Abstract

A new explanation of the origin of democracy is presented motivated by historical observations from ancient Athens. It is argued volatility in wealth across generations encouraged the elites to extend the franchise to nonelites. While being among the elite allows for the extraction of wealth from the nonelite, if there is a significant probability one's offspring will fall from the ranks of the elite, then the enfranchised may have the incentive to provide democracy. This improves an insurance for one's offspring. Furthermore, providing this protection allows in certain environments an individual to consume more in one's life.

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The Origin of Democracy in Athens

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> As a moneymaker, I [Cephalus] was sort of a mean between my grandfather and my father. For my grandfather, whose namesake I am, inherited pretty nearly as much substance as I now possess, and he increased it many times over. Lysanias, my father, used it to a point where it was still less than it is now. I am satisfied if I leave not less, but rather a bit more than I inherited, to my sons here (Plato, *The Republic*, Book I, line 220b).

1 Introduction

The puzzle of the origination of democracy and the extending of the franchise is an intriguing one. Why would those with the power to extract resources (money, land, labor, etc.) volunteer to share this power with those whom they may extract from? A full understanding of this question is crucial to appreciate the derivation of our modern democratic institutions and to assess the consequences and potential solutions to civil conflicts within countries today.

A number of explanations have been provided (which will subsequently be reviewed). The objective here is to provide another potential explanation for the origin of democracy. The motivating historical society is ancient Athens. In fact, it was the Athenians with the laws of Draco, the creation of democratic institutions of Solon, and the constitution of Cleisthenes that first introduced democracy to the Western world.[1] Evidence is presented of significant volatility in wealth levels across the generations of Athenian families. It is argued here that the provision of democracy can be explained

[1] One might also add the reforms to the Council of the Areopagus by Ephialtes, transfering many political powers from the council of predominantly wealthly, elderly elites to the *Ekklesia*, the assembly of all citizens, and the institution of pay for jury service and *Ekklesia* attendance initiated by Pericles to this list.

as a mechanism useful to both the nonelites of ancient Athenian society, but also by many elites who are interested in not only their own well-being, but also the well-being of their offspring.

A theoretical model is presented of an individual determining lifetime consumption. Increased consumption directly improves that individual's utility, but reduces the amount bequeathed to his offspring whom he cares about as illustrated in the opening quote. To an elite oligarchy is attractive since those in power are able to extract wealth from the nonelite to increase their wealth. Democracy, which provides decisionmaking power to those who would have been exploited, reduces the amount the elite are able to consume. Alternatively, to an elite democracy has the advantage of improving the quality of life of one's offspring if intergenerational shocks to wealth reduces his child's wealth to levels below elite status. Additionally, it is shown that democracy by providing this partial insurance to one's offspring allows for an elite of the society to consume higher amounts during one's life since he no longer needs to protect his offspring as much as what would be required in an oligarchy. The tools of stochastic dynamic programming are used to illustrate the conditions under which the benefits to democracy to the elite outweigh the benefits to oligarchy. Thus, intergenerational volatility in wealth provides another potential explanation for the origination of democracy.

This work contributes to the growing literature on the economic analysis of classical Greek institutions. Kyriazis (2009) and Kyriazis and Zouboulakis (2004) have investigated the public financing of the Athenian navy. Kaiser (2007) models the procedure used to contest a *liturgy* (tax payment responsibility). Bitros and Karayiannis (2008) and Karayiannis and Hatzis (2007)

investigate the role of social norms in entrepreneurship and the legal system respectively. Fleck and Hanssen (2006, 2009) contribute to the economic analysis of democracy (as will be reviewed later). The economic analysis of the legal system includes a formal model of the *timetos* procedure used to convict Socrates (McCannon, 2010b), screening in homicide trials in Athens (McCannon, 2010a), and the determination of jury size (McCannon, 2010c).

Section II discusses the literature on the extension of the franchise relating the work presented here to the others previously introduced. Section III provides evidence of the volatility of wealth across generations and ancient Greek reactions to this uncertainty. Section IV presents the theoretical model, while Section V derives the optimal consumption and bequests. Section VI, then, discusses the choice of providing democracy given the results presented and Section VII concludes.

