crucial for mobilizing this support base in elections. And where parties are seen as legitimate and even necessary for functioning of democratic

---

<sup>8</sup>Levitsky (1998) brings some cohesion to this debate arguing that both values of routinization of rules and behavior matter for institutionalization but they constitute separate dimensions. Actual parties may well be institutionalized on one dimension but not the other. As evidence, he gives Partido Justicialista (PJ), Argentina's Peronist party. According to Levitsky, PJ is institutionalized on the attitudinal dimension evidenced by its long-standing support from the lower classes and labor even after the death of Perón. But PJ is uninstitutionalized on the routinization dimension as seen by the fact that party members often ignore or change the party's rules and structures to suit their personal preferences at the time.

politics, ambitious individuals look to join existing parties to accomplish their political aspirations, thereby giving the party a new cohort of individuals that can sustain the organization even after the current cohort of party leaders leaves political life. By contrast, illegitimate parties with weak organizations, and only tenuous connections with social groups are likely to be fragile and unable to survive the exit of the part founder as the party has nothing except the popularity of the leader to sustain itself over time.

Despite their usefulness conceptually, practical and substantive concerns make measuring each of these three features difficult. A common way of measuring the legitimacy of an organization is through surveys of citizens in which respondents are asked to identify how much they trust various organizations. While use of such measures is common in American and comparative research, a trust instrument is problematic here. The most serious issue stems from the fact that the survey instrument does not allow us to identify the source of trust. Citizens may trust an organization on at least two grounds: the procedures by which the organization produces outcomes and the nature of the outcomes themselves (Almond and Verba 1963; Weatherford 1992).<sup>9</sup> In my theory, insofar as citizens assign legitimacy based on outcomes, there is bound to be pernicious endogeneity. I have argued that party institutionalization has observable consequences for economic policy and in the statistical models to test the theory, the dependent variables are indicators of an economy's ability and proven capacity to achieve sustained economic growth. Available evidence from comparative studies shows that real and perceived economic conditions affect the degree to which respondents trust various organizations (Anderson and Tverdova 2003). The finding that economic performance affects trust responses means reverse causality will be at

---

<sup>9</sup>So, for example, a judicial system can be seen as trustworthy (and hence legitimate) if it uses predictable and fair processes in adjudicating conflicts and/or, for example, because it manages to stamp out corruption in the government and bureaucracy.

work if the trust instrument is used on the right-hand side of statistical models as a measure of the degree of party institutionalization.

The same endogeneity problem arises with respect to measuring the strength of societal roots through survey instruments asking respondents to identify how “close” they feel to a certain party. My theory has assumed that evaluations of the incumbent party turn, at least in part, on evaluations of the economy. To the degree that attitudes of “closeness” to a party respond to the performance of the economy, citizens are going to feel close to a party presiding over a well-performing economy and distant from a party presiding over economic stagnation, malaise, and economic crisis. Again, because my theory links party institutionalization to economic policy choice and indirectly to economic performance, a causal relationship leading from economic performance to the dimensions of institutionalization creates endogeneity problems.

Instrumental variable regression provides some respite from the endogeneity concern, but such models are notoriously fickle and depend critically on strict exogeneity assumptions that often are unfulfilled (Bound et. al. 1995; Bartels 1991). And as difficult as it is to estimate an endogenous relationship between one right-hand side variable and the left-hand side variable, it is even more difficult to estimate accurately and usefully a model that accounts jointly for two endogenous relationships. An additional problem with using trust or closeness instruments is their limited spatial and temporal coverage in new and developing democracies. Surveys of the sort that asks trust questions cross-nationally are relatively new in the developing world and this lack of data will bias my sample toward stable and consolidated democracies and away from an important set of cases. Measuring the strength of an organization is not any easier. From Mainwaring’s discussion for example, one only knows a strong organization by the ability of the organization to live past the life of the leader.

An alternative strategy to measure party institutionalization is to find a variable from whose variations we can infer the values the three underlying variables take. This

variable can be used to proxy for legitimacy, societal roots, and organization strength. One variable that fits the bill is a party's *time since formation*. As discussed above, a clear observable implication of the degree to which a party is well-institutionalized is whether the party is long-lived. Illegitimate, poorly organized, and ideologically unattached parties are unlikely to persist over time. Indeed, on what grounds could such a party persist? The popularity of the leader is certainly one possibility, but the prospects of becoming a long-lived organization for a party whose political prospects turn entirely on the popularity of the party founder are bleak. By contrast, legitimate, well-organized parties with strong roots find it easier to survive over time. Party leaders can come and go and wax and wane in popularity while the party, through its organization, connectedness with groups in society, and perception of legitimacy can persist. A party's age is not a perfect proxy, of course. We do not know the exact relationships between legitimacy, societal roots, and organizational strength on one hand and party age on the other. Still, time since formation is a useful proxy as it certainly captures the sharpest differences between illegitimate, disconnected, and disorganized parties and their highly legitimate, connected, and organized counterparts.

Despite its many points of disagreement, the extant literature supports the notion of using an organization's age as an indicator of institutionalization. Huntington (1968) writes "the longer an organization or procedure has been in existence, the higher the level of institutionalization. The older an organization is, the more likely it is to continue to exist through any specified future time period" (13). Mainwaring concurs: "the ability of parties to survive a long time provides one indication that they have probably captured the long-term loyalties of some social categories" (p.31). Wibbels and Roberts (1999) use party age as a measure of party institutionalization in their study of electoral volatility in Latin America.<sup>10</sup>

---

<sup>10</sup>See also Dix (1992) Kuenzi and Lambright (2001).

Additionally, a party's time since formation is a good indicator of the degree to which a party is an OLG organization. Stokes (1999) reviews Alesina and Spear's model of parties and democratic accountability and writes, "If overlapping generations models have the mechanisms right, comparative research ought to reveal an association between the *age of parties* and the age of democracy on one hand and government responsiveness, on the other" (259-260, emphasis added). The same should apply to an OLG model of parties and economic policy. A party's time since formation is a useful indicator here precisely because it is a measure of the organization's proven capacity to survive longer than any cohort of members. With few exceptions especially new and young parties cannot be considered OLG parties as they simply do not fulfill a basic requirement: they have not actually "overlapped" anything. Older parties have proven their ability to outlive the members they serve.

I measure the age of parties with the World Bank's *Database of Political Institutions* (Beck, Clarke, Groff, Keefer, and Walsh, 2001). The database covers the period 1975-2004 for well over 150 countries of all levels of political and economic development. A party's age is coded according to the number of years since the party was founded under its current name. The investigators are aware of purely "cosmetic" name changes in which the party's name changes, but the party leaders, platform, and constituency remain the same, and they do not code an obviously cosmetic change as the date of a new party's formation. Those changes are incorporated into the time since formation of the party before the name changes.<sup>11</sup>

The left graph in Figure 3.5 shows the distribution of the age of the ruling party across all democratic country-years. The data clearly are right-skewed; this is expected. Countries that took part in the third wave of democratization constitute a

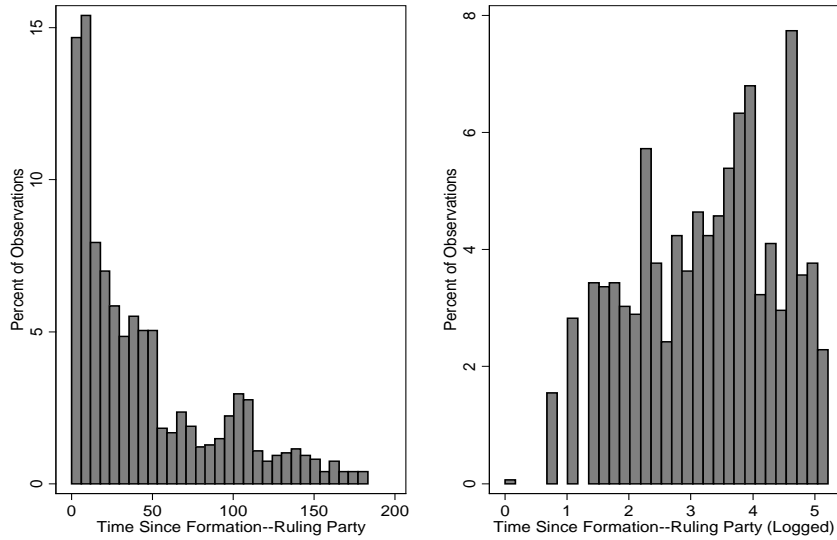
---

<sup>11</sup>A merger between parties is not counted as a new party with a new formation date unless the new party has an altogether new name instead of incorporating the name of one of the previous parties before the merger.



sizable share of the observations and it should not be surprising that the ruling parties in these countries often are relatively young; many of the parties formed only after the political openness brought by democratization. Even so, a nontrivial share of the sample have ruling parties over 50 years old. The graph on the right is the party age logged, which I will use in the subsequent statistical analyses to address the skew in the data and minimize the probability that extreme cases will wreak havoc on the estimated betas.

Figure 3.5: Time since formation for the ruling party



### 3.2.3 Modifying Independent Variables

The theory also discussed two variables that shape whether the mechanisms that connect party institutionalization to the economic policies in question here are activated. The first of these is the party’s medium-term viability, or the degree to which members of the ruling party (specifically deputy members) can reasonably expect to control a sizable share of future governments in the relatively near future. The argument is that deputies only value the increasing returns to technology policies if they believe

their party is sufficiently politically viable over time to retain some sizeable share of future governments, which in turns allows them to claim credit for some share of the returns created by technology policies deployed in a previous period.

How do we go about measuring expectations? The ideal strategy would be to interview politicians, but this is impractical in a cross-national analysis. Macro-political variables can suffice if we can use that data to simulate the calculations a politician in country  $i$  at time  $t$  actually might make when forming expectations about the party's political future. Formulating expectations about the share of future governments a party might control is exceedingly complicated and we should expect that a politician forming such expectations will look for shortcuts. That politician might assess the party's position in the legislature and government in previous years and use that as an informational shortcut regarding the party's future. So for example, a member of a party with a history of only barely exceeding the minimum number of votes necessary to receive seats in the legislature and that only rarely is part of a governing coalition will not expect that the party will control a sizable share of future governments. By contrast, members of an historically dominant party may reasonably expect to control a nontrivial share of seats in the future.

In other words, the information contained in a party's past acts as the politician's guide to how heroic the assumptions of changes in the political-economic environment must be for the politician to have suitably high expectations that the party will control a sizable share of future governments. A member of a traditionally small party that is also inessential for governing coalitions would need to make rather heroic assumptions about changes in the political and economic status quo to conclude that the party should expect to obtain a sizable share of future governments. Members of viable and dominant parties need not resort to such strained assumptions to reach the same conclusion. Rather in the political economy as it exists, members of this party can conclude that their party is a viable political actor. Therefore, we can

use macro-political data to approximate individual politicians' calculations regarding their parties' future prospects. Specifically, as alluded to above, perhaps the most useful information for a politician forming expectations about the party's prospects in the not-too-distant future is the ruling party's *past share of seats in the legislature*.

Worth noting is the fact that past shares of seats is not, and probably cannot be a perfect measure of *actual* seat shares a party receives in future periods. Unforeseen and exogenous shocks that decrease the relevance of past events may occur and politicians may alter their campaign and policymaking strategies based on their previous seat shares, thereby reducing the salience of past conditions for the future. Thirdly, a myriad of factors shape the share of seats a party obtains and actual share of seats simplifies the processes at work producing unavoidable estimation error. Each of these are serious concerns, but even so past seat share can still be useful.

For one, we do not need to predict the share of seats a party will actually control. For the purposes of testing my theory, the measure needs only to capture the likely estimate a party member has, accurate or not. Politicians will act according to their expectations, irrespective of whether those expectations prove close approximations to reality in a future period. With that in mind, my measure needs only to capture the crucial ingredients in that estimate, one of which almost certainly will be the party's past share of seats. Notice also that this logic implies that exogenous shocks that decrease the relevance of the past share of seats or the fact that politicians may alter their behavior based on the distribution of seat shares are not too troubling. If a given exogenous shock or policy change by members of an opposing party truly are unforeseen, their effects will not enter the calculations of party members in the present period and so they are irrelevant from the standpoint of forming expectations before the shocks and endogenous changes occur.

The variable that I create to measure expectations of the share of future governments a party can expect to control then is a *moving average of the party's past*

*share of seats*. I use a moving average both because over time, significant variation in a party's seat share can occur and because a representative politician is likely to weigh the recent past more heavily than the distant; a moving window simulates this by dropping information from the too-distant past from the politician's calculus altogether.

The inevitable concern with using a moving average is the possibility that the length of the window of time used to create the average will drive the results. There is no getting around the fact that the choice of window length is arbitrary, but to ensure the results are robust, I will create measures based on a couple of window lengths. Primarily, I will use a length of 5 years. Longer windows are preferable theoretically but as a practical matter, the costs of lengthening the window outweigh the benefits. A nontrivial share of observations in my database are new democracies or relatively short democratic episodes in between periods of autocratic rule and do not last much longer than 4 or 5 years and even then, the ruling party may change frequently during that period. Using a window of longer than five year excludes these observations from the sample and biases the sample toward stable countries and away from developing and transitioning ones. That said, five year years should be long enough in most countries to cover at least 1 election period and so should be long enough to find changes in the seat share of the parties.

The second variable that conditions when we should expect to observe the effects of party institutionalization on economic policy is the expected returns of the mobilization strategy. The crux of the theory is that party deputies hope to avoid a scenario in which party leaders use short-term economic growth policies exclusively and leave party deputies to shoulder the economic and political costs of that strategy in the future. It should be evident that if the mobilization strategy is not expected to run into diminishing returns in the near future, then party deputies will have no problem with an exclusive short-term strategy. In fact, just the opposite should be

the case. When it is not expected that the mobilization strategy will not exhibit diminishing returns, deputies' preference are completely in line with party leaders and everyone prefers to use the mobilization growth strategy exclusively. In this instance, deputies do not feel that their hands are being tied and their ability to manipulate the economy in a future period undermined by the behavior and economic policy preferences of party leaders. In other words, the intensity of members of the deputy cohort's preferences depends on the expected costs and benefits of the mobilization strategy itself. Should deputies expect that the mobilization will exhibit diminishing returns and that they will be forced to handle the economic and political fallout that comes with those decreasing returns, deputies will tend to prefer to place some nontrivial weight on technological progress (subject to the constraint of winning the most immediate election).

I measure the expected returns to mobilization as the level of *investment as a share of a country's Gross Domestic Product*. The hypothesis motivating this variable choice is that the growth effects of mobilizing capital and labor where those factors of production are under-mobilized will be much more significant in comparison to those countries where that have already invested in mobilizing those factors. In countries with especially low stocks of capital, a government initiative to mobilize capital and labor can have dramatic positive economic benefits. In countries where the stock of capital is already quite high, mobilizing more labor to a degree that has a significant economic impact becomes increasingly difficult and it should be in this instances where the effect of party institutionalization should be more pronounced.

### 3.2.4 Estimation

To test the theory, I estimate the following equations separately using Ordinary Least Squares.

$$ED_i = \beta_0 + \beta_1 PARTY_i + \beta X_i + \epsilon_i \quad (3.1)$$

$$ED_i = \gamma_0 + \gamma_1 PARTY_i + \gamma_2 MV_i + \gamma_3 PARTY_i * MV_i + \gamma X_i + \nu_i \quad (3.2)$$

$\beta_0$  and  $\gamma_0$  are constant terms,  $ED_i$  is either secondary or tertiary education attainment for country  $i$ ,  $PARTY$  is the party institutionalization measure,  $MV$  either of the modifying variables,  $X$  a set of economic and political control variables, and  $\epsilon$  and  $\nu$  the error terms. Equation 3.1 tests the general proposition that institutionalized ruling parties matter. Equation 3.2 test the validity of the modifying conditions. Both are useful to assess the theory.

One necessary control variable is the *log of per capita GDP*, which accounts for “Wagner’s Law”, the proposition that increasing levels of wealth correspond with more government spending on services like education programs. GDP per capita also measures the extent to which citizens have access to a private source of education supply. Wealthier citizens have easier access to private schools, which they can use if they deem the government’s education programs inadequate. Poor citizens must rely on public education programs. GDP may also be correlated with the age of parties. As an empirical matter, it is certainly the case that most countries that have long-lived parties are, with few exceptions, exceptionally rich countries and those countries with young parties are disproportionately new democracies and short-lived democratic episodes; observations disproportionately relating to the developing world. Additionally, insofar as economic performance affects citizen’s trust and closeness evaluations, it will be the case that parties in wealthier countries will find their support among the citizenry longer-lasting than the support of citizens for particular parties where the economy is poorly-performing.

I also include the *log of a country’s population* in the models. Recall that the dependent variables under scrutiny in this chapter are scaled as a percent of country  $i$ ’s total population. Countries with large populations then, will have to allocate more resources or allocate resources more productively than their less populated counterparts to achieve similar results. Data on GDP and population are obtained from the

Penn World Tables Version 6.1 (Heston, Summers, and Aten 2002).

Even though the sample of countries used in the statistical models excludes dictatorships, variation in the level of democracy still exists. This is relevant given the substantial evidence that more democratic countries spend more on education (and public goods in general) and spend more productively, evidenced by their better performance on education statistics (Lake and Baum 2001; Stasavage 2005; Brown and Hunter 2004; Kaufman and Segura-Ubiergo 2001; Rudra and Haggard 2005). To account for this and to isolate the effect of party institutionalization irrespective of the degree of democracy, I include *level of democracy* as a control using the Polity database (Marshall, Jaggers, and Gurr 2004).

The *log of the age of the regime* is a useful control variable as well. Using a party's time since formation as an independent variable runs the risk of conflating the effects of institutionalized parties with the effects of an institutionalized regime. Not surprisingly, old parties typically exist only in established regimes. Since there is little doubt that politics in established and new democracies differ considerably on many dimensions, including the age of the party, omitting the age of the regime may produce a spurious correlation on the party age variable. Its estimated effect may "pick up" the effects of the institutionalized and consolidated regimes.

The next set of variables are institutions that distinguish between types of democracies and that may also affect education spending patterns. First, I control for whether a country has a *presidential or parliamentary* arrangement given the evidence that this distinction generates differences in the amount of government spending and its efficiency. Persson, Roland, and Tabellini (2000) for example argue that presidential systems should have smaller governments as they will allocate fewer resources to inefficient programs and they spend less on public goods. Their finding regarding public goods is especially relevant here. Education spending is not a pure public good *per se*, but it is a public-regarding good as Cox and McCubbins (2001)

define that term. More significantly, the main outcome associated with human capital—namely sustained economic growth—does approximate a public good. I use the Database of Political Institution’s trichotomous measure which divides democracies into three types: parliamentary (which receives a score of 2), assembly-elected presidential (scored as 1), and directly-elected presidential systems (a score of 0).<sup>12</sup>

To account for any differences in spending levels and efficiency that may exist between majoritarian and proportional representation systems, I include an indicator variable from DPI that assigns a value of 1 to plurality systems and a 0 to PR systems.

I also include a set of regional dummy variables into the model. I do so to account for the broader political and economic trends that determine education statistics in individual countries. Take for example the set of Eastern European countries of the former Soviet Union that have successfully transitioned to democracies after the collapse of the U.S.S.R. During the Cold War, communist governments promoted education actively. They did so to teach and spread the ideology and also to create a stock of human capital that would rival, if not surpass, that in the West. Consequently, the countries of the Eastern Bloc had some of the highest education attainment rates in the world. After the collapse of the Soviet Union, these countries retained high stocks of human capital. For those countries that transitioned to democracy and therefore enter my sample here, the fact that they have high education attainment rates has nothing to do with the quality of their political parties since they became democratic, but rather the nature of the communist regime that controlled the country for decades. Failing to account for the fact that these new democracies emerged from regimes that placed a good deal of emphasis on education will mis-estimate the

---

<sup>12</sup>In the instance that a country has both a prime minister and president, the investigators consider whether the president has veto powers where the legislature needs a supermajority to override that veto, whether the president can appoint *and* dismiss the prime minister, and whether the president can dissolve parliament. A system is categorized if the first of these is true or the second *and* third points are true.



effect of party institutionalization.

A similar issue exists for countries in East and Southeast Asia. As has been recounted numerous times, autocratic regimes in these countries made great strides in increasing literacy rates since the 1950s and 1960s. Moreover, there is evidence that countries in the region learned from each other and mimicked successful economic policies including those oriented toward improving education. Since the 1990s, many of these countries have transitioned to democracy and many have altogether new parties controlling government. But since the education rates are sticky, it would seem that absent some set of controls to model the fact that a previous regime went a long way in forging the stock of human capital that we observe today, we will estimate poorly the effect of the party institutionalization on education attainment. Unfortunately, despite the volumes of literature on the topic, we still do not have a very good sense as to what determined why regimes in these countries went to such greater lengths to forge human capital and what factors shape the variations in the effort and ability the governments had to do so. A regional control variable can grant us some leverage here however. To account for these broader factors as well as potential similar issues in the other regions, I include a set of regional dummy variables in all of the models; Sub-Saharan Africa will be the excluded category.