2 The Provision of Democracy

The literature on the provision of democracy has provided a number of theoretical explanations. Acemoglu and Robinson (2000) argue that the extension of the franchise is a strategic decision to prevent social unrest. The poor can revolt and take possession of the resources of the elite. This revolution, though, is destructive. The elite may be interested in negotiating with the nonelite, but without the ability to commit to increased taxation such a compromise may be unsuccessful. Democracy provides the commitment necessary to eliminate desire for revolution. They identify the environments under which the franchise is extended to the poor of the society. Acemoglu and Robinson (2001) allow for both the nonelite to revolt and the elite to

mount a coup to eliminate a democracy. Thus, they are able to distinguish between a consolidated democracy and an unstable regime which oscillates between revolutions and coups. In their theoretical framework they identify the environments under which nondemocracy, a consolidated democracy, and society which continually switches regimes exist. In both frameworks the distribution of rich and poor is exogenously fixed and, therefore, they do not consider volatility in wealth and the possibility of switching status. Alternatively, those in power may have better information regarding the spoils of power than do the outside challenger. The offer attempting to co-opt the challenger serves as a signal. Dal Bó and Powell (2009) develop this idea and illustrate that conflict is more likely when income is low, the strength of the opposition is strong, and conflict is less destructive. In these arguments it is class conflict which leads to democracy.

Other theories of the origin of democracy look for conflict between those in power. Lizzeri and Persico (2003) argue that elites may wish to extend the franchise to steer politicians away from policies that serve only small constituents towards those with more diffuse benefits. Llavador and Oxby (2005) develop a theoretical model where the group of elite have conflicting interests. They look to disenfranchised groups for support for their preferred policies. Consequently, the search for support from the nonelites leads to both democratization and growth.

Alternatively, democracy may provide good incentives for the nonelite. The nonelite's response, i.e. additional investment or effort, may have positive spillovers for the elite of a society, which may compensate them for the loss of power. Jack and Lagunoff (2006a, 2006b) develop this point and de-

rive the environments in which the elite are motivated to voluntarily extend the franchise. Thus, there may be internal gains to democracy that provide the rationale for its provision, rather than external conflict.

The explanation for the origination of democracy in Athens as well as the nonprovision in other ancient Greek cities such as Sparta is addressed specifically by Fleck and Hanssen (2006). They argue that it is the agricultural output and terrain which determined the form of government in ancient Greece. The production of olives in Athens requires a significant amount of time. It takes at least eight to ten years from the time a sapling is planted for it to bear its first fruit (Foxhall, 2007). Furthermore, the hilly terrain makes monitoring difficult. Thus, the Athenian elite faced a moral hazard problem: how can the nonelites be provided the incentive to exert (unobservable) effort? The time inconsistency problem of being unable to commit not to extract the fruits of the *demos*' labor ("people's") lead to the provision of democracy. In Sparta, on the other hand, grain production does not require long-term investments and the flat plains allowed for monitoring and coercion. Thus, the Spartan elite need not provide democracy. Fleck and Hanssen (2006) build a theoretical model of the interaction between elites and nonelites who differ in their preferences for public and private goods to capture the role of democracy in dealing with the dual problems. Fleck and Hanssen (2009) provide a similar analysis to explain the rise of women's rights in Sparta. Again, legal rights provided women the incentive to properly manage the family estates and allowed for an improved allocation of labor in society.

It is not clear whether these explanations for the rise of democracy fully

explain the Athenian experience. Elements of each are prevalent in the society, but do not dominate throughout the *polis*. The two main democratic reforms in Athens did not occur due to a revolution (or the threat of one). While there is little surviving evidence, the installation of the constitution by Cleisthenes (510 B.C.), which among other things included (with full voting rights) all citizens in the legislative assembly referred to as the *Ekklesia*, was a peaceful reorganization of the power in Athens. Ephialtes pushed through a reform of the Council of the Areopagus (462 B.C.) transferring more power to the *demos*.[2] Previously the Council of the Areopagus, which was made up of elite citizens, had primary judicial control. With his reforms the determination of guilt and innocence and the imposing of sanctions were done by a representative body of citizens. In fact, the typical jury size was 500 (McCannon, 2010c). There may have been social unrest in the time of Solon's reforms in 594 B.C. Many of the poor had fallen into debt bondage, and this obligation was transferred to their offspring. Solon's reforms included debt forgiveness and the outlawing of debt bondage, but did not install most of the democratic institutions. Thus, as in Acemoglu and Robinson (2000) a compromise falling short of democracy was provided.