I estimate equations 3.1 and 3.2 using a cross-section sample of democratic episodes between the years 1975-1999, where an episode is defined as any country-year with a Polity score greater than 0 on the standard twenty point scale ranging from -10 to 10. At first glance, using a cross-section sample may appear questionable in light of the increasing popularity of TSCS samples and techniques in the comparative political economy field and the theory which deals with specifically with the nature of a specific ruling party at a specific country-time. Without a doubt TSCS models can be useful. They allow researchers to model both cross-national and temporal variations and avoid discarding useful information. Even so, there exist a couple of reasons why

a TSCS sample and corresponding techniques are inappropriate here.

The first is the problem of serial correlation in both independent and dependent variables. Education attainment statistics change only slowly over time and typically changes in attainment move in one direction: toward higher proportions of the population having attained some education. Age of the ruling party too, exhibits autocorrelation; not surprising since ruling parties are in power typically for more than one year at a time. The first-order correlation for secondary education attainment in my is 0.94 and even higher for tertiary education at 0.97. This, despite the fact that the education data were collected only once every 5 years. It is likely that the correlations would be even larger if the data were gathered on a yearly basis. The first-order correlation for the age of the ruling party is 0.97 for the observed values of the indicator and 0.93 for the log of the party age variable.

As is well-known serial correlation on the left-hand side presents several important statistical problems. One can however model the serial correlation with a lagged dependent variable (LDV) as Beck and Katz (1995) recommend. Doing so however, does not constitute a perfect solution. Achen (2000) warns of the statistical problems that arise with both independent and dependent variables exhibit high serial correlation. He shows that including an LDV on the right-hand side can wreak havoc on the model's exogenous autocorrelated Xs. Specifically, he finds that when both Xs and Ys exhibit serial correlation, the coefficient on the LDV is biased upward and dominates the regression, while at the same time wiping out the effect of the other trended exogenous variables. Even worse, the presence of an LDV may cause the sign on the exogenous coefficients to flip altogether. An AR(1) model avoids this concern, but is less appealing substantively here since we have reason to believe that it is not the errors that are correlated over time but rather the level of secondary and tertiary education attainment themselves.

An added complication is that the models require the inclusion of country-specific

fixed effects to model unit heterogeneity. In a model that included country dummies (not shown here), an F-test on the set of country dummies rejects the null hypothesis. The inclusion of country-specific effects is problematic though because many of the independent variables whose effects I want to estimate are time-invariant or move only infrequently over time. The country-specific effects will be highly correlated with the slowly-moving variables and perfectly correlated with the time invariant one; the sluggish variables will have very large standard errors and the time invariant ones will drop from the model altogether.<sup>13</sup>

Still, we might be able to gain some traction on equations 3.1 and 3.2 using a TSCS sample by using a distributed lag model, a distributed lag model with an autoregressive component, or an error-correction model, but I contend that even in light of these alternatives, an important issue exists that warrants the use of a cross-sectional sample. Simply put, given the data, *most of the variation that needs explanation is in fact cross-sectional in nature rather than temporal*. The issue here is that the variable I use to measure party institutionalization—the log of party age—moves more frequently than the concept of institutionalization itself does. Party age moves every year, but a party’s level of institutionalization is exceedingly sticky. To state the obvious, the ruling party cannot increase in age by more than 1 year at a time. This however, is far too small an increase to generate meaningful changes in institutionalization and so it is far too small to produce the changes in the dependent variable that I expect to observe. *In short, a unit change of the independent variable used in the model does not produce a change in the conceptual independent variable*.

A problem would not exist if a large number of countries had both well- and

---

<sup>13</sup>The main alternative to the fixed effects estimator, the random effects model, is inappropriate as well. The sampling strategy in this project is to collect as many democratic episodes as possible and so it is difficult to argue that the unit-effects are randomly drawn from some larger universe of cases. Nor are we likely to fulfill the rather strict assumptions of exogeneity between the Xs and the errors that the random effects model requires.

weakly-institutionalized parties and control of government frequently alternated between them. Unfortunately, precisely the opposite occurs more often. In most countries that have institutionalized parties, *all* of the major political parties are relatively well-institutionalized and vice versa. In my sample, for example, the average within-country standard deviation in the age of ruling parties is just over 11 years, the median is 9 years, and the 75<sup>th</sup> percentile only 15 years. It is quite a stretch to argue that 11 years is sufficiently different to distinguish between a well- and weakly-institutionalized ruling party. Add to this the fact that most countries that have large standard deviations in the age of the ruling parties are wealthy democracies and they have larger standard deviations in no small part because of longer time series in the data rather than because there are clear differences between the level of institutionalization in the ruling parties. Of the set of countries that have standard deviations in the age of ruling parties at the mean value (11.8) or lower, 75% of observations are developing countries (i.e., non-OECD democracies) and the average age of the democratic episodes for those developing countries is less than 14 years.<sup>14</sup> For countries in the 75<sup>th</sup> percentile in terms of the standard deviation of the age of ruling parties (14.94), just under 60% of the observations are OECD countries and the average age of the regime for these OECD countries is over 48 years.<sup>15</sup> Much of the variation in the standard deviation of party ages then comes as a function of the age of the regime, not because of any substantial differences in the level of institutionalization between parties in a country.

Think about it this way. Consider a hypothetical young democracy that has existed for ten years. Let the hypothetical country have two parties, each of which

---

<sup>14</sup>For all countries with a standard deviation at or below the mean value, the average regime age is still just under 20 years.

<sup>15</sup>For all countries above the 75<sup>th</sup> percentile, the average regime age is still just about 35 years.

ruled for 5 consecutive years. Party A ruled for the first five years and Party B rule for years 6-10. Assume each was formed immediately at the founding of the democratic regime. At the end of the 10-year period, it is safe to say that neither party would be old enough to be considered well-institutionalized. In a TSCS set of countries, all of the observations would indicate a weakly-institutionalized party ruled government even though in period 1, the ruling party was one year old and in period 10, the ruling party was ten years old. Despite the fact that the ages of the party changed over time, the observations represent repeated observations of the same political event—a weakly-institutionalized party controlling government. In this scenario, the conceptual independent variable is a constant even as the independent variable as operationalized varies. The relevant comparison groups are not the hypothetical country at time 1 versus the same country at time 10, but rather countries controlled by weakly-institutionalized and those controlled by well-institutionalized ones.

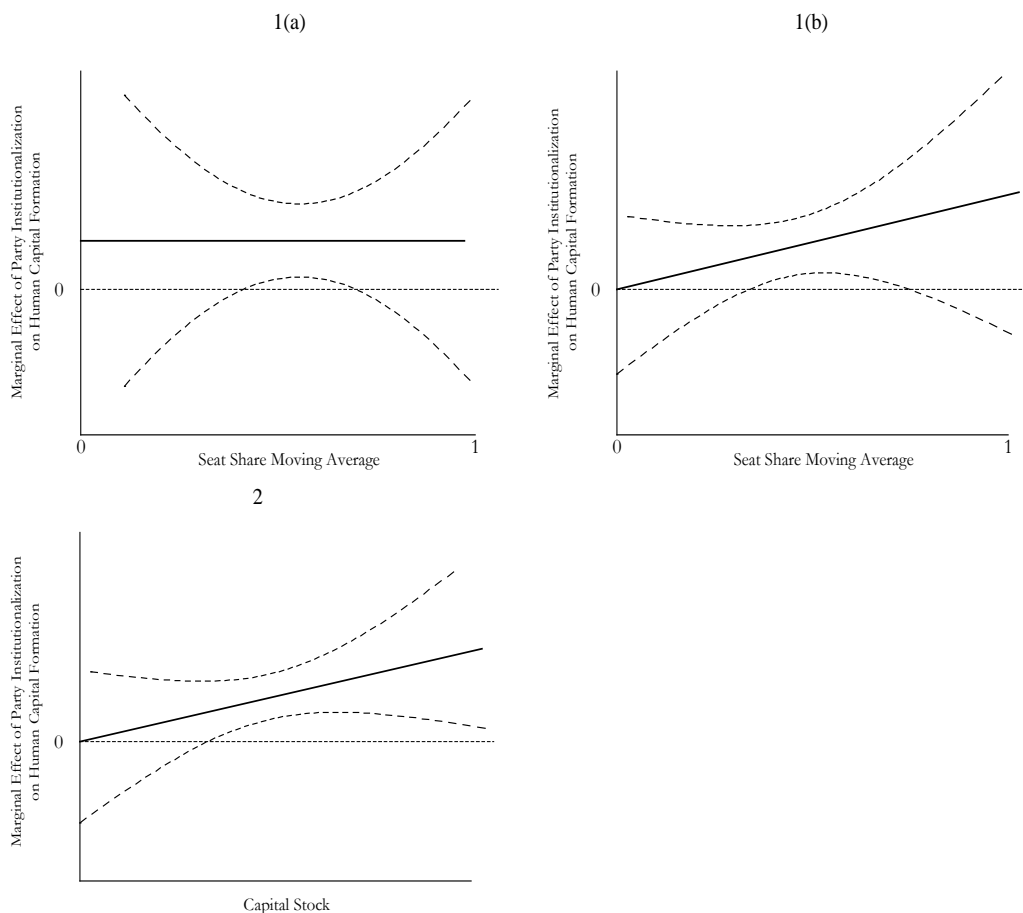
The upshot here is that for most countries, the variation in the ages of ruling parties is negligible relative to the variation needed to indicate significant cross-party variations in institutionalization. Consequently, given my theory, within a country over time, we will not observe noticeable differences in the premium technological progress receives. That this is true means that using a TSCS sample of countries is inappropriate since the core conceptual variable—party institutionalization—effectively is a constant for most countries or at least quite sluggish.

## **Expectations**

In Equation 3.1, the theory's expectations are clear: *PARTY* should be positive. Figure 3.6 illustrates the expectations stemming from Equation 3.2. In each graph, the bold solid line represents the marginal effect of party institutionalization, the curved dashed lines indicate the confidence intervals around that effect ( curved to represent the distribution of the modifying variable and the increased confidence we have of the marginal effect where we have more data).

Graph 1(a) reflects Equation 3.2 where the modifying variables is either the three-year or 5-year ruling party's past seat share. The figure shows that the marginal effect of party institutionalization is positive throughout the range of the modifying seat share variable, but is only statistically significant for a small range of that variable. This represents the theoretical proposition that it is only in the instances when the ruling party expects to control some sizeable share of future governments, measured by a moving average of past share of seats, that party deputies will have an incentive to press for a greater premium on technology policy. When they do not have such expectations (when the moving average of seat shares is small), deputies infer that they will be unable to reap the political rewards of their technology policies since they will not be in power to claim credit what returns ultimately arrive. Therefore, deputies do not use their bargaining leverage.

Figure 3.6: Theoretical expectations



Notice also that in Graph 1(a) that the effect of party institutionalization becomes insignificant at very high level of seats shares. This reflects the effects of weak competition on a ruling party's policymaking strategies. When a party has controlled an exceptionally large share of seats for some nontrivial length of time in the past, say upwards of 70% for example, it likely does so because of weak political competition, constraints on the ability of opposition parties to mobilize support, or outright manipulation at the ballot box. In any event, when a party controls an exceedingly large

share of seats, we can expect that the possibility of being evicted from office for poor economic performance is lower and so the incentive to provide a growing economy is lower too. As Lake and Baum (2001), Bueno de Mesquita, Siverson, Smith, and Morrow (2004) have noted, a certain level of political competition is necessary to inspire leaders to care about economic growth at all. Insofar as an exceptionally large share of seats over a long period of time is evidence of a lack of that level of competition it should be the case that the effect of a large share of seats trumps the effects of party institutionalization.

Graph 1(a) shows the marginal effect of party institutionalization as having a flat slope for illustrative purposes, but in practice, the slope may be positive as in Graph 1(b). Graph 2, reflects Equation 3.2 where the modifying variable is investment as a share of GDP. Here, the slope certainly should be positive, indicating the effects of party institutionalization should increase with the stock of capital as further mobilization will have smaller and smaller effects on the overall growth rate.

I now turn to the statistical results.

### **3.3 Results**

Table 3.1 presents the results from Equation 3.1. Model 1 in the table presents results using secondary education attainment as the dependent variable and Model 2 uses tertiary education attainment. The results of both models support the proposition in the theory regarding the effect of political parties are policies designed to fuel innovation and technology adoption. In each, the coefficient is positive and statistically significant. The sizes of the coefficients are of substantive importance too. Given that party age in its logged form, the results tell us that a 1-percent increase in the age of the ruling party increases secondary education attainment by about 2.7% of the population and tertiary education attainment by about 1.5%. This is consistent with the hypothesis that institutionalized, long-lived parties give a greater emphasis



on policies designed to fuel innovation and technology diffusion.

Notably, the effect of the age of the ruling party exists when controlling for the age of the regime. These results inform us that something particular about the nature of ruling parties determines education attainment. It is not just that older, consolidated democracies outperform new and unconsolidated democracies. Rather, we see in these two models that regimes where the ruling parties are on average more institutionalized tend to have politicians that set different kinds of policies than in countries dominated by weakly-institutionalized ones.

How stable are these results? For Model 1, Cook's Distance scores suggest that six countries might be outliers: Hungary, Jamaica, Papua New Guinea, Poland, Portugal, and Thailand. DFITS statistics identify, along with some of the above, Austria, Germany, Congo, Guyana, and South Korea.<sup>16</sup> In a small sample like this one, potential outliers can wreak havoc on the results and we want to assess whether the estimates depend on these observations. To do so, I reestimate the equations dropping each of the above cases from the model in turn. The results are reported in Table 3.2. For the model using tertiary education as the dependent variable, the results where secondary education is the dependent variable are presented in Table 3.3 and Table 3.3 shows the results of models using tertiary education as the dependent variable.<sup>17</sup>

---

<sup>16</sup>With respect to Cook's D, I follow Chatterjee and Hadi (1988) and identify potentially influential outliers if  $D_i \geq 4/(n - k - 1)$ . Regarding DFITS, I follow Bollen and Jackman's (1985) cutoff of  $DFITS_i \geq 2 * (k/n)^{1/2}$ .

<sup>17</sup>Note: the countries that are deemed outliers are different for the two dependent variables. The countries excluded are listed above each model in the two tables.

Table 3.1: Regression Results: Baseline model

Model Number	(1) <sup>a</sup>	(2)
DV:	Secondary	Tertiary
Party Age	2.71** (1.33)	1.58** (0.74)
GDP	8.57*** (2.50)	2.70* (1.38)
Regime Age	4.00** (1.60)	1.69* (0.89)
Polity Score	-0.92 (0.69)	0.22 (0.38)
Population	-1.26 (0.82)	-0.26 (0.46)
Pres/Parl	-3.30* (1.68)	-4.36*** (0.93)
Plurality	0.59 (2.21)	3.30*** (1.22)
OECD	8.61 (5.76)	7.83** (3.19)
Post-Soviet	21.10** (8.11)	6.90 (4.48)
L.America	-5.06 (3.57)	1.11 (1.97)
Mid.East	5.41 (7.48)	13.50*** (4.13)
S.Asia	10.06* (5.46)	5.01 (3.02)
E.Asia <sup>b</sup>	6.46 (4.48)	5.78** (2.48)
Constant	-47.62*** (16.33)	-24.37*** (9.03)
R-squared	0.67	0.59
Observations	73	73
Akaike	522.19	435.65
Schwartz	554.25	467.72

<sup>a</sup>\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

<sup>b</sup>Sub-Sahara Africa is the excluded regional category

Table 3.2: Regressions Results: Secondary education models excluding outliers

Model Number Excluded Case:	(3) <sup>a</sup> Hungary	(4) Jamaica	(5) Papua	(6) Portugal	(7) Thailand	(8) Austria	(9) Congo	(10) Germany	(11) Poland	(12) S.Korea	(13) Guyana
Party Age	2.71** (1.33)	2.25* (1.31)	2.56* (1.31)	1.90 (1.31)	3.32** (1.34)	2.46* (1.30)	2.51* (1.32)	2.70** (1.28)	2.71** (1.33)	2.93** (1.34)	2.59* (1.34)
GDP	8.66*** (2.50)	10.05*** (2.52)	8.00*** (2.47)	9.51*** (2.42)	7.96*** (2.46)	8.76*** (2.43)	8.86*** (2.47)	8.28*** (2.40)	8.66*** (2.50)	8.41*** (2.50)	8.96*** (2.54)
Regime Age	3.84** (1.61)	4.70*** (1.59)	4.30*** (1.58)	2.97* (1.59)	3.82** (1.57)	4.28*** (1.56)	4.31*** (1.59)	4.07** (1.54)	3.84** (1.61)	3.62** (1.63)	3.80** (1.62)
Polity Score	-0.89 (0.69)	-1.31* (0.69)	-0.57 (0.70)	-0.89 (0.66)	-1.18* (0.68)	-0.94 (0.67)	-0.83 (0.68)	-0.98 (0.66)	-0.89 (0.69)	-0.82 (0.69)	-0.65 (0.75)
Population	-1.29 (0.82)	-1.40* (0.80)	-1.32 (0.81)	-1.45* (0.79)	-1.02 (0.81)	-1.20 (0.80)	-1.13 (0.82)	-1.55* (0.80)	-1.29 (0.82)	-1.22 (0.82)	-1.13 (0.84)
Pres/Parl	-2.97* (1.70)	-4.56** (1.72)	-3.02* (1.65)	-3.44** (1.60)	-2.57 (1.68)	-3.44** (1.63)	-3.17* (1.65)	-3.52** (1.61)	-2.97* (1.70)	-2.83 (1.71)	-3.63** (1.71)
Plurality	0.92 (2.23)	0.14 (2.15)	0.68 (2.17)	-0.58 (2.17)	0.71 (2.16)	1.20 (2.16)	1.20 (2.21)	0.10 (2.13)	0.92 (2.23)	0.41 (2.21)	0.87 (2.23)
OECD	8.24 (5.76)	8.34 (5.59)	7.77 (5.67)	10.40* (5.56)	9.26 (5.64)	7.55 (5.61)	8.22 (5.69)	8.89 (5.52)	8.24 (5.76)	8.21 (5.75)	7.49 (5.89)
Post-Soviet	27.35*** (9.78)	20.15** (7.87)	21.20*** (7.95)	18.49** (7.82)	22.64*** (7.95)	20.89** (7.86)	21.19** (7.99)	22.25*** (7.78)	14.07 (10.17)	20.75** (8.08)	19.35** (8.32)
L.America	-4.91 (3.56)	-7.40** (3.62)	-4.89 (3.50)	-5.16 (3.41)	-4.30 (3.51)	-5.13 (3.46)	-4.34 (3.54)	-4.81 (3.42)	-4.91 (3.56)	-4.89 (3.56)	-6.12 (3.75)
Mid.East	5.21 (7.46)	5.40 (7.25)	4.52 (7.35)	4.29 (7.17)	6.25 (7.31)	5.47 (7.25)	5.62 (7.37)	6.06 (7.17)	5.21 (7.46)	4.97 (7.45)	4.73 (7.52)
S.Asia	9.82* (5.45)	12.20** (5.38)	9.49* (5.36)	11.68** (5.26)	8.56 (5.38)	10.00* (5.29)	10.45* (5.38)	11.06** (5.24)	9.82* (5.45)	9.47* (5.45)	10.05* (5.46)
E.Asia <sup>b</sup>	6.12 (4.48)	6.34 (4.35)	8.74* (4.57)	5.79 (4.30)	8.76* (4.53)	6.24 (4.35)	6.80 (4.43)	7.39* (4.31)	6.12 (4.48)	4.82 (4.66)	5.71 (4.56)
Constant	-48.25*** (16.30)	-53.83*** (16.07)	-45.56*** (16.05)	-47.42*** (15.62)	-45.73*** (15.97)	-49.62*** (15.85)	-52.96*** (16.41)	-42.44*** (15.78)	-48.25*** (16.30)	-47.30*** (16.26)	-52.29*** (17.08)
R-squared	0.67	0.69	0.68	0.70	0.68	0.67	0.68	0.68	0.66	0.67	0.67
Observations	72	72	72	72	72	72	72	72	72	72	72
Akaike	514.82	510.66	512.32	508.82	511.77	510.70	513.10	509.03	514.82	514.57	515.32
Schwartz	546.69	542.54	544.20	540.69	543.64	542.58	544.97	540.91	546.69	546.45	547.20

<sup>a</sup>\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

<sup>b</sup>Sub-Sahara Africa is the excluded regional category

In virtually every instance, the results do not change substantively; even the coefficients' sizes are relatively stable to the exclusion of these cases. Of the set of excluded cases only two cases total seem to change the results in any substantive way: Portugal (in Table 3.2) and Canada (in Table 3.3).

Even as the results are robust to their exclusion, dropping cases is not particularly appealing. Granato, Ingelhart, and Leblang (1996) critique this strategy thusly. "Not only do these cases provide valuable information, but also one imagines a situation where after deleting observations and reestimating the model other influential cases are identified and are removed. This process continues until few interesting observations remain" (623). Nor is adding a set of dummy variables for countries in question since there is no theoretical reason to add more variables to the models. In light of this, I employ a second strategy to assess the model's stability in light of potential outliers. Welsch (1980) proposes a one-step bounded-influence estimator, whereby one uses weighted least squares to estimate the equation of interest with weights calculated as follows:

$$Weight = 1 \quad \text{if} \quad |DFITS| \leq .34 \quad (3.3)$$

$$Weight = (.34/|DFITS|) \quad \text{if} \quad |DFITS| > .34 \quad (3.4)$$

where .34 is suggested as it provides approximate 95% asymptotic efficiency. This strategy will estimate the model weighs the potentially outlying observations less, by the degree to which it affects the coefficients in the model.