The theories of conflict among the elite has relevance to ancient Athens, but again do not fully explain the rise of democracy. Ephialtes' reforms clearly occurred under a situation of elite conflict. Those favoring the reforms, which included Pericles, were able to ostracize the leader of the opposition, Cimon. Ostracisms in Athens were banishments from the *polis* for ten years. With the opposing elites reduced in strength Ephialtes proceeded to

[2] A full history of the political reforms and institutions in ancient and classical Athens is not attempted here. One is encouraged to consult Rhodes (2006) as a source for details.

use the judicial system to remove the elites on the Council of the Areopagus. By transferring the power of the Council to the *demos* support for policy, specifically Pericles' policies of the 5th century, was obtained.[3] These reforms took place, though, after the franchise had already been extended and were simply a redistribution of the power amongst the citizens of the democracy. Thus, conflict amongst the elite fails to explain the origin of democracy.

Finally, the theories of internal sources of incentives to provide democracy have been applied specifically to Athens by Fleck and Hanssen (2006). As stated, their results rely on the prevalence of olive production in ancient Athens. The importance of olives and its causal relationship to the political organization of the society, though, can be called into question. Foxhall (2007) provides a detailed case study of olive production in ancient Greece. She argues that "there is little solid evidence for the large-scale specialized production of Attic olive oil or trade in it" (p.78). Olives were not a staple of the ancient Athenians. They were produced primarily by the wealthy because (1) labor needs were erratic and best done by slaveholders, (2) the storage of surplus can only be done by the elite, and (3) fragmented land holdings lead to the preponderance of mixed farming. The bulk of the population was engaged in subsistence agriculture. Olive crops are notoriously unreliable and unpredictable from year to year. They required significant and lumpy labor inputs. The mass production and widespread use of olives did not occur until the time of the Romans (Foxhall, 2007). Many Athenian citizens owned no land and most of those that did own land owned small parcels in which

[3]Such policies include restricting citizenship to those born of two citizens, pay for attending the *Ekklesia* and serving on the jury, the expansion of the Athenian empire (Delian League), the building of the Acropolis, and a trade embargo on Megara, among others.

necessary crops, such as grains, were grown. She argues that figs, which require much less time and labor and have a higher calorie content were likely the tree crops that the nonwealthy included to diversify their agricultural output. The wealthy were able to make the long-term investments to grow olives and along with food used the olives produced for lighting and personal cleaning and adornment. Olives served as a status symbol and were in short supply. Consequently, Foxhall (2007) is left to conclude that "the olive is not a causal agent in itself" (p.15). Therefore, while an important agricultural crop for Athenian society it seems dubious to claim that the commitment democracy provides to the nonelites was needed in ancient Athens to encourage the nonelites to exert effort over long periods of time in olive production. Thus, while class conflict, elite conflict, and the poor incentives of long-term investment decisions of the nonelite (i.e. olive cultivation) are valuable to understanding potential benefits to the origination of democracy in Athens, they seem only to play minor roles.

Interestingly, though, the olive as a representative output in the society may provide an insight into a primary motivation for democracy in Athens. Olives take twenty-five to thirty years until they reach full production (Foxhall, 2007). The use of surplus labor resources in activities such as olive cultivation increased the value of the land for future generations. Foxhall (2007) concludes that "a man plants [olives] aiming to feed his grandchildren" (p.248). Isiaos states, "my father planted [the patrimonial land] in trees and cultivated and made it double in value" (Isiaos 9, line 28). The issue of the inheritance of wealth, including the lands and its productive possibilities, is an important feature and is valued in Athenian society.

3 Volatility of Wealth

The objective of this work is to provide a new explanation for the origination of democracy; one that can explain, specifically, the rise of the institution in ancient Athens. The primary observation that motivates the theoretical results presented here is the empirical observations made by Davies (1981). By the classical period (478-322 B.C.) most democratic institutions had been implemented. The elite secured for themselves rights to the influential positions in the society, while much of the legislative and judicial power was shared with the *demos*. The burden of financing public goods fell on the richest families in the city. This class of elite was referred to as *leitourgountes* (Cohen, 1992). Each year families were selected to pay taxes for important public goods. A *liturgy* is when a wealthy family is designated to outfit a *triereme* for the Athenian navy. The designated taxpayer covered the supplies and salaries of the crew. During the fourth century men whose property was worth less than three talents were free from liturgical obligations. Of those who were not released from this obligation the 400 richest families were assigned to occasionally perform the *liturgy*. This number was reduced to 300 in the fourth century (Davies, 1981). This propertied class made up approximately 1-2% of the Athenian citizens and represents the top of the Athenian economic structure. Davies (1981) collected data on contributions made by *leitourgountes* over the period circa 600 B.C. to 300 B.C., which includes both the ancient and classical period. The data set consists of five generations of Athenian families.