The results of the bounded-influence estimations for both education attainment statistics are presented in Models 24 and 25 in Table 3.4. Here again, the substantive results do not change. In fact, the coefficients of the party age variable both increase in size in both models. From these estimates a 1-percent increases in ruling party age increases secondary attainment in the population by just under 3% and tertiary education just under 2%. In the tertiary model, the coefficient is even more significant

Table 3.3: Regressions Results: Tertiary education models excluding outliers

Model Number Excluded Case:	(14) <sup>a</sup> Canada	(15) Hungary	(16) Israel	(17) NZ	(18) Peru	(19) Philippines	(20) USA	(21) Poland	(22) Sri Lanka	(23) Turkey
Party Age	0.97 (0.63)	1.58** (0.74)	1.60** (0.73)	1.50** (0.72)	1.69** (0.73)	1.68** (0.74)	1.29* (0.74)	1.58** (0.74)	1.53** (0.73)	1.60** (0.73)
GDP	3.09** (1.16)	2.66* (1.39)	2.33* (1.39)	2.75** (1.35)	2.64* (1.36)	3.11** (1.41)	2.74** (1.36)	2.66* (1.39)	2.88** (1.37)	2.33* (1.39)
Regime Age	1.45* (0.75)	1.76* (0.89)	1.49* (0.89)	1.56* (0.87)	1.76** (0.87)	1.48 (0.89)	1.47* (0.88)	1.76* (0.89)	2.08** (0.90)	1.49* (0.89)
Polity Score	0.21 (0.32)	0.20 (0.38)	0.23 (0.38)	0.23 (0.37)	0.32 (0.38)	0.19 (0.38)	0.16 (0.37)	0.20 (0.38)	0.18 (0.37)	0.23 (0.38)
Population	-0.34 (0.38)	-0.25 (0.46)	-0.10 (0.46)	-0.10 (0.45)	-0.31 (0.45)	-0.30 (0.45)	-0.35 (0.45)	-0.25 (0.46)	-0.47 (0.47)	-0.10 (0.46)
Pres/Parl	-4.35*** (0.78)	-4.50*** (0.94)	-4.13*** (0.93)	-4.22*** (0.90)	-4.44*** (0.91)	-4.12*** (0.94)	-3.72*** (0.98)	-4.50*** (0.94)	-4.89*** (0.97)	-4.13*** (0.93)
Plurality	2.43** (1.04)	3.16** (1.24)	3.19** (1.21)	2.88** (1.21)	3.67*** (1.22)	3.20** (1.22)	2.77** (1.24)	3.16** (1.24)	3.10** (1.21)	3.19** (1.21)
OECD	7.16*** (2.68)	7.99** (3.20)	8.33** (3.17)	7.10** (3.12)	7.52** (3.14)	7.04** (3.22)	7.45** (3.14)	7.99** (3.20)	7.91** (3.14)	8.33** (3.17)
Post-Soviet	5.77 (3.77)	4.27 (5.43)	7.19 (4.43)	6.32 (4.37)	6.95 (4.40)	6.07 (4.49)	6.57 (4.41)	9.86* (5.65)	7.27 (4.42)	7.19 (4.43)
L.America	1.12 (1.66)	1.04 (1.98)	1.52 (1.97)	1.05 (1.92)	0.62 (1.96)	0.86 (1.97)	1.58 (1.96)	1.04 (1.98)	0.69 (1.96)	1.52 (1.97)
Mid.East	12.48*** (3.48)	13.59*** (4.14)	8.59 (5.18)	12.86*** (4.04)	13.66*** (4.06)	12.97*** (4.12)	12.64*** (4.09)	13.59*** (4.14)	13.74*** (4.08)	18.57*** (5.24)
S.Asia	5.67** (2.54)	5.11* (3.02)	4.36 (3.01)	4.57 (2.94)	5.06* (2.96)	5.03* (2.99)	4.86 (2.97)	5.11* (3.02)	7.85** (3.42)	4.36 (3.01)
E.Asia <sup>b</sup>	5.58*** (2.08)	5.92** (2.49)	5.80** (2.45)	5.47** (2.42)	5.81** (2.44)	4.43 (2.66)	5.62** (2.44)	5.92** (2.49)	6.27** (2.46)	5.80** (2.45)
Constant	-23.58*** (7.58)	-24.10** (9.05)	-22.83** (8.98)	-25.45*** (8.80)	-24.73*** (8.87)	-26.70*** (9.13)	-22.29** (8.95)	-24.10** (9.05)	-23.95*** (8.90)	-22.83** (8.98)
R-squared	0.64	0.59	0.59	0.58	0.61	0.60	0.53	0.59	0.60	0.60
Observations	72	72	72	72	72	72	72	72	72	72
Akaike	404.74	430.15	428.17	426.00	427.35	428.83	427.37	430.15	427.70	428.17
Schwartz	436.62	462.02	460.04	457.87	459.22	460.70	459.25	462.02	459.57	460.04

<sup>a</sup>\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

<sup>b</sup>Sub-Sahara Africa is the excluded region.

than in the original model.<sup>18</sup>

According to the standard litany of statistical tests and post-estimation plots, heteroscedasticity exists and is especially prevalent in the tertiary education model (Model 2 in Table 3.1. Models 26 and 27 in Table 3.4 present results of the estimated equations using Huber/White “robust” standard errors. Once again, the substantive results do not change.

### 3.3.1 Testing the Modifying Conditions

We have tested whether an unconditional effect of party age exists and whether the direction of the effect is as the theory predicts and thus far the results support the proposition developed in Chapter 2 that party institutionalization matters.

But the theory also proposed that the effects of party institutionalization may be conditional. I argued that it need not be the case that the mechanisms that translate variations in party institutionalization to variations in outcomes are always activated. Rather, it may be the case that those mechanisms are activated under certain conditions, when the party expects to control some sizeable share of future government and when the expected returns to mobilization are low, and that the mechanisms should remain latent when these conditions do not hold. The hypothesis is represented in Equation 3.2 and I turn to testing that model here. Table 3.5 shows results where secondary education is the dependent variable and the five-year moving average of seat share is the modifying variable. Model 28 estimates the equation with OLS, Model 29 uses the bounded-influence procedure discussed above and Model 30, includes robust standard errors given the finding of heteroscedasticity from tests and

---

<sup>18</sup>The author also conducted jackknife estimation whereby Equation 3.1 was estimated  $n$  times, each time dropping one observation from the database to assess the stability of the results. Similarly, the author conducted a bootstrapping exercise whereby Equation 3.1 was estimated 1000 times, each time dropping a set of countries with replacement. The results of both procedures do not change the substantive results reported thus far. Results are available from the author upon request.

Table 3.4: Regressions Results: Bounded-influence and and “robust” estimation

Model Number	(24) <sup>a</sup>	(25)	(26)	(27)
DV:	Secondary	Tertiary	Secondary	Tertiary
Model Details	Bounded	Bounded	Robust SEs	Robust SEs
Party Age	2.97** (1.18)	1.98*** (0.70)	2.71** (1.34)	1.58* (0.88)
GDP	8.37*** (2.30)	2.46** (1.23)	8.57*** (2.18)	2.70** (1.07)
Regime Age	4.15*** (1.53)	1.90** (0.77)	4.00** (1.71)	1.69** (0.67)
Polity Score	-0.85 (0.66)	0.24 (0.33)	-0.92 (0.72)	0.22 (0.27)
Population	-1.45* (0.77)	-0.17 (0.40)	-1.26* (0.70)	-0.26 (0.39)
Pres/Parl	-3.33** (1.56)	-4.33*** (0.80)	-3.30* (1.67)	-4.36*** (0.85)
Plurality	0.75 (2.01)	4.26*** (1.14)	0.59 (2.23)	3.30** (1.47)
OECD	8.72 (5.79)	8.36*** (2.60)	8.61* (4.52)	7.83*** (2.17)
Post-Soviet	22.11*** (7.57)	7.75* (4.14)	21.10*** (6.76)	6.90** (3.22)
L.America	-4.04 (3.48)	1.07 (1.62)	-5.06 (3.24)	1.11 (1.27)
Mid.East	6.12 (7.78)	14.42*** (3.50)	5.41 (4.41)	13.50*** (4.18)
S.Asia	10.99** (5.11)	4.48* (2.52)	10.06** (4.47)	5.01* (2.66)
E.Asia <sup>b</sup>	6.60 (4.35)	5.92*** (2.04)	6.46 (4.19)	5.78*** (1.84)
Constant	-46.52*** (15.24)	-26.05*** (7.97)	-47.62*** (13.23)	-24.37*** (6.75)
R-squared	0.74	0.68	0.67	0.59
Observations	73	73	73	73
Akaike	507.98	416.43	522.19	435.65
Schwartz	540.05	448.50	554.25	467.72

<sup>a</sup>\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

<sup>b</sup>Sub-Saharan Africa is the excluded regional category

plots. Models 31-33 repeat the procedure but use tertiary education as the dependent variable. Table 3.6 conducts the same set of tests using the three-year moving average instead.

Following Franseze and Kam (2007) and Brambor, Clark, and Golder (2005), I graph the marginal effect of the variable of interest over the range of the respective modifying variable to assess the accuracy of the theory. Figure 3.7 presents these results for four different models. In each, the solid line represents the marginal effect of the log of the age of ruling party as the five-year moving average of ruling parties' past seat share increases. The dashed lines represent 90% confidence intervals around that marginal effect, and the histograms show the distribution of the modifying variable and should be evaluated according to the vertical axis on the right side of each graph. The top two graphs in the figure use secondary attainment as the dependent variable; the bottom two refer to tertiary education. Graphs on the left use robust standard errors and graphs on the right use the bounded-influence procedure.

The set of graphs show strong support for the theory. In the top two figures, the marginal effect of party age is positive as expected but statistically significant only in the middling ranges of the seat share variable. When the seat share variable is low, that is when a ruling party has not controlled a large share of legislative seats in the past, there is no effect of having a well-institutionalized party control government. Increasing the seat share moving average brings the marginal effect into significance but the effect fades away again when the seat share is exceedingly large.<sup>19</sup> Moving down to the second row of graphs, we observe similar patterns. In the bottom left graph, the marginal effect of party age never reaches statistical significance as the confidence intervals span 0 throughout the range. But at the middle ranges of the

---

<sup>19</sup>Note that the lack of significance at high values of the marginal effect can occur due to weak competition, as I argued earlier, or because there are simply too few cases for us to have confidence around the point estimate. Both are possible and we cannot distinguish between them here.



Table 3.5: Regression Results: Party age modified by 5-year seat share average

Model Number	(28) <sup>a</sup>	(29)	(30)	(31)	(32)	(33)
DV:	Secondary	Secondary	Secondary	Tertiary	Tertiary	Tertiary
Model Details:	OLS	Bounded	Robust SEs	OLS	Bounded	Robust SEs
Party Age	3.08 (5.84)	2.93 (5.21)	3.08 (4.60)	-1.20 (3.50)	-1.75 (3.43)	-1.20 (3.16)
5-Year Seat Share	11.84 (41.97)	9.64 (37.68)	11.84 (27.71)	-16.49 (25.20)	-19.16 (24.65)	-16.49 (23.31)
Party Age * Seat Share	-0.92 (12.04)	-0.00 (10.81)	-0.92 (8.92)	5.85 (7.23)	7.03 (7.05)	5.85 (7.49)
GDP	9.07*** (2.84)	9.03*** (2.56)	9.07*** (2.24)	2.70 (1.71)	2.73 (1.73)	2.70* (1.38)
Regime Age	5.34*** (1.90)	5.61*** (1.84)	5.34** (2.12)	2.33** (1.14)	2.44** (1.15)	2.33** (1.04)
Pres/Parl	-2.63 (1.99)	-2.73 (1.86)	-2.63 (1.87)	-5.06*** (1.20)	-5.08*** (1.19)	-5.06*** (1.17)
Plurality	1.59 (2.68)	2.11 (2.53)	1.59 (3.05)	3.31** (1.61)	3.69** (1.61)	3.31* (1.82)
Polity Score	-0.13 (0.85)	-0.08 (0.83)	-0.13 (0.79)	0.56 (0.51)	0.54 (0.51)	0.56 (0.36)
Population	-1.60 (0.97)	-1.62* (0.95)	-1.60* (0.85)	-0.59 (0.58)	-0.54 (0.58)	-0.59 (0.56)
OECD	5.76 (5.99)	5.40 (5.53)	5.76 (4.46)	7.86** (3.60)	8.25** (3.60)	7.86*** (2.31)
Post-Soviet	30.58*** (10.46)	30.91*** (9.82)	30.58*** (5.76)	4.53 (6.28)	4.74 (5.70)	4.53 (3.25)
L.America	-2.73 (4.47)	-3.02 (4.11)	-2.73 (3.54)	1.14 (2.69)	1.18 (2.59)	1.14 (1.70)
Mid.East	5.66 (8.02)	5.83 (7.41)	5.66 (4.72)	13.66*** (4.82)	13.91*** (4.68)	13.66*** (3.82)
S.Asia	12.37* (6.36)	12.62** (6.22)	12.37** (5.03)	7.02* (3.82)	6.29 (3.78)	7.02* (4.02)
E.Asia <sup>b</sup>	10.33* (6.04)	9.41 (5.61)	10.33* (5.80)	9.30** (3.62)	9.37** (3.73)	9.30*** (2.48)
Constant	-65.36** (30.42)	-65.71** (27.36)	-65.36*** (21.55)	-17.42 (18.26)	-17.23 (18.15)	-17.42 (14.98)
R-squared	0.68	0.73	0.68	0.53	0.56	0.53
Observations	58	58	58	58	58	58
Akaike	418.95	412.34	416.95	359.77	357.61	357.77
Schwartz	451.92	445.31	447.86	392.74	390.58	388.68

<sup>a</sup>\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

<sup>b</sup>Sub-Saharan Africa is the excluded regional category

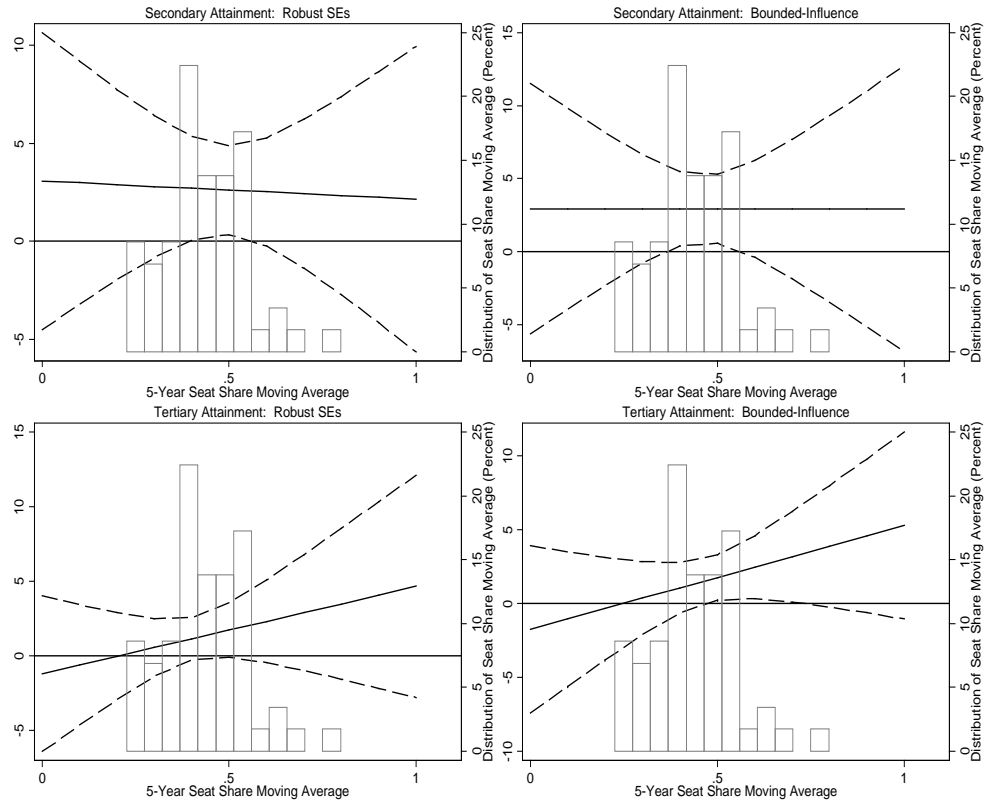
Table 3.6: Regression Results: Party age modified by 3-year seat share average

Model Number	(34) <sup>a</sup>	(35)	(36)	(37)	(38)	(39)
DV:	Secondary	Secondary	Secondary	Tertiary	Tertiary	Tertiary
Model Details:	OLS	Bounded	Robust SEs	OLS	Bounded	Robust SEs
Party Age	2.26 (5.62)	1.70 (4.97)	2.26 (4.26)	-1.68 (3.32)	-2.30 (3.30)	-1.68 (3.26)
3-Year Seat Share	4.51 (38.53)	-1.97 (34.42)	4.51 (24.05)	-20.10 (22.80)	-23.92 (22.51)	-20.10 (23.17)
Party Age * Share	1.24 (11.18)	3.19 (9.96)	1.24 (8.17)	6.77 (6.62)	8.18 (6.52)	6.77 (7.53)
GDP	8.77*** (2.74)	8.71*** (2.47)	8.77*** (2.11)	2.70 (1.62)	2.67 (1.63)	2.70** (1.30)
Regime Age	5.39*** (1.89)	5.51*** (1.79)	5.39** (2.08)	2.23* (1.12)	2.31** (1.13)	2.23** (1.00)
Pres/Parl	-3.33* (1.95)	-3.59** (1.77)	-3.33* (1.83)	-4.95*** (1.15)	-4.96*** (1.13)	-4.95*** (1.15)
Plurality	0.74 (2.61)	1.12 (2.47)	0.74 (2.97)	3.41** (1.54)	3.73** (1.54)	3.41* (1.72)
Polity	-0.18 (0.84)	-0.16 (0.81)	-0.18 (0.79)	0.57 (0.50)	0.55 (0.50)	0.57 (0.35)
Population	-1.53 (0.97)	-1.61* (0.93)	-1.53* (0.83)	-0.64 (0.57)	-0.58 (0.57)	-0.64 (0.55)
OECD	6.04 (5.96)	6.05 (5.72)	6.04 (4.22)	7.71** (3.53)	8.10** (3.57)	7.71*** (2.33)
Post-Soviet	22.22** (8.53)	22.41*** (7.74)	22.22*** (7.92)	7.10 (5.05)	7.21 (5.03)	7.10* (3.74)
L.America	-3.98 (4.20)	-4.49 (3.90)	-3.98 (3.32)	1.00 (2.49)	1.00 (2.43)	1.00 (1.73)
Mid.East	5.30 (7.87)	5.59 (7.40)	5.30 (4.36)	13.32*** (4.66)	13.49*** (4.55)	13.32*** (3.75)
S.Asia	12.08* (6.17)	12.58** (5.84)	12.08** (4.57)	6.81* (3.65)	6.00 (3.60)	6.81* (3.86)
E.Asia <sup>b</sup>	10.12* (5.99)	9.28 (5.63)	10.12* (5.49)	9.28** (3.54)	9.50** (3.59)	9.28*** (2.53)
Constant	-58.91** (26.82)	-56.00** (23.98)	-58.91*** (17.95)	-14.93 (15.87)	-13.82 (15.85)	-14.93 (13.42)
R-squared	0.68	0.74	0.68	0.54	0.57	0.54
Observations	60	60	60	60	60	60
Akaike	432.64	425.25	432.64	369.71	367.93	369.71
Schwartz	466.15	458.76	466.15	403.22	401.44	403.22

<sup>a</sup>\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

<sup>b</sup>Sub-Saharan Africa is the excluded regional category

Figure 3.7: Marginal effect of party age modified by 5-year seat share average

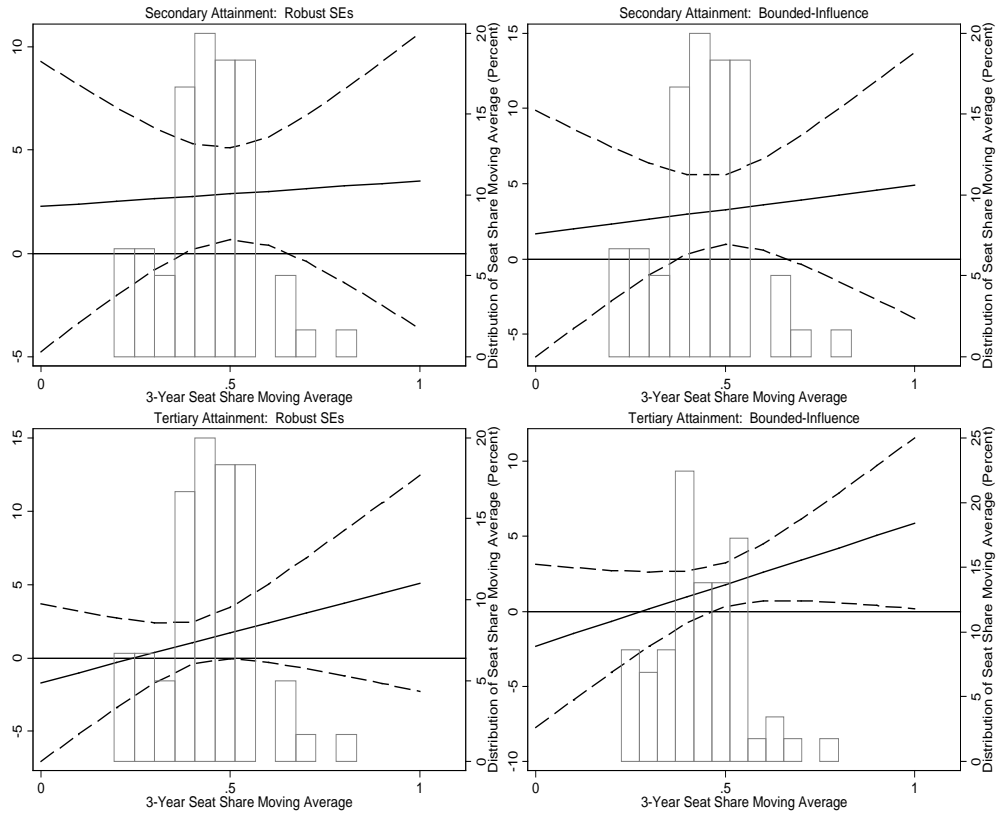


modifying variable, the marginal effect is very close to significance and so does provide some support for the theory. The results using the bounded-influence procedures produce stronger results.

The results from models using the three-year moving average are shown in Figure 3.8. Here again, the bottom left graph, where tertiary education is the dependent variable and the model uses robust standard errors, the marginal effect never quite reaches significance, but it is especially close around 0.5 on the X-axis.

Table 3.7 and Figure 3.9 repeat the analysis using investments share of GDP as

Figure 3.8: Marginal effect of party age modified by 3-year seat share average



the modifying variable. Once again, the graphs in the figure reflect the theoretical expectations as represented in Figure 3.6. The marginal effect is significantly positive at high levels of the modifying variable. This support the proposition that where the expected returns to mobilization are likely to be large, the effects of party institutionalization are not activated, but as the expectations regarding the benefits of mobilization decrease, the effects of institutionalization begin to emerge.

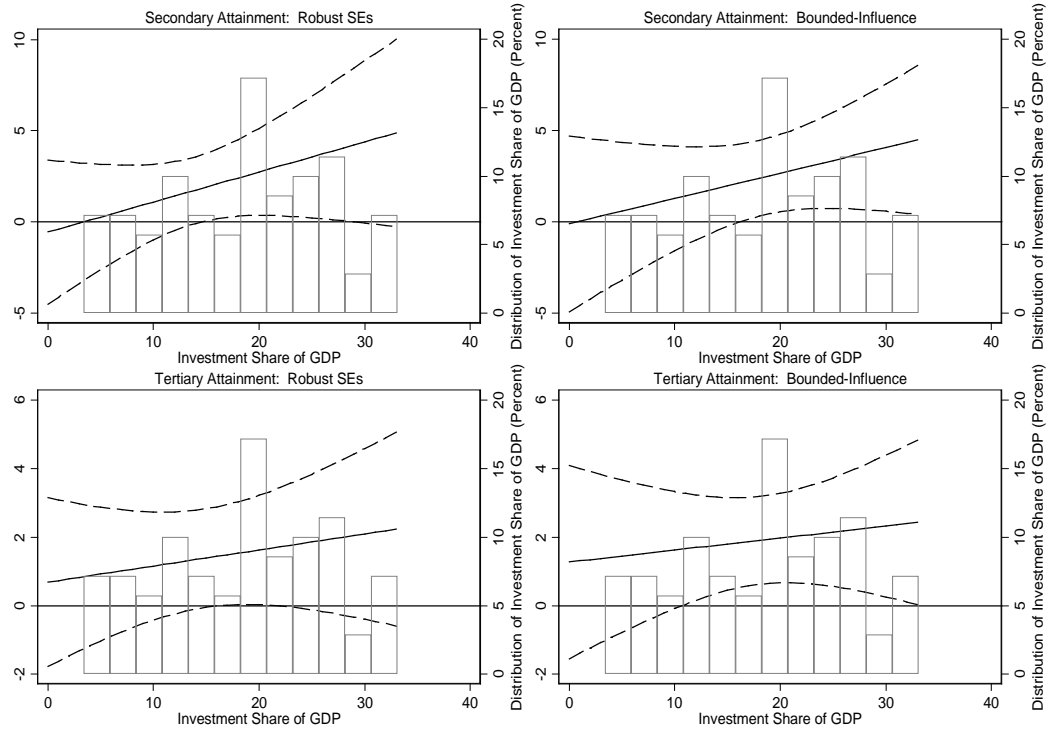
Table 3.7: Regression Results: Party age modified by investment share of GDP

Model Number	(40) <sup>a</sup>	(41)	(42)	(43)	(44)	(45)
DV:	Secondary	Secondary	Secondary	Tertiary	Tertiary	Tertiary
Model Details:	OLS	Bounded	Robust SEs	OLS	Bounded	Robust SEs
Party Age	-0.55 (3.11)	-0.11 (2.92)	-0.55 (2.40)	0.69 (1.77)	1.27 (1.71)	0.69 (1.50)
Investment	-0.26 (0.51)	-0.22 (0.50)	-0.26 (0.49)	-0.01 (0.29)	0.00 (0.28)	-0.01 (0.26)
Party Age * Investment	0.16 (0.15)	0.14 (0.14)	0.16 (0.15)	0.05 (0.09)	0.04 (0.08)	0.05 (0.08)
GDP	7.82*** (2.51)	7.98*** (2.32)	7.82*** (2.10)	2.31 (1.43)	2.28 (1.43)	2.31** (0.99)
Regime Age	4.13** (1.63)	4.32*** (1.60)	4.13** (1.72)	1.62* (0.93)	1.75* (0.92)	1.62** (0.73)
Pres/Parl	-3.47* (1.76)	-3.47* (1.73)	-3.47** (1.71)	-4.67*** (1.00)	-4.68*** (0.96)	-4.67*** (0.88)
Plurality	0.27 (2.22)	0.44 (2.14)	0.27 (2.17)	3.25** (1.26)	3.94*** (1.28)	3.25** (1.47)
Polity	-0.31 (0.75)	-0.33 (0.75)	-0.31 (0.79)	0.47 (0.43)	0.46 (0.39)	0.47* (0.24)
Population	-1.22 (0.82)	-1.34 (0.81)	-1.22 (0.74)	-0.29 (0.46)	-0.24 (0.45)	-0.29 (0.40)
OECD	4.41 (6.06)	4.93 (5.99)	4.41 (4.82)	5.94* (3.45)	6.44* (3.31)	5.94** (2.48)
Post-Soviet	19.86** (8.16)	20.08** (7.74)	19.86*** (6.97)	5.99 (4.64)	6.62 (4.61)	5.99 (3.62)
L.America	-5.29 (3.69)	-4.99 (3.64)	-5.29 (3.16)	0.65 (2.10)	0.57 (1.97)	0.65 (1.26)
Mid.East	2.64 (7.62)	2.93 (8.36)	2.64 (4.53)	12.10*** (4.34)	13.03*** (4.07)	12.10*** (4.04)
S.Asia	10.32* (5.41)	10.67* (5.36)	10.32** (4.37)	5.08 (3.08)	4.76 (2.87)	5.08* (2.68)
E.Asia <sup>b</sup>	7.50 (4.94)	7.42 (4.76)	7.50* (4.30)	5.63* (2.81)	5.71** (2.71)	5.63** (2.12)
Constant	-39.94** (17.59)	-41.32** (16.55)	-39.94** (15.49)	-21.32** (10.01)	-23.70** (9.97)	-21.32*** (7.27)
R-squared	0.69	0.72	0.69	0.58	0.63	0.58
Observations	70	70	70	70	70	70
Akaike	500.25	494.81	500.25	421.37	414.96	421.37
Schwartz	536.22	530.79	536.22	457.35	450.94	457.35

<sup>a</sup>\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

<sup>b</sup>Sub-Saharan Africa is the excluded regional category

Figure 3.9: Marginal effect of party age modified by investment share of GDP



### 3.4 Conclusion

This chapter subjected the theory to the first round of empirical tests using the stock of human capital as the dependent variable. The results are encouraging. Controlling for various confounding factors, to include GDP, the level of democracy, the age of the democratic regime, and regional controls, the results show that the age of the ruling party predicts the stock of human capital in the way theory would predict. These results are robust and they indicate that OLG place a greater premium on policies

designed to stimulate technological progress. We also see evidence in support of two modifying propositions. First, party institutionalization seems to matter only when deputies in the party in question expect that when they hold the party's reigns of power, the party will also be political viable in the sense of controlling some nontrivial share of the government. When such expectations are absent, deputies have no incentive to plan for the future as they do not expect to be able to reap the political rewards of technology policy. The second modifying condition is that deputies' preferences for technology policy is increasing as the expectation that accumulation will exhibit diminishing returns is decreasing. This proposition, too, receives empirical support.

In the next chapter, I continue testing the theory, using total factor productivity as a measure for the premium that governments place on technological progress.

## Chapter 4

### OLG Parties and Total Factor Productivity

#### 4.1 Introduction

In Chapter 3 I found that variation in the degree to which ruling parties in a country are typically well-institutionalized, OLG organizations is positively correlated with secondary and tertiary education attainment rates—consistent with my theory that intraparty politics may help explain the premium governments place on technological development as a source of economic growth. In institutionalized parties, inter-general bargaining can produce a sort of burden-sharing agreement in which one output is a greater priority on time beyond the immediate future. In the context of economic growth policy, this increased premium on the future may include policies designed to catalyze technological progress, such as developing human capital. By contrast, the internal politics of weakly-institutionalized parties are almost entirely biased toward the immediate future. The results in Chapter 3 also found support for the two modifying conditions. First, party institutionalization only affects education attainment rates when deputy members of the ruling party expect to control a sizable share of government when they take control of the party’s leadership positions. This supports the argument that because politicians that set policy do not have ownership rights over the outcomes those policies produce, incumbents will set long term growth policies only when they expect to be in power to claim credit for the policy’s returns. Secondly, as the theory predicted, there is evidence that the effect of well-institutionalized parties on human capital formation increases as the expected



returns to further mobilization decrease.

Even as these results are supportive, this chapter subjects the argument to further empirical scrutiny. Because of the unobservable nature of the conceptual dependent variable—the premiums governments assign to technological progress—we need to use various proxies that capture different dimensions of the underlying variable to assess the theory’s accuracy. In this regard, data on government R&D subsidies and loans, and/or public R&D spending may be useful as proxies of government premiums. Unfortunately, since we cannot infer intentions from spending amounts, we cannot know the political rationale of government spending. We cannot know, for example, whether a government that spends money on R&D programs does so because its premium on technological progress is high or because the resource allocation is meant to buy the support of owners of capital and/or particular sectors of the economy. Consequently, I follow the strategy proposed in Chapter 3 and avoid using policy variables as a proxy for government premiums and instead use *outcomes* that we can logically and empirically connect back to government policy initiatives. In this chapter, I rely on *total factor productivity* as a dependent variable, which should respond to a host of government policy actions. Below, I discuss the strengths and weaknesses of the variable and its measurement. From there, I present the results of econometric models that put total factor productivity on the left-hand side of the equation.

## **4.2 Total Factor Productivity as a Proxy for Government Premiums on Technological Progress**

The premium governments place on technological progress should be evident in the efficiency with which the factors of production, capital and labor, are used in an economy. All else constant, where political factors induce governments to place a greater premium on technological progress, governments will engage in a host of

activities designed to provide incentives for private economic actors to engage in innovation and adoption of frontier technologies. When economic actors undertake such initiatives, we should observe that a given stock of capital or labor will be able to produce more output or output of a higher quality than before. To see this, start with the production function  $Y_i = F(K_i, L_i)$ , where  $Y$  is output in country  $i$ ,  $K$  is the stock of capital, and  $L$  is the stock of labor. Introduce variation in the productivity of these inputs by allowing the production function to shift up or down. More exactly, assume economies operate according to the Hicksian production function:

$$Y_i = AF(K_i, L_i), \quad (4.1)$$

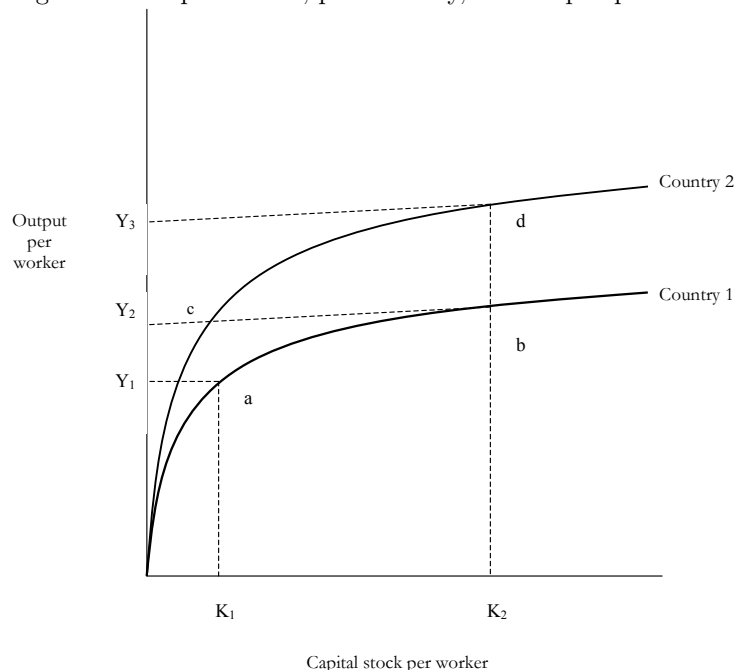
where  $A$  is the technology parameter and changes thereof shift the production function. For simplicity, express Equation 4.1 in terms of per worker output as

$$y_i = AF(k_i), \quad (4.2)$$

where  $y = Y/L$  and  $k = K/L$ .

Figure 4.1 shows production functions of the form in Equation 4.2 for two hypothetical countries. For Country 1, increasing the stock of capital from  $K_1$  to  $K_2$  constitutes a movement along its production function from point a to b and produces the increase in output per worker from  $Y_1$  to  $Y_2$ . Notice that for Country 2, the same increase in capital per worker, from  $K_1$  to  $K_2$ , produces an increase in output from  $Y_2$  to  $Y_3$ , represented by the movement along its production function from c to d. Controlling for the per worker capital stock, labor in Country 2 is always more productive, and hence wealthier, than labor in Country 1, which would indicate that labor in Country 2 has access to more efficient production processes and capital goods that make them more productive.

Figure 4.1: Capital stock, productivity, and output per worker



We should expect to observe that where economic actors are engaging in innovation and technology adoption, the inputs to production will be more efficient, all else constant. According to my theory, where OLG parties typically control government, we should expect to observe more productive capital and labor stocks than in countries where fragile parties dominate the landscape. In Figure 4.1, the difference between the two kinds of countries is indicated by the difference between points a and c or between b and d.<sup>1</sup>

---

<sup>1</sup>The production function in Equation 4.1 assumes that technological development affects  $K$  and  $L$  proportionately instead of being biased toward either labor or capital respectively. This is the most common way of expressing the relationship between capital, labor, and output, but the production function can be expressed in other ways as well. For example, some have argued that a shift in the production function might in fact cause further savings and investment and hence an increase in the capital stock per worker. This is the “induced accumulation effect” (Hulten 1975) and can be expressed as  $Y_i = F(K_i, aL_i)$ . The idea here is that “A shift in the production function at a given capital-labor ratio leads to an increase in output per workers and some of this extra output is saved, leading to more output, more saving and so on” (Hulten and Isaksson 2007, 9). Whether one uses the Hicksian or Harrodian production function depends on the question under scrutiny. Hulten and Isaksson (2007) suggest that “In order to find out how efficiently existing labor and capital are used, the Hicksian approach is the right way to proceed. However, if the question is about the relative importance of capital deepening versus efficiency change as the *cause* of growth,

### 4.2.1 Measuring Factor Productivity

How might we measure the productivity with which the factors of production are used and distinguish the *efficiency* effect of factor inputs on economic output and output growth from the *stock* effect? This is, of course, an enduring problem for scholars and one that has not yet been resolved. Thus, scholars are relegated to estimating the productivity of inputs using one of two strategies. The first uses econometric techniques to estimate (subscripts removed)  $\Delta Y/Y = \beta_0 + \beta_1 \cdot \Delta K/K + \beta_2 \cdot \Delta L/L + \epsilon$ . Here  $\beta_0$  is the growth rate of factor productivity (Barro 1999).<sup>2</sup>

Using regression to estimate TFP suffers from various deficiencies however. Among them is the fact that the estimated equation is merely one in a larger system of equations that model growth in output. Capital, for example, grows as a function of variables that affect the propensity to save and the efficiency of financial institutions that direct savings into investment. Estimating the equation above without modeling these other relationships could result in biased estimates (Hulten and Isaksson 2007). Additionally, and perhaps more serious, is the endogeneity between factor productivity and the stocks of capital and labor, which may result in biased estimates if not properly modeled (Barro 1999). Given the difficulty of finding appropriate instruments, this concern may be especially relevant.<sup>3</sup> Given these problems, scholars often balk at using econometric techniques to create a measure of TFP.

The second approach avoids some of the pitfalls of econometric techniques. Instead

---

the Harrodian model gives the better answer, since capital formation is endogenous” (11, emphasis in original). Since I am interested in the degree to which political institutions influence the efficiency of the factors of production rather than the determinants of growth *per se*, the data I use is based on the Hicksian model.

<sup>2</sup>The coefficients  $\beta_1$  and  $\beta_2$  are the marginal products of  $K$  and  $L$  respectively, leaving the intercept term as a measure of the growth or regress in the productivity of the factor inputs.

<sup>3</sup>See however, Mankiw, Romer and Weil (1992) and Senhadji (2000) for strategies of using econometrics to estimate TFP while avoiding or modeling the potential endogeneity of the right-hand side variables.

of estimating TFP with regression, this method uses accounting identities to generate a measure of factor productivity. Solow (1957) showed that economic growth can be expressed as a function of growth in capital, weighted by its share of income in GDP, and the stock of labor weighted by its share. He also concluded that the growth rate of TFP is that part of total output growth unaccounted for by the share-weighted growth in the capital stock and labor force. Rewriting Equation 4.1 in terms of growth rates (taking the log of both sides and the partial derivative with respect to time) yields (subscripts removed)

$$\frac{\Delta Y}{Y} = \alpha \cdot \frac{\Delta K}{K} + (1 - \alpha) \cdot \frac{\Delta L}{L} + \frac{\Delta A}{A}, \quad (4.3)$$

which can be rearranged to produce

$$\frac{\Delta A}{A} = \frac{\Delta Y}{Y} - \alpha \cdot \frac{\Delta K}{K} - (1 - \alpha) \cdot \frac{\Delta L}{L}. \quad (4.4)$$

In these equations,  $0 \leq \alpha \leq 1$  is the share of capital in total income. The equations show that, with data on the growth of capital, labor and output, and an estimate of  $\alpha$ ,  $\frac{\Delta A}{A}$  can be measured as a residual.  $\frac{\Delta A}{A}$  is the so-called “Solow residual” and scholars have used the residual as an estimate of TFP growth and to calculate the share of output growth for which TFP growth accounts.<sup>4</sup> A similar procedure can calculate TFP *levels* rather than growth rates. In fact, increasingly, economists have argued that *levels* accounting is a more useful procedure than growth accounting. Senhadji (2000), drawing from Hall and Jones (1999) and Mankiw, Romer, and Weil (1992), contends that levels accounting is a more appropriate exercise:

First, growth rates are important only to the extent that they are a determining factor of levels. Second... Easterly and others (1993) show that

---

<sup>4</sup>Griliches (2001) shows that Solow was not the first to come up with this idea and so the “Solow residual” is a misnomer.

growth rates over decades are only weakly correlated, suggesting that cross-country differences in growth rates may essentially be transitory. Moreover, several recent models of technology transfer across countries imply convergence in growth rates as technology transfers prevent countries from drifting away from each other indefinitely (Senhadji 2000 p.131).