He showed that there was significant volatility in this class of elites. In fact, only one family can be identified to be in the wealthy, elite class during

the entire period. Table 1 presents the distribution of families and their longevity in the class of elites (Davies, 1981, p.86).

Table 1: Wealth Volatility

# of generations in liturgical class	# of families	% of families
5	1	0.2%
4	5	1.2%
3	16	3.8%
2	44	10.4%
1	357	84.4%

Thus, for the overall sample most families spent one generation in the liturgical class, while only a small minority remained amongst the ranks of the elite for more than two generations (5.2%). To elaborate, for the generation who were socially/politically active in the years 366-333 B.C. (the fourth generation of the sample) 117 families can be traced. Table 2 presents the distribution of this group of families across the number of previous generations who were also of an elite status.

Table 2: *Leitourgountes* (336-333 B.C.)

# of generations in liturgical class	# of families	% of families
4	1	0.9%
3	5	4.3%
2	20	17.1%
1	91	77.8%

A number of explanations can be given for this dramatic volatility in elite status over the generations in ancient and classical Athens. Davies (1981)

provides two causes. First, family disappearance through, for example, childlessness can explain the departure of a family from the list. Second, economic shocks to the family's wealth can occur. Examples of economic shocks he lists include:

- overseas landholding, which was common for Athenian elites as they gained military victory, could be lost (due to a local revolt, for example)
- landed property normally leased out to tenants might cease to be a source of revenue (with population decreases, for example)
- revenue-earning slaves may revolt (exodus out of Athens)
- mine-exploitation was common for Athenian elites and these mines may lose their productivity or be lost (e.g. war or earthquake)
- products of a particular workshop (run by an elite's slaves) may fail to be successful
- poor moneylending practices and uninsured banking deposits may falter
- political conflict often lead to large fines
- special taxation and liturgies may drain a family's resources
- inappropriate lavishness by a family member.

Millett (1991) uses this evidence to argue that the high degree of impermanence among families making up the liturgical class may be explained by the practical problems involved in repaying nonproductive loans (e.g. dowries

and funerals) out of inadequate estates. He further argues that the democracy of Athens allowed for a man of limited wealth to continue to play an active role in the political process.

Evidence of Athenians' views on the instability of wealth arises in preserved writings. The quote from *The Republic* previously given illustrates the desire of the rich man, Cephalus, to maintain the wealth level provided by his ancestors so that his offspring can enjoy the same status he enjoyed. As another example, Lysias in *Against Epicrates and His Fellow Envoys* argues against the men pointing out that they advanced themselves from poverty to wealth while others were faltering. Previously, he argued, they were unable to support themselves, but now they contribute to the special levies producing dramas and dwelling in great houses (Lysias, 27, lines 9-10). Thus, anxiety from the fear of falling upon hard times resulted in backlash against those who were able to improve their status to those of the elite.

In the Athenian society status was defined based not on family bloodlines and reputation, but on wealth level obtained. For example, in Solon's laws of 594 four levels of citizenship were created. Each level was defined by the amount of grain produced in a year, which is obtained using land and slave labor. Access to public office and privileges were dependent on these classes. Thus, wealth was the determinant of elite status.

Therefore, the thesis of the work presented here is that in the ancient period of Athens the elite experienced significant volatility in wealth. While a man might enjoy the privileges and gains associated with being amongst the elites in a generation there was a significant probability that his offspring would not experience the same quality of life. Status in Athens was dependent

on the wealth level obtained and the output produced from that wealth. Such a man is interested in both his level of consumption during his lifetime along with the quality of life of his offspring. Democracy provided an insurance against the unfortunate state. This allows such a man to no longer have to self-insure his offspring by building up his wealth level and, consequently, allows for more consumption. I now turn to a formal model illustrating this effect of democracy on consumption.