Accounting techniques are the most common way of estimating TFP, largely due to the intuitiveness of the measures. Such exercises are not without deficiencies however. Among them is the fact that *accounting* for growth is distinct from showing *causation*. Accounting exercises can show the magnitude of TFP, the pace of its growth over time, and its contribution to output levels and growth, but accounting cannot show that TFP growth causes output growth (Barro 1999; Easterly and Levine 2001).<sup>5</sup>

Secondly, values of the residual are not exclusively a function of technology improvements or regressions. To see why, consider that it is not uncommon for TFP growth to be negative over some substantial period of time for a given country. If TFP was exclusively a function of technological knowledge this would indicate a process of “forgetting” technological knowledge. This, however, seems unlikely. Instead, we need to keep in mind that, while many scholars equate the residual with technological knowledge and its pace of change (Grossman and Helpman 1997), it incorporates other variables as well. If one were to conduct a variable decomposition technique,

---

<sup>5</sup>Related to the debate over whether TFP causes growth is a debate among economists regarding the percent of total output and output growth for which TFP accounts. Some, like Mankiw, Romer and Weil (1992) conclude that the vast majority of cross-national differences in per capita output is due to capital accumulation, while others like Prescott (1998), Klenow and Rodriguez-Clare (2001), Easterly and Levine (2003), Senhadji (2000), and Grossman and Helpman (1990, 2003) conclude that TFP matters more. Although I make use of TFP data in the econometric models in this chapters, I do not intend to participate in this debate. The exact percent of total output and output growth for which TFP accounts is less important here than the fact that TFP itself is a useful measure of the efficiency of production inputs. Whatever its contribution to economic growth, TFP can serve as useful way to test the relationship between the nature of political parties and the premiums governments place on technological progress as a source of economic growth.

one would almost certainly find that the residual captures phenomena like cost reductions (Harberger 1998), infrastructure investments, variation in institution efficiency, and scale economies, all of which affect productivity even though they have little to do with advances in technological knowledge. For these reasons some have quite accurately posed that TFP is a “measure of our ignorance” regarding what drives growth and output levels.<sup>6</sup>

Despite its deficiencies, the Solow residual is still a commonly used measure of the productivity with which the factors of production are used and may be the best summary measure of the efficiency of the factors of production that we have to date. More than that, the variable is especially useful for the purposes of testing the theory. One of the points to keep in mind is that, while the theory recognizes that governments have access to any number of strategies to stimulate technological progress should they be so inclined to do so, the theory does not attempt to ascertain the conditions under which governments will use some set of policies and avoid using others. Presumably, governments will use all policies at their disposal to the degree that the marginal benefit of the policy equals the marginal cost, but the costs and benefits of the policies may differ according to institutional or political-economic contexts. Accordingly, two countries may both be interested in stimulating technological progress for the reasons developed in the theory, but how they do so might differ quite substantially. The benefit of using a summary measure like the Solow residual is that we are not tied to using a particular policy variable as the dependent variable. Rather, we can assume that governments will use all the policies available to them and each policy should contribute in some way to increasing the productivity of factor inputs. Thus, TFP should be higher in contexts where governments place a premium on technological

---

<sup>6</sup>The concern that the residual includes other determinants of TFP besides technological knowledge has led some scholars to use alternative measures of technological development. Griliches (1990) points to the usefulness of patent data as an alternative measure of the level of technological knowledge and its pace of change.

progress and lower where governments fail to do so, irrespective of what particular policies governments employ to fulfill their goal. To be sure, the residual is a noisy measure, but in combination with the human capital models used in Chapter 3, the TFP indicator has significant benefits.

### 4.2.2 Data Description

The TFP data I use comes from Baier, Dwyer, and Tamura (2006) who calculate the Solow residual for 145 countries. Each TFP observation is calculated using data on physical capital, human capital, and GDP averaged over a ten-year period. Averaging the data over the course of a decade ensures that the resulting TFP calculation is not too heavily influenced by business cycles or exogenous shocks. The database is comprised of multiple observations per country where the data used to calculate TFP are averaged by decade between 1950 and 2000.<sup>7</sup> However, since the independent variables that I use in the subsequent models date back only to 1975, I will only use the last two calculations only: 1981-1990 and 1991-2000.<sup>8</sup>

A nice feature of this database is the fact that the production function Baier, Dwyer and Tamura (hereafter BDT) use to calculate TFP includes human capital on the right-hand side of the equation:  $Y_i = AF(K_i, H_i)$ , where  $H_i$  is the level of human capital, operationalized as the average number of years of schooling and the average number of years employed for an employed person.<sup>9</sup> The inclusion of human capital into the production function is valuable because it ensures that a correlation between TFP and party institutionalization is not due simply to the relationship between

---

<sup>7</sup>For 24 countries, calculations extend back to 1900 or earlier.

<sup>8</sup>BDT do not provide the original annual data used to create their calculations and so I cannot alter the time periods.

<sup>9</sup>The latter of these variables captures human capital developed by learning-by-doing processes. See Arrow (1962) for one growth model that incorporates learning-by-doing.



party institutionalization and human capital that we saw in Chapter 3. Recall that the statistical models revealed a relationship between party institutionalization and secondary and tertiary education attainment. In this chapter, we are not interested in replicating that finding. Rather, we want to assess whether party institutionalization increases productivity through mechanisms other than human capital formation. If however, human capital was not included in the production function, the residual would soak up variations in human capital and, should an effect of party institutionalization on TFP be revealed, we would be unable to ascertain whether the relationship exists because the residual incorporates human capital or because party institutionalization activates other mechanisms along with human capital.

As with the empirical models in Chapter 3, the sample of countries with which I will test the theory are democracies. Specifically, a country is included in the sample if its average PolityIV score is greater than zero for the ten-year period of time for which BDT collect data on capital, output and labor. Using this sample of countries for the last two time periods in the BDT database, Figure 4.2 shows the distribution of TFP levels.

Figure 4.3 further explores the TFP variable by plotting both the logged levels of TFP and the logged levels of capital per worker on the X-axis against output per worker on the Y-axis. We want to assess whether the BDT data generally are consistent with the expected relationships between capital and output on one hand and TFP and output on the other. Both trends are positive as we would expect, but notice also that the slope of the TFP trend is substantially steeper than the capital per worker trend. This is indicative of the conclusion many scholars reach that the magnitude of TFP's effect on output may be a good deal larger than the effect of increasing capital. That is, the marginal effect of increasing the productivity of the factors of production on output per worker seems to be larger than the marginal

Figure 4.2: Distribution of total factor productivity (1981-2000)

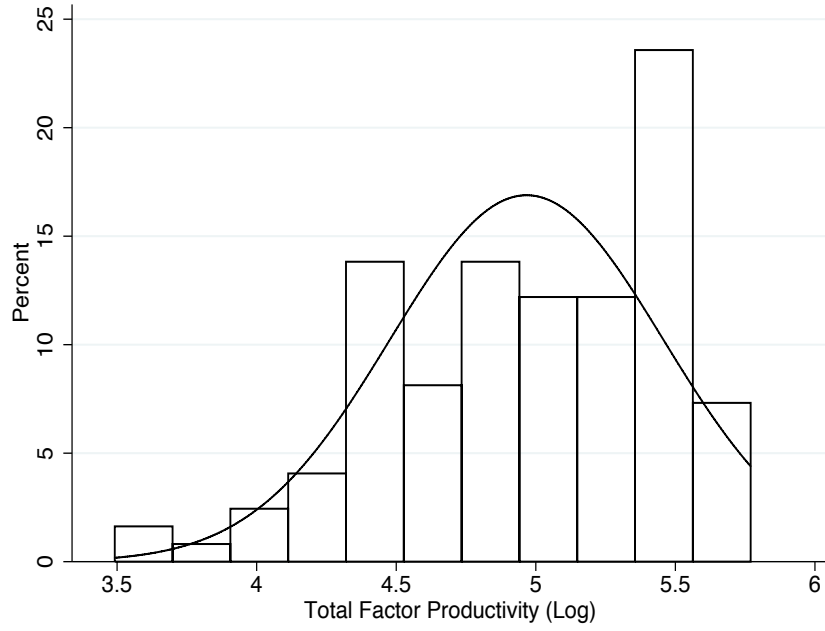
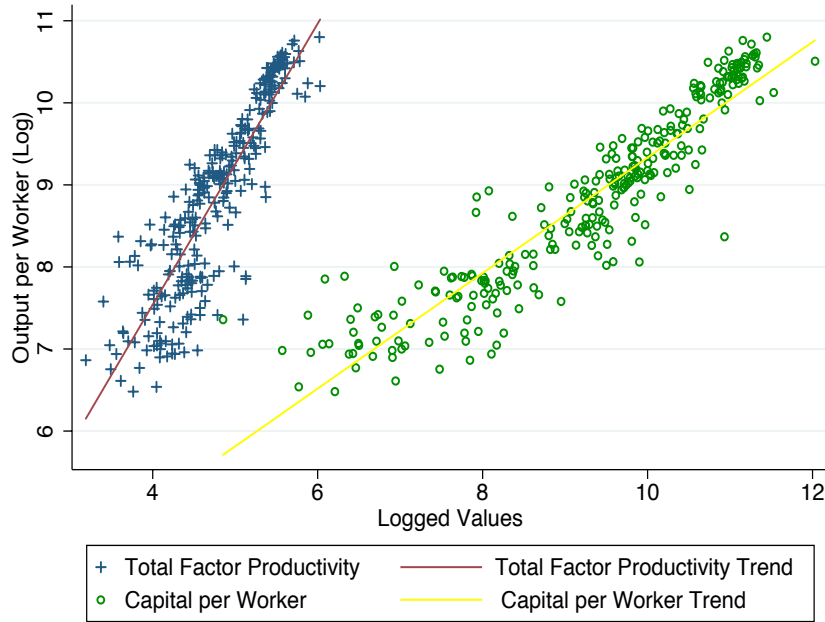


Figure 4.3: TFP, capital per worker, and per worker output (1981-2000)



effect of increasing capital per worker at the status quo level of productivity.<sup>10</sup> Even as variation in capital per worker is important to understand cross-national variation in output production, cross-national variation in TFP appears at least as important, if not more so.

### 4.2.3 Model Specification and Estimation

The hypothesis under scrutiny is that countries typically ruled by overlapping generations political parties will have higher levels of factor productivity compared to countries ruled by fragile, weakly-institutionalized parties. We test this idea using OLS on a sample of democratic countries at all levels of economic development. Two models, estimated separately, will be the basis for assessing the theory:

$$TFP_i = \beta_0 + \beta_1 PAGE_i + \beta X_i + \epsilon_i \quad (4.5)$$

and

$$TFP_i = \gamma_0 + \gamma_1 PAGE_i + \gamma_2 SHARE_i + \gamma_3 PAGE_i * SHARE_i + \gamma X_i + \nu_i. \quad (4.6)$$

Equation 4.5 tests the main theoretical proposition—that the degree to which parties are OLG organizations affects the level of technological development in a country. In 4.5, *PAGE* is the measure of overlapping-ness. It is the age of the largest party in government. *X* is a set of controls. If the theory is correct,  $\beta_1$  should be positive. Equation 4.6 tests the modifying proposition, presented in Chapter 2, that OLG ruling parties will only pursue technological development if deputies expect their party to control a sizable share of governments in the future when they take over the reigns of the power in the party. *SHARE* is the seat share variable that we used in Chapter 3 to measure these expectations. It is the ruling party’s moving average

---

<sup>10</sup>A comparison of slopes test reveals a statistically significant difference between them ( $p = 0.000$ )

of seat shares of a window of three years. If the modifying condition is correct, we should find that  $\gamma_3$  is positive,  $\gamma_1 + \gamma_3 * SHARE > 0$ , and the confidence intervals will show the marginal effect of party institutionalization to be significant at traditional levels over the range of the modifying variable indicating expectations of controlling a more sizable share of future governments.

I will not however, test the proposition that the effects of party institutionalization is conditioned by the expected returns to further accumulation. The reason for this is a technical issue rather than a concern with the validity of the proposition itself. Recall that the expected returns to further mobilization was operationalized in Chapter 3 as an economy's capital stock. I argued that the expected returns to capital accumulation should be higher where the capital stock is currently small. Where there is little capital per worker, the accumulation strategy can produce a dramatic increase in output per worker. Given that technology policies have deferred benefits and upfront costs and the accumulation strategy will have large returns much more immediately, when the capital stock is low, there is no political need for deputies to force party leaders to set technology policies. The unequal burden-sharing agreement that encourages deputies to overcome problems of collective action, wherein leaders continue to set only short-term policies and leave deputies to suffer the consequences thereof, is wholly absent. The problem with testing this argument in this chapter is the endogenous relationship between TFP and the capital stock. Since the Solow residual is calculated from the stock of capital (and human capital-augmented labor), adding the stock of capital on the right-hand side as a *predictor* of TFP is inappropriate. For similar reasons, GDP per capita and population do not enter the model as controls.

Equations 4.5 and 4.6 control for the following variables. First I control for the *level of democracy* to account for any differences that may exist between moderately and fully democratic systems. Second, I control for the *age of the democratic regime* to

ensure that the coefficient on the party age variable captures only differences between countries ruled by well-institutionalized and weakly-institutionalized parties and does not capture the degree to which the *regime* is institutionalized and consolidated. Finally, I control for *regional indicators* with the OECD “region” as the excluded category. We want to control for regional effects as evidence suggests some regional trends in the degree to which TFP accounts for output and output growth. For example, the available evidence shows consistently that East Asian countries growth experiences since the 1960s, while exceptional, failed to exhibit much TFP growth (Young 1992, Krugman 1994, Collins and Bosworth 1996, Bosworth and Collins 2003). Similarly, the human capital formation and technological development pursued by the communist regimes of the Eastern Bloc and former Soviet Union may distinguish the TFP levels and growth rates of the successor states in those areas from other regions around the world.

Since the BDT database has more than one observation per country, one might be tempted to pool the multiple observations, thereby taking advantage of all the available information, and employ some combination of a lagged dependent variable (or whatever more complex lag structure theory would suggest and the data allow), fixed effects to control for unit heterogeneity should it exist, and panel-corrected standard errors. These techniques are inappropriate here due to the very small number of time periods covered in the samples that I use. The coverage of the independent variable is relatively short and I can use only TFP observations calculated with data averaged between 1981-1990 and 1991-2000. Two time periods is far too few for the standard time-series cross-section techniques. Therefore, I estimate OLS on the pooled data, and cluster the standard errors by country to model the fact that the multiple observations for the same country are not independent from each other.<sup>11</sup> Additionally,

---

<sup>11</sup>Clustered standard errors will not remedy omitted variable bias that may result from unit-heterogeneity should it exist, but it will estimate more accurately the standard errors.

fixed effects are inappropriate here since a large number of countries have only one observation in the database given the that they were democratic for only one period. Eastern European countries are particularly relevant in this regard. I will also present results that estimate the equations on each time period separately.

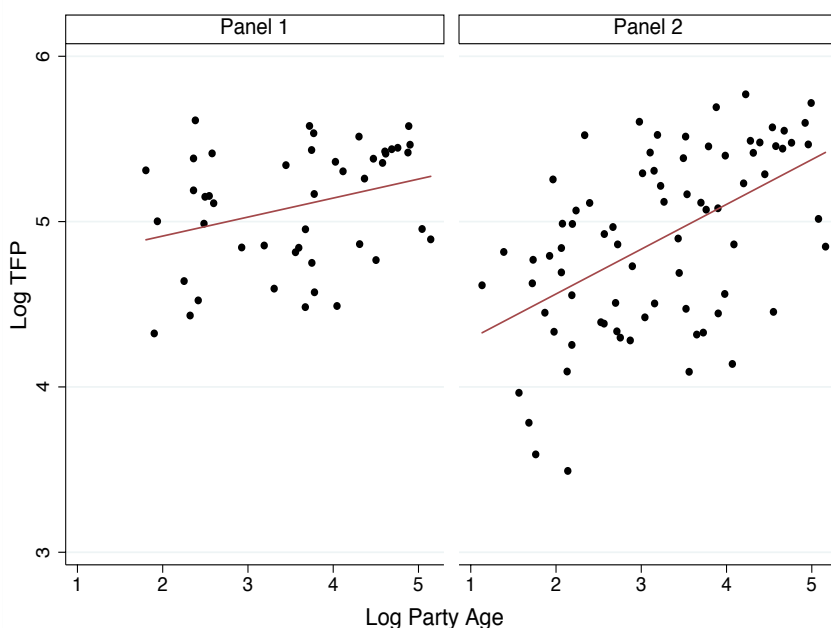
To anticipate the findings, there is some evidence in support of the unconditional effect for party institutionalization. Unfortunately, the results are not robust and depend on the time period used. The results from Equation 4.5 support the theory only when estimated using the 1991-2000 panel. Importantly, however, it is also this sample of countries that offers that largest variation in the party institutionalization independent variable. Results using only the first panel do not support the theory because the within panel distribution in party institutionalization is such that there are too few countries typically ruled by weakly-institutionalized parties for us to draw useful and accurate inferences regarding the effects of non-OLG ruling parties. By contrast, where we have sufficient numbers of observations with weakly-institutionalized ruling parties, we also observe robust support for the theory's predictions. The evidence of a conditional effect is similarly weak. The conditional models also faces the the problem of influential outliers. When the outliers are accounted for, the results support the theory.

#### **4.2.4 Unconditional effects of party institutionalization**

Before turning to the coefficient estimates, the scatterplots in Figure 4.4 show the relationship between TFP levels and the average age of the largest government party. The trends are positive as we expect, but notice that the slope is quite a bit shallower in the first panel when compared to the second. We will return to this difference below.

The OLS estimates for the pooled sample are presented in Table 4.1. Model 1 includes the complete set of controls, Models 2-4 exclude various controls to assess

Figure 4.4: Party age and TFP by panel



stability. Looking at the set of models, we see some support for the theory. In Models 2-4, the coefficient on party age is positive and significant in every instance. Unfortunately, the conclusions we draw from these models are tempered with the results in Model 1. Here, the coefficient is in the predicted direction and the p-value is small, but with a value of 0.121, it is just a bit too large for standard levels of confidence.

What explains the marginal level of support for the theory using the pooled model? While we cannot dismiss the possibility that Model 1 is an accurate reflection of reality, at least two other explanations exist as well. In combination, they go a long way in explaining the weak level of support. The first is collinearity of the Xs—in particular, the possibility that the regional indicators are “soaking up” the explanatory power of the party age variable. There are both theoretical and empirical reasons to believe that the regional indicators and party institutionalization are correlated such that variation in the degree to which ruling parties are OLG organizations *within* the various regions of the world is substantially less than variation in “overlapping-ness”

Table 4.1: Regression Results: Party age and TFP (Pooled panel)

Model Number	(1) <sup>a</sup>	(2)	(3)	(4)
Party Age	0.06 (0.04)	0.23*** (0.04)	0.11** (0.05)	0.09* (0.05)
Regime Age	0.06 (0.04)		0.23*** (0.05)	0.17*** (0.05)
Polity Score	0.02 (0.02)			0.07*** (0.02)
E.Asia <sup>b</sup>	-0.35** (0.17)			
S.Asia	-0.93*** (0.10)			
L.America	-0.52*** (0.10)			
E.Europe	-0.66*** (0.16)			
Mid.East	-0.04 (0.17)			
Africa	-0.59*** (0.17)			
Constant	4.78*** (0.26)	4.21*** (0.16)	3.92*** (0.14)	3.60*** (0.18)
R-squared	0.62	0.22	0.36	0.43
Observations	123	123	123	123
Akaike	63.93	144.27	120.76	109.02
Schwartz	92.05	149.89	129.20	120.27

<sup>a</sup>\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

<sup>b</sup>The OECD “region” is the excluded regional category.

*across* those regions. The consequence of this is that, when included, the regional indicators may wash out the explanatory power of the party institutionalization measure. A comparison of Model 1 with Models 2-4 suggest this may be happening. In 2-4, all of the independent variables are significant, including the positive coefficient on the party institutionalization measure (*Log Party Age*). It is only when we include the regional indicators that support for the theory vanishes.

Table 4.2 presents further evidence of a correlation between the regional indicators and the party institutionalization measure. The table presents results from a set of



Table 4.2: P-values from comparison of means tests evaluating the age of the largest government party by region. Numbers in parentheses are the regions average age for largest government parties.

	OECD	L. America	Africa	S. Asia	E. Asia	Mid. East	E. Europe
OECD (77.60)	–	0.016	0.000	0.006	0.000	0.031	0.000
L. America (47.83)		–	0.006	0.127	0.067	0.078	0.006
Africa (31.47)			–	0.347	0.285	0.075	0.017
South Asia (27.59)				–	0.574	0.050	0.051
E. Asia (21.79)					–	0.229	0.111
Middle East (13.25)						–	0.451
E. Europe (11.28)							–

comparison of means tests where the variable in question is the party age variable and the mean is compared across the seven regions. If the proposition that within regional differences are greater than across region differences is correct, we should observe a large number of statistically significant differences between the regions. The values in each cell are p-values for one-tailed tests that investigate whether the mean party age in the *row* region is larger than the mean in the *column* region. The regions are arranged in descending order according to their means, which in turn are displayed inside the parentheses. For example, the mean of the party age variable in the OECD is 77.60 years, while in Latin America, the mean is 47.83 years. A one-tailed test where the null hypothesis is the two means are equal and the alternative hypothesis being that the OECD mean is larger than the Latin American mean, produces the p-value of 0.016. We can reject the null hypothesis that the two means are the same and conclude instead that the OECD mean is larger than the Latin America mean. Going through the table, we see statistically significant differences across many of the world’s regions. This is evidence of the fact that within region differences in the degree to which parties are OLG organizations are smaller than the across region differences. Thus, including the regions may suppress the explanatory power of the party institution.

Another factor explaining the insignificant results in Model 1 is that the strength of the relationship between party institutionalization and TFP differs across the two

time periods that are pooled together in the models in Table 4.1. We saw glimpses of this in Figure 4.4. Table 4.3 explores this possibility more rigorously by estimating the relevant equation on the two time periods separately. Models 5-8 in the table estimate the unconditional effect of party institutionalization for the 1981-1990 period and Models 6-9 do the same for 1991-2000. Start with Models 5-8. There are no instances of the positive effect of institutionalization on TFP that theory would lead us to predict, with the exception of Model 6, which is too parsimonious to be accurate. In Model 5, the coefficient is not just insignificant, it also has the “wrong” sign. Models 9-12 tell a much different story. In these models, the coefficient on the party age variable is always positive and significant. Here, party institutionalization has a robust effect on the productivity with which the factors of production are used in an economy.

There is no theoretical reason why the predictions should receive support in the second panel only. Rather, the two panels produce different results because they use different samples. The first panel includes 46 countries, 50% of which are the consolidated democracies of the industrialized world. Notably, the major political parties in these countries typically are long-lived, OLG organizations. The mean value of the party age variable for the OECD set of countries in this panel is 70 years. Additionally, many of the developing world democracies in this sample also tend to have long-lived parties. For example, Thailand’s value of the party age variable is 41 years, Peru’s value is 58 years, South Africa 73 years, Honduras 90 years, and Colombia 170 years. Of the just 46 countries in the sample, the majority have a value on the institutionalization measure that indicate OLG parties are important parts of the political landscape. There are too few cases of parties typically dominated by weakly-institutionalized parties for us to draw accurate conclusions of their effects. While there is no precise age at which point we can conclude that a party is institutionalized and OLG, assume a criteria that a party can be considered at least

Table 4.3: Unconditional effect of party institutionalization by panel

Model Number	(5) <sup>a</sup>	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel:	1 <sup>b</sup>	1	1	1	2	2	2	2
Party Age	-0.01 (0.04)	0.11** (0.05)	0.03 (0.07)	0.03 (0.06)	0.11** (0.06)	0.27*** (0.05)	0.14** (0.06)	0.11** (0.06)
Regime Age	0.07* (0.04)	0.19*** (0.05)	0.13** (0.05)	0.05 (0.05)	0.05 (0.05)	0.25*** (0.06)	0.19*** (0.06)	0.19*** (0.06)
Polity Score	0.00 (0.03)	0.07*** (0.03)	0.03 (0.03)	0.03 (0.03)	0.01 (0.03)	0.07*** (0.03)	0.06** (0.03)	0.06** (0.03)
E.Asia <sup>c</sup>	-0.45* (0.23)	-0.45* (0.23)	-0.35* (0.18)	-0.35* (0.18)	-0.35* (0.18)	-0.35* (0.18)	-0.35* (0.18)	-0.35* (0.18)
S.Asia	-0.99*** (0.14)	-0.99*** (0.14)	-0.97*** (0.12)	-0.97*** (0.12)	-0.97*** (0.12)	-0.97*** (0.12)	-0.97*** (0.12)	-0.97*** (0.12)
L.America	-0.50*** (0.10)	-0.50*** (0.10)	-0.57*** (0.14)	-0.57*** (0.14)	-0.57*** (0.14)	-0.57*** (0.14)	-0.57*** (0.14)	-0.57*** (0.14)
E.Europe	-	-	-0.63*** (0.19)	-0.63*** (0.19)	-0.63*** (0.19)	-0.63*** (0.19)	-0.63*** (0.19)	-0.63*** (0.19)
Mid.East	-0.14 (0.14)	-0.14 (0.14)	-0.03 (0.22)	-0.03 (0.22)	-0.03 (0.22)	-0.03 (0.22)	-0.03 (0.22)	-0.03 (0.22)
Africa	-0.47** (0.19)	-0.47** (0.19)	-0.69*** (0.20)	-0.69*** (0.20)	-0.69*** (0.20)	-0.69*** (0.20)	-0.69*** (0.20)	-0.69*** (0.20)
Constant	5.15*** (0.32)	4.68*** (0.21)	4.40*** (0.18)	3.95*** (0.25)	4.72*** (0.33)	4.02*** (0.17)	3.72*** (0.17)	3.50*** (0.21)
R-squared	0.71	0.08	0.24	0.37	0.57	0.26	0.39	0.42
Observations	46	46	46	46	77	77	77	77
Akaike	-11.84	36.12	27.76	20.31	67.74	101.50	87.98	85.24
Schwartz	4.62	39.78	33.24	27.63	91.18	106.19	95.01	94.61

<sup>a</sup>\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

<sup>b</sup>Panel 1: Data averaged between 1981-1990. Panel 2: Data averaged between 1991-2000.

<sup>c</sup>The OECD "region" is the excluded regional category.

moderately institutionalized when it has survived for thirty consecutive years, in this sample, some 60% of observations would meet that standard. More revealing is the fact that only 16 observations *fail* to meet the criteria. This may be too few to draw accurate conclusions.

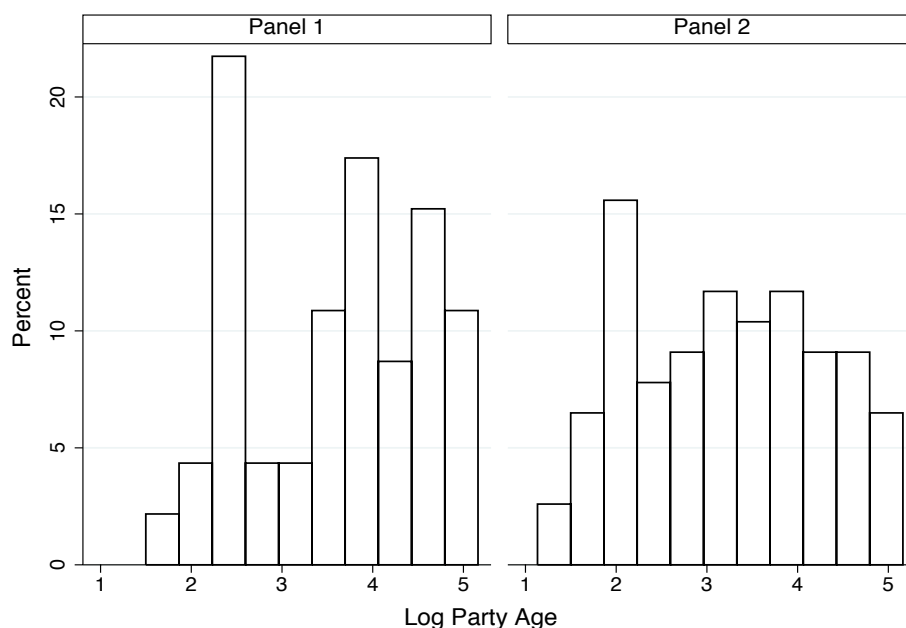
By comparison, the second panel adds about 30 observations, each of which is a developing or transitioning country and virtually all of which have values that indicate relatively young ruling parties. Table 4.4 displays the countries included in the second panel but not the first and lists their values on the party institutionalization and TFP measures. The bottom of the table presents summary statistics for the government age variable by panel. Notice that with the additional 31 countries, the median value of the party institutionalization measure falls from just over 41 years to around 25. Figure 4.5 goes further and shows the distribution of party age by panel. We can see in the figure that the increase in the number of cases in the second panel makes the distribution more bell-shaped, whereas the age variable is distributed such that most countries have high values in the first. Returning to our institutionalization age criteria of 30 years, we find that in the second panel, only 35% of the sample would be identified as well-institutionalized

There is, then, good reason to believe that the relationship between party institutionalization and TFP varies across the two panels (and hence we see no evidence of a relationship in the pooled sample) because there are too few weakly-institutionalized cases in the first panel of time to draw useful conclusions. In the panel where we have substantial variation in institutionalization, we see strong support for the theory's predictions. Additionally, these results are robust. In other models not displayed here, I have have estimated the relevant equation on the second panel controlling for additional variables, to include whether the system is presidential or parliamentary, the district magnitude of the country, and whether the country uses majoritarian or proportional electoral formula. Bootstrap and jackknife estimations, which drop

Table 4.4: Countries included in Panel 2 only and summary statistics by panel

Country	Party Age	Log TFP		
Bangladesh	43.2	4.328062		
Bulgaria	8.16667	4.253947		
Central African Republic	20	4.421105		
Chile	42	5.072697		
Czech Republic	83.3333	5.080637		
Estonia	7	4.692174		
Ethiopia	12	4.382529		
Georgia	4.5	3.782732		
Guatemala	10	5.112178		
Guyana	48.5	4.444707		
Hungary	8.5	5.067324		
Latvia	2.2	4.615222		
Lithuania	8	4.554778		
Malawi	7.5	3.491704		
Mali	7.5	4.092689		
Moldova	5	3.592694		
Mozambique	37.5	4.317428		
Namibia	39.5	5.11532		
Nepal	43.1667	4.091968		
Nicaragua	12.8333	4.334585		
Pakistan	25.8333	4.504384		
Panama	17.5	4.729644		
Paraguay	58.5	4.862701		
Philippines	4.88889	4.62645		
Poland	7	4.840887		
Romania	3	4.815996		
Russian Federation	5.5	4.448468		
Slovakia	8	4.985594		
South Korea	6.5	5.254907		
Taiwan	104.5	5.441057		
Ukraine	4	3.965307		
<b>Summary Statistics by Panel</b>				
Panel	Obs.	Mean	Std. Dev.	Median
1981-1990	46	53.58	44.98	41
1991-2000	77	42.73	41.71	25.83

Figure 4.5: Distribution of party age by panel



cases to assess the stability of the estimate, reveal that the results do not depend on the inclusion of one or a few influential cases.<sup>12</sup>

What are we to conclude then? The results are decidedly mixed. It would be going too far to conclude from the results using the second panel that the data *strongly* support the theory, but we do find evidence in the direction the theory predicts where history provides the most variation in the key independent variable. This is certainly an encouraging finding.

#### 4.2.5 Conditional effects of party institutionalization

Next, we turn to a discussion of whether the effect of party institutionalization on TFP is mediated by parties' expectations of future political influence. To reiterate, the hypothesis is that if time  $t$ 's ruling party deputies do not expect their party to control a sizable share of future governments when they become party leaders, they

---

<sup>12</sup>Results available from the author.

forgo proposing the burden-sharing scheme that prioritizes technology policies. They refrain from doing so expecting to be unable to claim credit for the economic benefits technology policies produce and hence being unable to reap the political rewards from such policies.

As we did in Chapter 3, we measure party deputies' expectations of future government control with data on their party's previous seat share. The notion here is that for party deputies, one of the best estimates they have regarding the prospects of their party in the future is the performance of the party in the relatively recent past—even if that estimate is not a particularly *good* one in the sense of having a small margin of error. Equation 4.6 tests the hypothesis. The control variables are the same as those included in the unconditional models. All models use Huber/White standard errors.

As we learned above, there is reason to believe there may be too little variation in party institutionalization in the 1981-1990 panel to draw useful inferences. Consequently, I start the discussion here with the results from the 1991-2000 panel. Subsequently, I discuss results from the first panel and the pooled model.

Table 4.5 displays the coefficient estimates. Model 13 is the full model and Models 14-16 check the stability of the estimates when the controls variables are excluded. Model 17 excludes influential outliers from the analysis, a model that will be discussed below. The results from the full sample appear to reject the theory. In three of the four models that retain the full sample, the coefficient on the interaction term is negative, indicating that the effect of party institutionalization on TFP is decreasing in magnitude as deputies begin to expect that their party will control a larger share of future governments. The theory predicts just the opposite.

These unsupportive results are due to outliers however. Two cases in particular seem to be the culprits: Ukraine and Jamaica. Both of these cases have DFFITS scores and Cooks' Distances scores greater than the recommended thresholds. We

Table 4.5: Regressions Results: Marginal effect of party age on TFP modified by 3-year seat share average

Model Number	(13) <sup>a</sup>	(14)	(15)	(16)	(17)
Panel	2	2	2	2	2
Outliers Dropped?	No	No	No	No	Yes
Party Age	0.27 (0.17)	0.30** (0.14)	0.18 (0.12)	0.09 (0.12)	0.07 (0.15)
Seat Share	0.79 (1.33)	-0.38 (1.14)	-0.27 (1.03)	-0.51 (1.03)	-0.51 (1.27)
Party Age * Seat Share	-0.33 (0.38)	-0.06 (0.35)	-0.07 (0.30)	0.07 (0.30)	0.12 (0.34)
Regime Age	0.07 (0.06)		0.24*** (0.06)	0.18*** (0.06)	0.07 (0.05)
Polity Score	-0.00 (0.03)			0.07* (0.04)	0.01 (0.03)
E.Asia <sup>b</sup>	-0.40* (0.22)				-0.36 (0.22)
S.Asia	-0.98*** (0.14)				-0.95*** (0.14)
L.America	-0.55*** (0.13)				-0.51*** (0.12)
E.Europe	-0.51** (0.22)				-0.49** (0.21)
Mid.East	-0.03 (0.23)				-0.03 (0.23)
Africa	-0.58** (0.24)				-0.58** (0.23)
Constant	4.38*** (0.66)	4.22*** (0.45)	3.89*** (0.40)	3.69*** (0.39)	4.87*** (0.62)
R-squared	0.55	0.27	0.40	0.43	0.56
Observations	70	68	68	68	68
Akaike	66.12	86.89	74.59	71.89	59.31
Schwartz	93.10	95.77	85.69	85.21	85.94

<sup>a</sup>\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

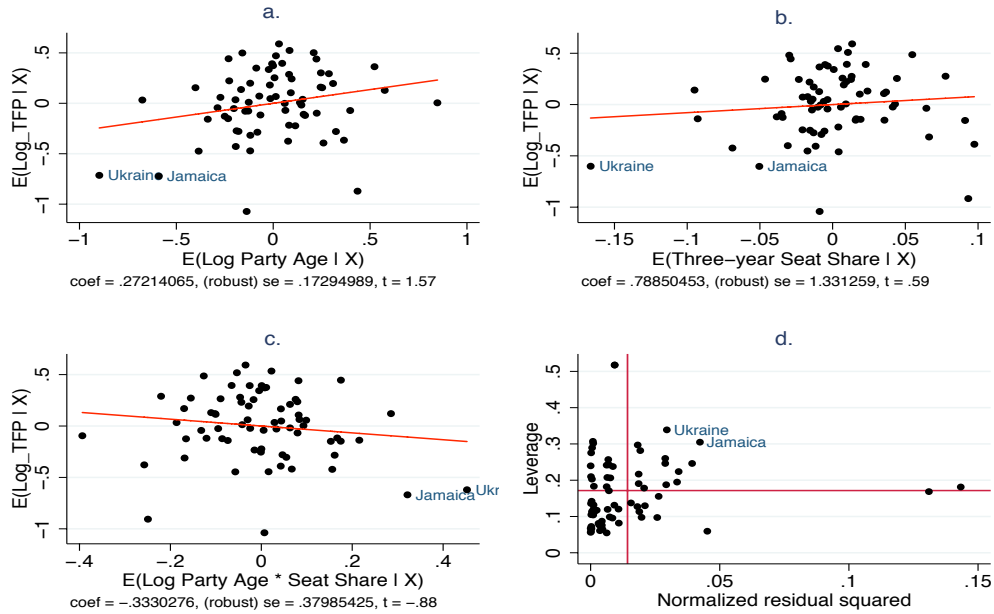
<sup>b</sup>The OECD "region" is the excluded regional category.



can get a better sense of the observations' effects by examining the partial regression plots and leverage versus residual plot in Figure 4.6. Looking at the partial regression plots, it seems possible that Ukraine and Jamaica are influencing the slope of the coefficient of the party age variable in Graph a. and the interaction term in Graph c. Turning to the graph in the bottom right of the figure, we see that, of the set of countries in the sample, Ukraine and Jamaica both have substantial residuals, and appear to be two of the more influential points in the database.

I assessed whether these cases are in fact affecting the results, by estimating the same model, but dropping these cases from the analysis. The result is presented in Model 17 in Table 4.5. Here, we see that the results appear more supportive of the theory. In this case, both the party institutionalization measure and its interaction with the seat share variable are positive as predicted.

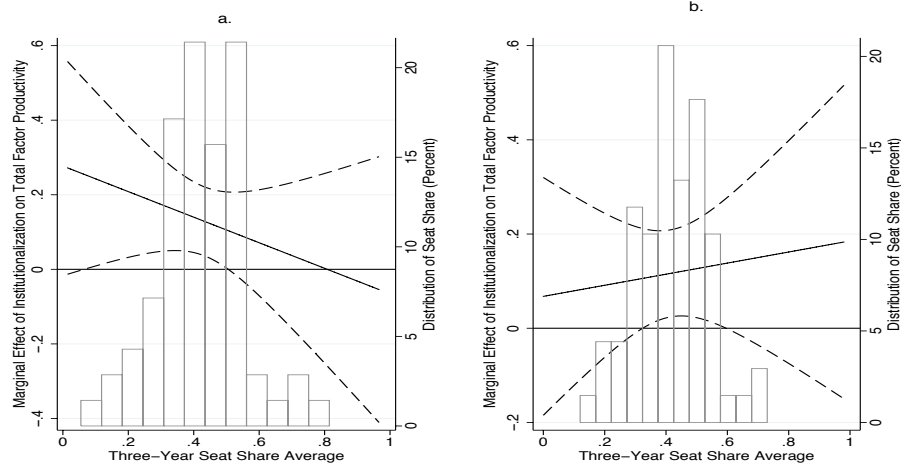
Figure 4.6: Partial regression plots for Panel 2



Due to the interaction term, it is difficult to assess whether the theory has support since it is difficult to ascertain from the coefficient estimates whether there is a range of the modifying variable where party age is a significant predictor of TFP levels.

Figures are useful in understanding the results (Brambor, Clark, and Golder 2006; Franzese and Kam 2007). Figure 4.7 displays two graphs. In each, the solid line is the marginal effect of party institutionalization and the two dashed lines indicate the 90% confidence interval around that marginal effect. Each figure also displays a histogram of the seat share variable's distribution. The histogram is to be evaluated according to the second Y-axis and we include it in the graph to better understand whether the marginal effect of institutionalization is statistically significant for a substantively important share of the sample in question. Graph a. comes from the results of Model 13, which includes all of the countries and b. comes from Model 17, which excludes the outliers.

Figure 4.7: Marginal effect of party age modified by 3-year seat share average (1991-2000)



Note: Histograms display seat share distribution in percent and should be evaluated using the second Y-axis  
All results use 90% confidence intervals

The most noticeable difference between the two graphs is that when we allow the outliers to remain in the sample, the marginal effect of party institutionalization is decreasing with increases in the seat share variable, but when we take into account the presence of outlying observations, the slope of the marginal effect becomes positive and the results become more supportive of the theory. Focusing for the moment on Graph b., notice that at low values of the modifying variable, party institutionalization is an insignificant predictor of total factor productivity levels, evidenced by the

fact that the confidence intervals fall on either side of the 0 horizontal line. This is consistent with the argument that where party deputies do not expect their party to control a sizable share of future governments when they become party leaders, they have little interest in pursuing technological development since they will be unable to reap the political rewards from those policies. When party members begin to expect to control a larger share of future governments, the effect of party institutionalization becomes more positive and statistically significant since both confidence intervals rise above the 0 line. This too, is consistent with the theory and is evidence that the degree to which party members care about technological development is correlated with expectations of being able to claim credit for the policies' benefits in the future. Finally, Graph b. shows a result consistent with that uncovered in Chapter 3—namely that at very high levels of the seat share variable, party institutionalization is also statistically insignificant. This results from the fewer cases at higher values of the modifying variable as we can see with the underlying histogram. Graph a., however, does not support the theory. Here we see that the effect of party institutionalization is greatest at low levels of the modifying variable.

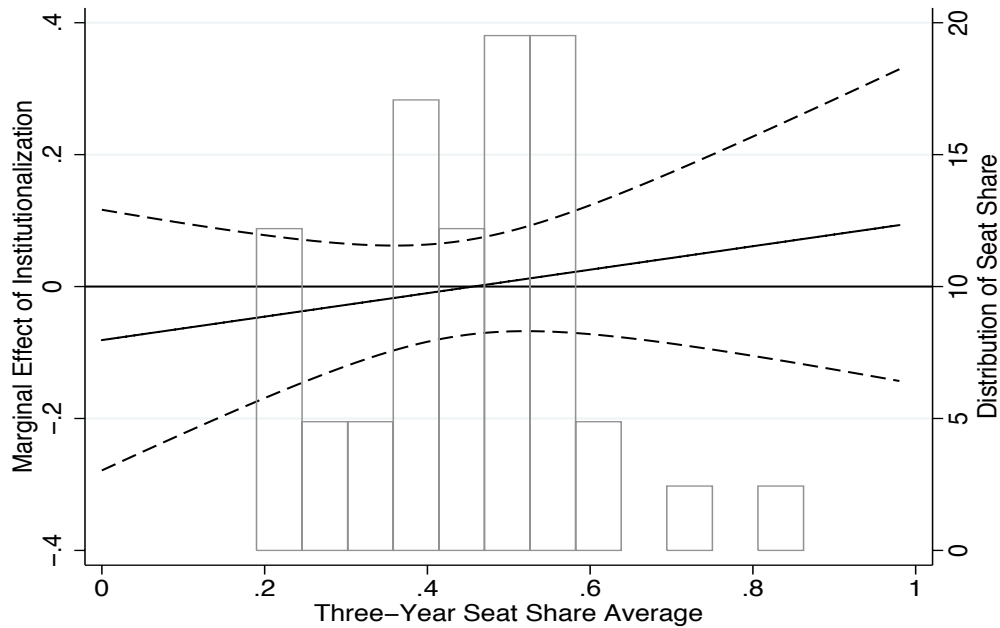
While the results here are marginally supportive, the results from the 1981-1990 panel do not support the theory at all. The marginal effect graph is presented in Figure 4.8.<sup>13</sup> Here, the slope of the line is positive as we expect; the effect of party institutionalization on TFP is increasing with the seat share variable. However, there is no range of the modifying variable where institutionalization obtains statistical significance. Hence, we are forced to conclude that there is no support for the theory using this sample.<sup>14</sup>

---

<sup>13</sup>The coefficient estimates are suppressed here to preserve space. Results available from the author.

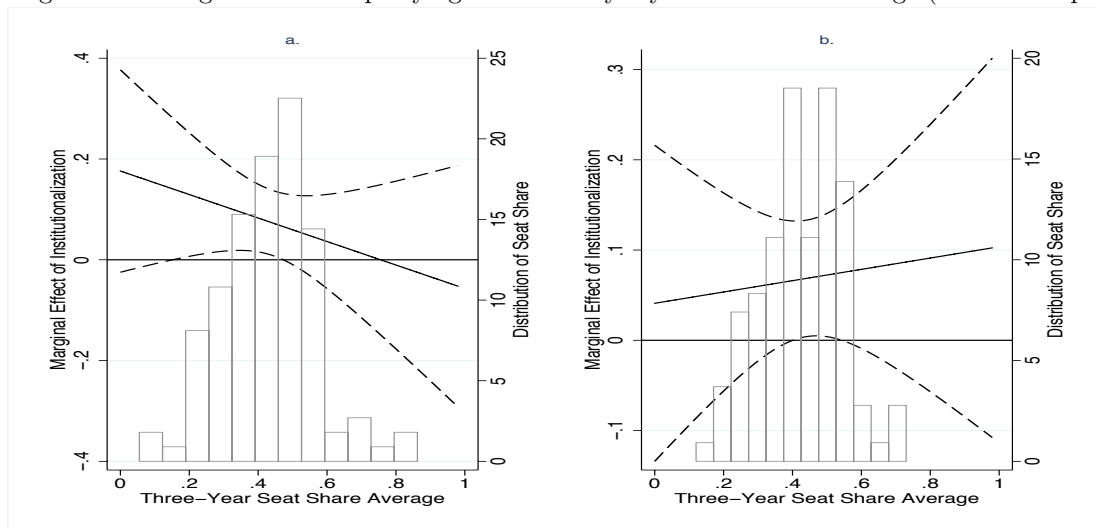
<sup>14</sup>This model does not exclude outliers. Ukraine is not included in this sample at all and the Jamaica observation in this sample is not an outlier.

Figure 4.8: Marginal effect of party age modified by 3-year seat share average (1981-1990)



The results from the pooled model reflect those from the 1991-2000 sample. Post-estimation tests and graphs show that Ukraine and Jamaica are outliers and once again the choice to include or exclude them is not innocuous. The relevant marginal effect graphs are presented in Figure 4.9. In graph a., which includes the offending countries, the marginal effect of institutionalization is decreasing. When we exclude the outliers, in the graph to the right in the figure, the slope is increasing. As we saw using only the 1991-2000 panel, the marginal effect is insignificant at very low values of the modifying variable, becomes significant as the seat share variables becomes larger and then becomes statistically insignificant at very high values of the modifying variable.

Figure 4.9: Marginal effect of party age modified by 3-year seat share average (Pooled sample)



### 4.3 Conclusion

The fact that the conceptual dependent variable of the dissertation—the premiums governments place on technological development—is unobserved means that we can have confidence in the theory only if we use a set of variables that act as measures for that concept, each of which captures a different aspect of the conceptual variable. Consistent results across a variety of measures instills greater confidence in the theory. Chapter 3 began the empirical investigation, focusing its attention on human capital and the current chapter turned its attention to the efficiency of inputs to production, or TFP. The main benefit of using TFP is that it is an outcome measure that frees us from having to make troublesome assumptions regarding what policies governments will use to catalyze technological progress and the political intentions behind government policies, such as R&D subsidies and grants.

That said, the results of the TFP models are decidedly mixed and ultimately weaken our confidence in the theory’s accuracy. In the models estimating an unconditional effect of institutionalization, there is robust support for the theory when we use the 1991-2000 time period, but the results of the 1981-1990 panel reject the the-

ory outright. Accordingly, when we pool the samples the results are in the predicted direction and the p-value is small, but still too large for standard levels of confidence ( $p = 0.121$ ). The difference between the two panels' results are due to their different samples and the within panel variation in the institutionalization measure and, while our results are strongest where we have the most variation and weakest in the panel that provides the fewest observations with sufficiently young, fragile ruling parties, the fact that the theory does not have support over various time periods weakens our confidence in it.

The results from the conditional model further undermine the theory. The supportive results depend entirely on the exclusion of two outlying cases, Ukraine and Jamaica. While these two cases are indeed influential outliers according to post-estimation tests and graphs, there is no *theoretical* reason to exclude these cases from the sample. When included in the model, the relevant coefficients have the wrong sign and show a significant effect of institutionalization at a range we would not expect if the theory were accurate. These results seem quite damaging to the theory.

What can explain the weak results? I offer a couple of suggestions here, each of which will receive more development in Chapter 5. First, if we assume for the moment that these measures are good ones, then we must conclude that the theory is inaccurate, or at the very least, party institutionalization is not a first-order concern when it comes to understanding variation in TFP and that other factors, perhaps economic in nature, are more important and trump political considerations.

But before we reach this conclusion, it may be the case that the measures used here obscure more than they reveal. First, for all of its usefulness, TFP is not a perfect measure of the premium governments place on technological progress. After all, it is a residual in an accounting identity and *anything* that affects GDP levels that is not the capital stock or the stock of human-capital augmented labor is included within it. Economies of scale, cost-reductions, and even geography are just a few of the factors

that might be included in the residual. The fact that TFP is a residual means all of the other things that affect output and output growth make it a noisy proxy for the premiums governments place on technological progress. Second, the seat share modifying variable is also a noisy measure of expectations of future government control and this too may be a reason for the unsupportive results. Chapter 5 addresses these concerns and offers strategies for testing the theory further with potentially better measures.

## Chapter 5

### Conclusion

#### 5.1 Summary of the Theory

Understanding why countries vary in their levels of wealth and rates of income growth has long had a prominent role in comparative political economy and every indication points to this continuing in the future. Since Solow's seminal papers in the mid-1950s, a central challenge for students of economic development is to explain the pace of technological progress. Most of the extant literature gives attention to economic competition, but scholars are beginning to place more focus on political factors such as policy credibility, constraints on government predation, and public policy. This dissertation is situated within this politics-oriented literature and focuses on explaining when and why governments deploy the kinds of policies thought to catalyze innovation and technology adoption. This concentration on policymaking is motivated by the literature showing that market failures, financial costs, and risks all act as hindrances to technological progress, but their effects can be reduced by government policies.

The motivation of the project is this: given the current state of knowledge of politics and economics, we would expect that governments would always and everywhere *eschew* precisely the kinds of policies designed to facilitate technological progress. The problem is one of incompatible time horizons. In democracies, politicians' horizons are determined by the electoral calendar and are far shorter than the horizons needed to value the delayed returns of technology policy. When this inherent incompatibility



is combined with the fact that leaders interested in creating growth can also follow a strategy that produces more immediate economic returns, it would seem that politicians should have little interest in deploying technology policies. The puzzle is that, even in light of the seeming horizon incompatibility, there can be little doubt that governments do deploy policies designed to stimulate technological progress. How can we explain this?

To answer this question, I proposed a model that began by illuminating the costs and benefits of the short-term “accumulation” growth strategy and the longer-term “technology” strategy and then proceeded to address how politics shapes how governments prioritize these two strategies. I argued of a relationship between the nature of a country’s dominant political parties and the premium governments place on the technology strategy. The argument can be summarized as follows. Cohorts within an overlapping generations (OLG) party conflict over the distribution of costs and benefits of economic policy. An older generation of “party leaders” expects to leave the political arena shortly and consequently, places no value on policies with delayed returns. They prefer instead to emphasize the short-term growth strategy that has more immediate returns and delayed costs. This preference conflicts with those of the party’s cohort of “deputies”, the members that expect to be involved in politics for some time to come. Deputies want a policy regime that promises to retain sufficient policy flexibility so that they can manipulate the economy to their advantage in future periods. This cohort recognizes that the short-term growth strategy constitutes an implicit burden-sharing scheme that reifies leaders’ utilities at the expense of their own since the short-term strategy suffers from political and economic diminishing returns, which constrain leaders’ abilities to manipulate the economy in a politically advantageous way. Since these constraints to the accumulation strategy arrive with a delay, time  $t$ ’s deputies are concerned that they will be the politicians most likely exposed to those constraints while time  $t$ ’s leaders will have exited the political scene

long before these costs arrive.

To assess how the generational conflict could be resolved, I drew from the literature on OLG organizations like the firm, and proposed a bargain that involves inter-generational utility transfers. In the solution, deputies offer to strengthen leaders' agenda-setting and seniority powers by credibly committing to backing the leaders' non-growth-related policy agenda if, in return, those leaders commit to an economic regime that places a greater premium on technology policy. Deputies also offer to forgo bargaining over the the distribution of the pork elements of whatever technology policies leaders initiate, instead leaving the distribution entirely to the leaders. Leaders can then use their seniority powers and control of the distribution of pork to offset the costs they pay by deploying long-term growth policies that has returns they cannot use. Thus, should the bargain hold, technology policy can be understood as an output of an intra-party, inter-generational burden-sharing arrangement.

The central hypothesis from the model is that the nature of a country's ruling parties will determine the premium technology policy receives. For the bargain to exist, a party needs a cohort of members that have an incentive to care about the future as this relatively more forward looking cohort makes the proposal. Such a cohort will exist only when parties recruit new members and the party is sufficiently institutionalized such that the new recruits can have reasonable expectations of having long political careers by leveraging the party's organizational structure and label. Subject to winning the most immediate election, deputies in this party have an incentive to consider what kinds of policies will extend their political career beyond the immediate election.

Leaders in fragile and short-lived parties, by contrast, might be unable or uninterested in recruiting new members, allowing leaders' preferences for the short-term strategy to go uncontested. Even if the party does recruit successfully, however, deputies will not have incentives to be forward-looking since they do not expect to

be able to rely on the party continuing to exist over time and help them win future elections. The party's fragility leaves much uncertainty regarding their future political prospects and under these circumstances, there are few reasons to value policies with delayed benefits, even if those benefits are substantial and allow for sustained increases in well-being. In short, in non-OLG parties, nobody demands technology policy. Consequently, countries typically ruled by OLG parties should show evidence of having a greater premium on technological progress.

Two factors modify the effects of OLG ruling parties. The first is the expectation deputies in a party have that their party will control a sizable share of future governments. Today's deputies must expect that they will rule the *government* in the future, not just their party. To value technology policies, deputies must expect to be able to claim credit for the positive benefits those policies produce, but in the model, only the party in power when the returns arrive can claim credit for them. If deputies do not have expectations along these lines, they will not value technology policy. The second modifying factor is the expected returns to further accumulation. If deputies expect that the short-term strategy will not tie their hands in the future period—that is, decreasing returns are a very long way off, as in very capital poor developing countries—then they have no concerns with the short-term strategy and will have no reason to press leaders for technology policies.

## **5.2 Summary of Empirical Results**

Chapters 3 and 4 present the statistical tests of the theory. I argued in Chapter 3 that one way to measure the premium politicians place on technology policies is by examining post-primary education statistics. Human capital is crucial for technological development and post-primary education policy has the temporal return structure as that proposed in the theory. Using data on secondary and tertiary education attainment in the population and data on the time since formation of the

largest government party as the measure of the degree of overlapping-ness, I found strong and consistent support for the theory. Those findings can be summarized as follows.

1. *Countries governed by long-lived, OLG parties have populations where more citizens have some secondary and tertiary education.* This is as predicted. Notably, this effect is not a function of the fact that OLG parties tend to exist in more stable, long-lived and consolidated democracies as the models control for the age of the democratic regime. Similarly, the results hold given a battery of robustness checks for outliers and the inclusion of potentially confounding variables or the exclusion of variables in the baseline model.
2. *The effect of OLG parties is modified by the share of future governments deputy members expect their party to control.* The modifying variable was measured by a moving average of party  $i$ 's past seat share, based on the argument that the best information a party member has about future prospects is past performance. When deputies do not expect their party to control a large share of future governments, the marginal effect of the party age variable is not distinguishable from zero. But as a party's future prospects improve, OLG parties distinguish themselves from their weakly-institutionalized counterparts. In short, OLG parties only matter when those parties are also politically viable in the sense of being an important part of future governments. These results hold for both secondary and tertiary education attainment models.
3. *The effect of parties is modified by the expected to returns to further accumulation.* Here, the modifying variable is measured according to investments share of GDP. I find that, as investment share of GDP increases, indicating a greater likelihood of a situation in which decreasing returns to *further* accumulation will occur, the party age variable is positively and statistically significantly cor-

related with the human capital variables. At low levels of investment, there is no effect of the party age variable. These findings are consistent with the claim that in low investment environments, the returns to accumulation are thought to be high and so few politicians demand technology policies. These results are also robust.

### **5.2.1 OLG Parties and Total Factor Productivity**

Chapter 4 continued the empirical investigation, estimating the effects of parties on total factor productivity (TFP). These results show only limited support for the theory. In a cross-section of countries between 1991-2000, there is support for the proposition that countries ruled by OLG parties prioritize technology policy more than countries ruled by weakly-institutionalized parties. Results from the period covering 1981-1990 reject the theory, however. Here, the slope is positive as predicted, but it is not significant statically. This discrepancy can be explained by the sample of countries in the two time periods. The 1991-2000 sample is both the largest in terms of observations and it has the largest variation in the independent variables of interest. As such, where we have the most countries, we see support for the theory. This is encouraging, but the lack of robust results tempers our enthusiasm. In neither sample is there robust support for the hypothesis that the effect of parties is modified by expectations of future government control.

These weaker results deserve to be taken seriously, but they do not necessarily undermine the theory. As noted in Chapter 4, TFP is a very noisy measure of the conceptual dependent variable. TFP is, after all, measured as a residual and it captures many other factors and combinations of factors not modeled in the theory. Additionally, the causal chain between policy and TFP is a good deal more complex than that between government education policy and secondary and tertiary education attainment. That this complicated causal chain is not modeled explicitly in the

empirics almost certainly affects the coefficient estimates on the party age variable. A more sophisticated statistical model may produce more supportive results.

While not all the results are robust, that we find *any* support for the model is an improvement over the state of knowledge prior to this dissertation. Given what we know about politics and economics, we have been hard pressed to understand why governments deploy such policies at all. Furthermore, given the theory, the conditions under which governments deploy technology policies are extremely strict. Consider the factors that must be properly aligned according to my theory for a ruling party to set such policies:

1. Parties must be OLG.
2. Deputies must expect that their party will control a sizable share of future governments.
3. The expected returns to further accumulation must be small.
4. Deputies and leaders must be able to make credible commitments.
5. Deputies must have some ability to sanction leaders should leaders refuse to accept deputies' proposal. Additionally, deputies must be able to overcome problems of collective action to use their sanctioning ability.<sup>1</sup>

At least five variables must take on particular values for a ruling party to prioritize technology policies. Should any of these factors not hold, leaders will not initiate technology policies and what technological progress occurs will be due to reasons orthogonal to public policy. We would expect that the chances of the five variables being properly aligned will be uncommon and so it is not too surprising that it is

---

<sup>1</sup>To facilitate theory building, I assumed away points 4 and 5 in the theory, but they are certainly relevant in reality.

hard to find evidence of an effect of OLG parties. In fact, it should be the case that technology policy deployment is a rare event. Yet, we do find evidence of a party effect, the robustness of which seems to depend on the usefulness of the dependent variables more than the accuracy of the theory itself.

### 5.3 Theoretical Contributions

Beyond the empirical findings regarding technological progress, this dissertation provides theoretical contributions to our understanding of political parties by offering a novel and plausible way to think about intra-party conflicts and their resolution. Scholars have long recognized that the assumption of parties as unitary actors is one that is false in many instances and that the heterogeneity that exists within parties can be useful in understanding various features of political and economic environment.<sup>2</sup> In the existing literature, two kinds of intra-party preference heterogeneity receive the most attention: heterogeneity produced by variation in the safeness of legislators' seats and heterogeneity in legislators' ideal points on some spatial dimension. Here, I have presented an altogether different source of intra-party preference heterogeneity where one's political generation affects one's time horizons. In comparative political economy, we typically assume that politicians seek to win and retain office, but the extreme version of this proposition—that politicians are focused exclusively on winning the most immediate elections, but give no attention to time periods beyond that—may be too restricting. Whether for “ego rents” or policy positions, politicians want to retain office for the long haul. For deputies, this certainly means winning the immediate election, but it also entails establishing an environment one can use in the effort to *continue* winning elections over time. As Aldrich (1995) writes, “[Political] ambition is for a career. To that end, victory in the immediate election is

---

<sup>2</sup>That the assumption is not literally true does not mean it cannot be a useful simplifying assumption for modeling exercises.

crucial, for any defeat greatly reduces the prospects for a long career. So too, however, are the prospects for continued election critical.” (54). The key source of preference heterogeneity is the potential for a career that extends well into the future and how that potential differs between political generations. Leaders will look less far into the future than deputies will and their preferences over policy will differ accordingly.

This discussion of another basis for intra-party conflict is a valuable proposition, but so too is the offered resolution to it. To my knowledge, the argument that increased seniority and agenda-setting powers constitutes one part of the solution is novel. Other solutions to the conflict exist as well, but the possibility that the seniority institution is maintained by an ongoing inter-generational bargain is a new approach and a proposition that may be worth studying and testing further.

### **5.3.1 Further Implications**

I conclude the dissertation with a brief discussion of how these theoretical contributions can be used to understand other issue areas besides technology policy. Consider the question of how governments remain credible in the presence of incentives to exploit foreign direct investment (FDI). FDI is a vital source of capital and technology and countries compete vigorously to lure FDI, usually by offering potential investors tax incentives. Owners of capital, however, demand policy credibility from politicians. Capital owners know that politicians in the host country have incentives to take advantage of FDI’s substantial irreversibilities and the fact that investors are at a weaker bargaining position relative to the host country’s government once a plant has been constructed. Politicians may be tempted to renege on their tax policy promises and raise taxes to increase state revenues.

Under what conditions will politicians keep their promises? An OLG model of parties can help answer this question. Reneging on promises sullies the party’s reputation with owners of capital and in the future, potential investors will go elsewhere.



In an OLG model of parties, where political survival depends at least in part on the rate of economic growth and where party reputations for credibility endure over time, renegeing on policy promises disproportionately hurts party deputies who, when they become party leaders (and, subject to electoral context, perhaps government leaders) will have to find ways to attract FDI to stimulate growth absent credibility with investors. Deputies in this model have an incentive to persuade party leaders to commit credibly to their tax policy promises and maintain the party's credibility. One solution is an inter-generational utility transfer that amounts to at least the size that leaders would obtain by renegeing. Such a bargain will not occur in fragile, weakly-institutionalized, non-OLG parties, where members have few reasons to plan for the future and so are less concerned about their and their party's reputations over time. Non-OLG parties will act instead like Olson's (2000) "roving bandits" that will renege on their promises to gain immediate rents.<sup>3</sup>

Whether this or other applications receive support remains to be seen. And should the hypothesized correlations show up in the data, however, we would still need to probe deeper into the empirical record to know whether the mechanisms posited in the theory (i.e., inter-generational transfers) are the cause of that correlation. Case studies will be useful in this regard and in future research, I hope to show evidence that I have specified the mechanisms correctly. In any case, we would do well to consider the generational conflicts that exist within parties, how they are resolved, and the implications these processes have on policymaking and an array of other phenomena of interest to political scientists.

---

<sup>3</sup>Following Nooruddin (2003), we may be able to use a somewhat similar logic to reach the conclusion that a relationship between OLG parties and growth rate volatility should exist as well.

## References

- Acemoglu, Daron, Philippe Agion and Fabrizio Zilibotti. (Forthcoming). Distance to Frontier, Selection, and Economic Growth. *Journal of the European Economic Association*.
- Achen, Christopher H. (2000) Why Lagged Dependent Variables Can Suppress the Explanatory Power of Other Independent Variables. Paper presented at the Annual Meeting of the Political Methodology Section of the American Political Science Association, July 20-22, UCLA.
- Aghion, Philippe (2004). Growth and Development: A Schumpeterian Perspective. *Annals of Economics and Finance*. 5:1-24.
- Aghion, Philippe and Peter Howitt. (1992). A Model of Growth through Creative Destruction. *Econometrica*. 60(2): 323-351
- Aldrich, John H. (1995). *Why Parties: The Origin and Transformation of Political Parties in America*. Chicago: University of Chicago Press.
- Alesina, Alberto and S.E. Spear (1988). An Overlapping Generations Model of Electoral Competition. *Journal of Public Economics*. 37: 359-379.
- Almond, Gabriel A. and Sidney Verba. (1963). *The Civic Culture: Political Attitudes and Democracy in Five Nations*. New York: Little, Brown, and Company.
- Alston, Lee J. and Bernardo Mueller. (2006). Pork for Policy: Executive and Legislative Exchange in Brazil. *Journal of Law, Economics and Organization*. 22(1): 87-114
- Anderson, Christopher J., and Yuliya V. Tverdova. (2003). Corruption, Political Allegiances, and Attitudes Toward Government in Contemporary Democracies. *American Journal of Political Science*. 47(1): 91-109
- Archibugi, Daniele and Alberto Coco. (2003). A New Indicator of Technological Capabilities for Developed and Developing Countries (ArCo). *World Development*. 32(4): 629-654

- Arrow, Kenneth, J (1962). The Economic Implications of Learning by Doing. *The Review of Economic Studies*. 3(3): 155-173.
- Aswicahono, Haryo and Hal Hill. (2002). Perspiration versus Inspiration in Asian Industrialisation: Indonesia Before the Crisis. *The Journal of Development Studies*. 38(3): 138-163.
- Baier, Scott L., Gerald P. Dwyer Jr., and Robert Tamura. (2006). How Important are Capital and Total Factor Productivity for Economic Growth? *Economic Inquiry*. 44(1): 23-49.
- Barro, Robert J. (1999). Notes on Growth Accounting. *Journal of Economic Growth*, 4(2):119-137.
- Barro, Robert J. and Jong-Wha Lee. (2000). International Data on Educational Attainment: Updates and Implications. *CID Working Paper No. 42*. Available at <http://www.cid.harvard.edu/ciddata/ciddata.html>
- Bartels, Larry M. (1991). Instrumental and “Quasi-Instrumental” Variables. *American Journal of Political Science*. 35(3): 777-800.
- Beck, Nathaniel and Jonathan N. Katz. (1995). What To Do (And Not To Do) With Time-Series Cross-Section Data. *The American Political Science Review*. 89(3): 634-647.
- Beck, Thorsten, George Clarke, Alberto Groff, Philip Keefer, and Patrick Walsh. (2001). New Tools in Comparative Political Economy: The Database of Political Institutions. *World Bank Economic Review*. 15(1): 165-176.
- Bollen, Kenneth A. and Robert W. Jackman. (1985). Regression Diagnostics. *Sociological Methods & Research*. 13(4): 510-542.
- Bosworth, Barry P. and Susan M. Collins (2003). The Empirics of Growth: An Update. *Brookings Papers on Economic Activity*. 68: 113-206.
- Brambor, Thomas, William Roberts Clark, and Matt Golder. (2006). Understanding Interaction Models: Improving Empirical Analyses. *Political Analysis*. 14(May): 63-82.
- Brown, David S. and Wendy Hunter. (2004). Democracy and Human Capital Formation. *Comparative Political Studies*. 37(7): 842-864.
- Bueno de Mesquita, Bruce, Alastair Smith, Randolph M. Siverson, and James D. Morrow. (2004). *The Logic of Political Survival*. Cambridge: MIT Press.

- Chappell, Henry W. Jr. and William R. Keech. (1985). A New View of Political Accountability for Economic Performance. *The American Political Science Review*. 79(1): 10-27.
- Chatterjee, Samprit and Ali S. Hadi. (1988). *Sensitivity Analysis in Linear Regression*. New York: John Wiley and Sons.
- Chen, Edward K. Y. The Total Factor Productivity Debate: Determinants of Economic Growth in East Asia. *Asian-Pacific Economic Literature*.
- Chen, Yongmin and Thitima Puttitanun. (2005). Intellectual Property Rights and Innovation in Developing Countries. *Journal of Development Economics*. 78(2): 474-493.
- Cohen, Linda R. and Roger G. Noll. (1991). *The Technology Pork Barrel*. Washington D.C.: Brookings Institution Press.
- Collins, Susan M. and Barry P. Bosworth (1996). Economic Growth in East Asia: Accumulation versus Assimilation. *Brookings Papers on Economic Activity*. 2: 135-191.
- Coppedge, Michael. (2001). Latin American Parties: Political Darwinism in the Lost Decade. In Larry Diamond and Richard Gunther (eds.), *Political Parties and Democracy*. Baltimore: Johns Hopkins University Press.
- Cox, Gary W. and Matthew D. McCubbins. (2001). The Institutional Determinants of Economic Policy Outcomes. In Stephan Haggard and Matthew D. McCubbins (eds.), *Presidents and Parliaments*. Cambridge: Cambridge University Press.
- Crémer, Jacques. (1986). Cooperation in Ongoing Organizations. *The Quarterly Journal of Economics*. 101(1): 33-49.
- Dasgupta, Partha and Joseph Stiglitz. (1980). Industrial Structure and the Nature of Innovative Activity. *The Economic Journal*. 90(358): 266-293.
- DeLong, J. Bradford and Lawrence H. Summers. (1991). Equipment Investment and Economic Growth. *Quarterly Journal of Economics*. 106(2): 445-502
- Duch, Raymond M. (2001). A Developmental Model of Heterogeneous Economic Voting in New Democracies. *The American Political Science Review*. 95(4): 895-910.
- Duch, Raymond M., Harold D. Palmer and Christopher J. Anderson. (2000). Heterogeneity in Perceptions of National Economic Conditions. *American Journal of Political Science*. 44: 635-652.

- Easterly, William (2003). *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics*. Cambridge: MIT Press
- Easterly, William and Ross Levine (2001). Its Not Factor Accumulation: Stylized Facts and Growth Models. *World Bank Economic Review*. 15(2): 225-227.
- Evans, Diana. (1994). Policy and Pork: The Use of Pork Barrel Projects to Build Policy Coalitions in the House of Representatives. *American Journal of Political Science*. 38(4): 894-917.
- Fagerberg, Jan. and Godinho, Manuel M. (2003). Innovation and catching-up. Working paper, No. 24, TIK, Oslo.  
Available at <http://ideas.repec.org/p/tik/wpaper/24.html>.
- Fiorina, Morris P. (1981). *Retrospective Voting in American National Elections*. New Haven: Yale University Press.
- Franzese, Robert J. Jr. (2002). *Macroeconomic Policies of Developed Democracies*. Cambridge: Cambridge University Press.
- Franzese, Robert J. Jr. and Cindy D. Kam. (2007). *Modeling and Interpreting Interactive Hypotheses in Regression Analysis: A Brief Refresher and Some Practical Advice*. Ann Arbor: University of Michigan Press.
- Friedman, Thomas L. (2005). *The World is Flat: A Brief History of the Twenty-First Century*. New York: Farrar, Straus, and Giroux.
- Gerschenkron, Alexander (1962). *Economic Backwardness in Historical Perspective*. Cambridge: Harvard University Press
- Granato, Jim, Ronald Inglehart, and David Leblang. (1995). The Effect of Cultural Values on Economic Development: Theory, Hypotheses, and Some Empirical Facts. *American Journal of Political Science*. 40(3): 607-631.
- Griliches, Zvi. (1990). Patent Statistics as Economic Indicators: A Survey. *Journal of Economic Literature*. 28(4): 1661-1707.
- Grossman, Gene M. and Elhanan Helpman (1997). *Innovation and Growth in the Global Economy*. Cambridge: MIT University Press.
- Guellec, Dominique and Bruno van Pottelsberghe (2001). The Impact of Public R&D Expenditure on Business R&D. *Economics of Innovation and New Technology*. 12(3): 225-243

- Haggard, Stephan and Robert R. Kaufman. (1995). *The Political Economy of Democratic Transitions*. Princeton: Princeton University Press.
- Hall, Bronwyn H. (2004). Innovation and Diffusion. In Jam Fagerberg, David Mowery and Richard R. Nelson (eds.), *Handbook of Innovation*. Oxford: Oxford University Press, 2004.
- Hall, Bronwyn H. and John Van Reenen (2000). How Effective Are Fiscal Incentives for R&D? A Review of the Evidence. *Research Policy*. 29: 449-469.
- Hall, Peter A. and David Soskice. (2001). *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. New York: Oxford University Press
- Hall, Robert and Charles I. Jones (1999). Why Do Some Countries Produce So Much More Output Per Worker than Others? *The Quarterly Journal of Economics*. 114: 83-116.
- Harberger, Arnold C. (1998). A Vision of the Growth Process. *The American Economic Review*. 88(1): 1-32.
- Helpman, Elhanan. (1993). Innovation, Imitation, and Intellectual Property Rights. *Econometrica*. 61: 1247-1280.
- Heston, Alan, Robert Summers, and Bettina Aten. (2004). *Penn World Table Version 6.2*. Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania. Available at <http://pwt.econ.upenn.edu/>.
- Hicken, Allen and Joel W. Simmons. (2008). The Personal Vote and the Efficacy of Education Spending. *American Journal of Political Science*. 52(1): 125-141
- Holbrook, Thomas and James C. Garand. (1996). Homo Eonomus? Economic Information and Economic Voting. *Political Research Quarterly*. 49(2): 351-375.
- Hulten, Charles R. (1975). Technical Change and the Reproducibility of Capital. *The American Economic Review*. 65(5): 956-965.
- Hulten, Charles R. and Anders Isaksson. (2007). Why Development Levels Differ: The Sources of Differential Economic Growth in a Panel of High and Low Income Counties. *NBER Working Paper*. No. W13469.
- Huntington, Samuel P. (1968). *Political Order and Changing Societies*. New Haven: Yale University Press.
- Job Protests Grip French Cities. *BBC News Online*. March 18, 2006. Available at <http://news.bbc.co.uk/2/hi/europe/4819052.stm>.

- Kaufman, Robert R. and Alex Segura-Ubierno. (2001). Globalization, Domestic Politics, and Social Spending in Latin America: A Time-Series Cross-Section Analysis. *World Politics*. 53(4): 553-587.
- Knot, Anne Marie and Hart E. Posen. (2003). Does Competition Increase Innovation? New Evidence from Old Industries. Unpublished manuscript.
- Kreps, David M. (1990). Corporate Culture and Economic Theory. In James E. Alt and Kenneth A. Shepsle (eds.) *Perspectives on Positive Political Economy of Institutions and Decisions*. Cambridge: Cambridge University Press.
- Krugman, Paul. (1992). *The Age of Diminished Expectations*. Cambridge: MIT Press
- Krugman, Paul (1994). The Myth of Asia's Miracle: A Cautionary Fable. *Foreign Affairs*. 73(6): 62-78.
- Kuenzi, Michelle and Gina Lambricht. (2001). Party System Institutionalization in 30 African Countries. *Party Politics*. 7(4): 437-468.
- Lach, Saul and Mark Schankerman. (1989). Dynamics of R&D and Investment in the Scientific Sector. *The Journal of Political Economy*. 97(4): 880-904.
- Lake, David, and Matthew Baum. (2001). The Invisible Hand of Democracy: Political Control and the Provision of Public Services. *Comparative Political Studies*. 34(6): 622-650.
- Lall, Sanjaya and Carlo Pietrobelli. (2002). *Failing to Compete: Technology, Development, and Technology Systems in Africa*. Edward Elgar Publishing.
- Levitsky, Steven. (1998). Crisis, Party Adaptation, and Regime Stability in Argentina: The Case of Peronism, 1989-1995. *Party Politics*. 4(4): 445-470.
- Levitsky, Steven. (1999). Fujimori and Post-Party Politics in Peru. *Journal of Democracy*. 10(3): 78-92.
- Levitsky, Steven and Maxwell Cameron. (2003). Democracy without Parties? Political Parties and Regime Change in Fujimori's Peru. *Latin American Politics and Society* 45(3): 1-33.
- Lewis-Beck, Michael and Mary Stegmaier. (2000). Economic Determinants of Electoral Outcomes. *Annual Review of Political Science*. 3(June): 183-219.
- Lizzeri, Alessandro and Nicola Persico. (2001). The Provision of Public Goods Under Alternative Electoral Incentives. *The American Economic Review*. 91(1): 225-239.

- Loury, Glenn C. (1979). Market Structure and Innovation. *The Quarterly Journal of Economics*. 93(3): 395-410.
- Lucas, Robert E. Jr., (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*. 22(1): 3-42.
- Lucas, Robert E. Jr., (1993). Making a Miracle. *Econometrica*, 61: 251-272.
- MacKuen, Michael B., Robert S. Erikson, and James A. Stimson. (1992). Peasants or Bankers? The American Electorate and the U.S. Economy. *The American Political Science Review*. 86(3): 597-611.
- Mandel, Michael J. 2004 This Way to the Future. *Business Week*. October 11, 2004: 92-98.
- Mani, Sunil. (2002). *Government, Innovation and Technology Policy: An International Comparative Analysis*. Edward Elgar Publishing.
- Mainwaring, Scott. (1999). *Rethinking Party Systems in the Third Wave of Democratization: The Case of Brazil*. Stanford: Stanford University Press
- Mainwaring, Scott and Timothy R. Scully. (1995). *Building Democratic Institutions: Party Systems in Latin America*. Stanford: Stanford University Press.
- Mankiw, N.Gregory, David Romer, and David N. Weil (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics*, 107(2):407-437.
- March, James G. and Johan P. Olsen. (1984). The New Institutionalism: Organizational Factors in Political Life. *The American Political Science Review*. 78(3): 734-749.
- Marshall, Monty, Keith Jagers, and Ted Robert Gurr. (2004). *Polity IV Project: Political Regime Characteristics and Transitions, 1800-2003*.
- McMillan, Margaret S. and William A. Masters (2003). An African Growth Trap: Production Technology and the Time-Consistency of Agricultural Taxation, R&D and Investment. *Review of Development Economics*. 7(2): 179-191.
- Meltzer, Allan H. and Scott F. Richard. (1981). A Rational Theory of the Size of Government. *The Journal of Political Economy*. 89(5): 914-927.
- Metcalf, J. S. (1978). Innovation, Economic, and Government Policy. *Physics Technology*. 9:54-60.



- Mokyr, Joel. (1990). *The Lever of Riches: Technological Creativity and Economic Progress*. New York: Oxford University Press.
- Muthoo, Abhinay and Kenneth A. Shepsle. (2006). Information, Institutions, and Constitutional Arrangements. Unpublished manuscript.
- National Academy of Sciences, National Academy of Engineering, and Institute of Medicine of the National Academies. (2007). *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. National Academies Press.
- Nooruddin, Irfan. (2003). *Credible Constraints: Political Institutions and Growth-Rate Volatility*. Ph.D. Dissertation. University of Michigan.
- North, Douglas. C. (1981). *Structure and Change in Economic History*. New York: Norton.
- North, Douglass C. North. (1990). *Institutions, Institutional Change, and Economic Performance*. Cambridge: Cambridge University Press.
- Northpoth, Helmut (1996). Presidents and the Prospective Voter. *The Journal of Politics*. 58(3):776-792.
- Olson, Mancur (1993). Dictatorship, Democracy, and Development. *The American Political Science Review*. 87(3): 567-576.
- Olson, Mancur, Naveen Sarna, and Anand V. Swamy. (2000). Governance and Growth: A Simple Hypothesis Explaining Cross-country Differences in Productivity Growth. *Public Choice*. 102(3-4): 341 - 364:.
- Pack, Howard and E. Larry Westphal. (1986). Industrial Strategy and Technological Change: Theory versus Reality. *Journal of Development Economics*. 22(1): 87-128.
- Panbianco, Angelo. (1988). *Political Parties and Power*. Cambridge: Cambridge University Press.
- Papageorgiou, Christopher (2002). Technology Adoption, Human Capital, and Growth Theory. *Review of Development Economics*. 6: 351-368.
- Papageorgiou, Christopher (2003). Distinguishing Between the Effects of Primary and Post -primary Education on Economic Growth. *Review of Developmental Economics*. 7: 622-635.
- Parente, Stephen L. and Prescott, Edward C. (1994). Barriers to Technology Adoption and Development. *Journal of Political Economy*. 102(2): 298-321.

- Parente, Stephen L. and Edward C. Prescott. (2000). *Barriers to Riches*. Cambridge: MIT Press.
- Persson, Torsten, Gerard Roland, and Guido Tabellini. (2000). Comparative Politics and Public Finance. *Journal of Political Economy*. 108: 1121-1161
- Pinto, Pablo and Jeff Timmons. (2005). The Political Determinants of Economic Performance, Political Competition and the Sources of Growth. *Comparative Political Studies* 38(1): 26-50
- Prescott, Edward C. (1998). Lawrence R. Klein Lecture 1997: Needed: A Theory of Total Factor Productivity. *International Economic Review*. 39:525-551.
- Przeworski, Adam, Michael Alvarez, Jose Cheibub, and Fernando Limongi. (2000). *Democracy and Development: Political Regimes and Material Well-Being in the World, 1950-1990*. New York: Cambridge University Press
- Randall, Vicky and Lars Svåsand. (2002). Political Parties and Democratic Consolidation in Africa. *Democratization*. 9(53): 30-52.
- Ravenscraft, D. and F. M. Scherer. (1982). The Lag Structure of Returns to Research and Development. *Applied Economics*. 14(6): 603-620.
- Riots Erupt After French Protests. *BBC News Online*. March 19, 2006. Available at <http://news.bbc.co.uk/2/hi/europe/4821670.stm>.
- Rivera-Batiz, Francisco L. (2002). Democracy, Governance, and Economic Growth: Theory and Evidence. *Review of Development Economics*. 6(2):225-247.
- Roberts, Kenneth M. (1996). Economic Crisis and the Demise of the Legal Left in Peru. *Comparative Politics*. 29(1): 69-92.
- Roberts, Kenneth M. and Erik Wibbels. (1999). Party Systems and Electoral Volatility in Latin America: A Test of Economic, Institutional, and Structural Explanations. *American Political Science Review*. 93(3): 575-590.
- Romer, Paul (1986) Increasing Returns and Long-Run Growth. *The Journal of Political Economy*. 94(5): 1002-1037.
- Romer, Paul (1990a). Capital, Labor, and Productivity. *Brookings Papers on Economic Activity*. 1990: 337-367.
- Romer, Paul (1990b). Endogenous Technological Change. *The Journal of Political Economy*. 98(5): S71-S102.

- Rostow, W. W. (1975) *How it All Began: Origins of the Modern Economy*. New York: McGraw-Hill.
- Rouvinen, Petri. (2002). R&D Productivity Dynamics: Causality, Lags and 'Dry Holes'. *Journal of Applied Economics*. V(1): 123-156.
- Rudra, Nita and Stephan Haggard. (2005). Globalization, Democracy, and Effective Welfare Spending in the Developing World. *Comparative Political Studies*. 38(9): 1015-1049.
- Sartori, Giovanni. (1976). *Parties and Party Systems: A Framework for Analysis*. New York: Cambridge University Press.
- Schattschneider, E. E. (1942). *Party Government*. New York: Rinehardt.
- Schmookler, Jacob. (1966). *Invention and Economic Growth*. Cambridge: Harvard University Press.
- Schumpeter, Joseph A. (2002). *The Theory of Economic Development*. New Brunswick: Transaction Publishers.
- Senhadji, Abdelhak. (1999). Sources of Economic Growth: An Extensive Growth Accounting Exercise. IMF Working Paper. No. 99/77.
- Solow, Robert M. (1956). A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics*. 70: 65-94.
- Solow, Robert M. (1957). Technical Change and the Aggregate Production Function. *The Review of Economics and Statistics*. 39(3): 312-320.
- Solow, Robert M. (1988). Growth Theory and After. *The American Economic Review*. 78(3): 307-317.
- Soskice, David, Robert H. Bates, and David Epstein. (1992). Ambition and Constraint: The Stabilizing Role of Institutions. *Journal of Law, Economics & Organization*. 8(3): 547-560.
- Stasavage, David. (2005). Democracy and Education Spending in Africa. *American Journal of Political Science*. 49(2): 343-358.
- Stiroh, Kevin J. (2002). Information Technology and the U.S. Productivity Revival: What Do the Industry Data Say? *The American Economic Review*. 92(5): 1559-1576

Stokes, Susan. (1999). Political Parties and Democracy. *Annual Review of Political Science*, 2:243-67.

Stokes, Susan. (2001). Introduction: Public Opinion of Market Reforms a Framework. In Susan Stokes (ed.), *Public Support for Market Reforms in New Democracies*. New York: Cambridge University Press.

Weatherford, M . Stephen. (1992). Measuring Political Legitimacy. *The American Political Science Review*. 86(1): 149-166.

Whitten, Guy D. and Harold D. Palmer (1999). Cross-national analyses of economic voting. *Electoral Studies*, 18:49-67.

Young, Alwyn (1992). A Tale of Two Cities: Factor Accumulation and Technical Change in Hong Kong and Singapore. *Macroeconomics Annual 1992*. MIT University Press.

Young, Alwyn (1995). The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience. *The Quarterly Journal of Economics*. 110(3): 41-680.