4 Model

Let time be discrete and indexed $t = 0, 1, 2, ...$ An agent lives for one time period and at the end of the time period has one offspring. The offspring is identical to the parent in that it has the same preferences. Let $c_t \in \Re$ denote the consumption by the agent in period t. This may include private good consumption, public good consumption, or the consumption of honor, respect, social standing, etc. generated from family, friends, neighbors, or the community. Since the agent lives for only one period this is best thought of as lifetime consumption. Let $u : \Re \to \Re$ be the utility function. Thus, $u(c_t)$ is the utility derived from the consumption of c_t. Again, this is lifetime utility for the agent and assume u does not depend on t, or rather the offspring has the same utility function as the parent. The agent is altruistic in that he receives a benefit from the well-being of his offspring. The agent discounts his child's well-being at a constant rate of $\delta \in (0, 1)$. Consequently, the total utility derived by an agent is comprised of the utility received during his life and the discounted sum of offspring's well-being. Define $U(k_t)$ as the total

utility where $k_t = \{c_\tau\}_{\tau=t,\ldots,\infty}$. Hence, $U(k_t) = u(c_t) + \delta U(k_{t+1})$, or rather,

$$U(k_t) = \sum_{\tau=t}^{\infty} \delta^{\tau-t} u(c_\tau). \tag{1}$$

Define an agent's wealth as $W_t \in R$. Wealth can, obviously, be thought of as monetary resources available to the agent, but may also represent land, buildings, and slaves owned by the agent. The monetary resources, slaves, and physical capital allow the agent to increase his and potentially his offspring's consumption. Alternatively, one may think of W_t as social capital possessed that can be used by the agent to improve his utility, which can be expanded upon or denigrated by an individual.

The evolution of wealth is of primary interest here. First, the use of current wealth to improve current consumption diminishes the amount of wealth bequeathed to the agent's offspring. Define $\beta \geq 0$ as the portion of consumption that diminishes wealth. Thus, if $\beta = 1$, then the consumption fully deteriorates wealth. For example, land and slaves can be sold to finance an individual's expenditures. Alternatively, if $\beta = 0$, then current consumption has no effect on the level of wealth. For example, one may only consume the fruits of the agricultural land. More generally, consider $\beta \in (0, 1]$.

Second, wealth cannot only be used to consume, but may also be productive and grow. Land produces harvests. Transfers from external sources, such as tribute from subject *poleis*, may improve consumption. Similarly, exogenous factors may deteriorate the value of an individual's wealth. In peaceful times without war or disease an individual's wealth may grow: livestock herds reproduce and grow, fruits trees which take a substantial time until they produce a harvest may be planted, and new land can be cleared or irrigated. With war, outlawry, or other negative exogenous shocks wealth

may be lost. To keep the results general, then, consider shocks to both the wealth level and the growth rate of wealth. Define υ_t as the exogenous increase in the wealth level where in each period υ is drawn, independently, from the distribution function $F : [\underline{\upsilon}, \overline{\upsilon}] \rightarrow [0,1]$ where $\underline{\upsilon} < 0 < \overline{\upsilon} < \infty$ with a mean $\widehat{\upsilon} > 0$. Thus, $F(\upsilon)$ is the probability the increase to wealth is less than υ. Similarly, define γ_t as the exogenous growth rate of wealth where in each period γ is drawn, independently, from the distribution function $G : \left[\underline{\gamma}, \overline{\gamma}\right] \rightarrow [0,1]$. Assume $-1 < \underline{\gamma} < 0 < \overline{\gamma} < \infty$ with a mean $\widehat{\gamma} > 0$. Thus, $G(\gamma)$ is the probability the growth rate of wealth is less than γ.

Third, taxation may transfer wealth between individuals in the society. Since the objective is to model the provision of democracy, fiscal policy without democracy and with democracy need to be defined. It is assumed that each individual prefers both private good consumption and public good consumption. The absolute wealth level of the elite citizens is greater and therefore, their optimal consumption bundle includes more public goods being provided by the government, regardless of the form of government used. Assume that without democracy the elites are able to extract more taxes from the poor to be used to provide public goods than with a democracy. While the poor benefit from the public good, the net effect of the extraction is to reduce their wealth level. The elite who benefit substantially gain from the taxation. Hence, to model this phenomenon a threshold wealth level, Ω, distinguishes an elite from a non-elite individual. If $W_t \geq \Omega$, then the individual is a member of the elite who benefits from the taxation, while if $W_t < \Omega$, then he is not. The amount transferred is a rate λ^o if an oligarchy is in control and a rate λ^d if a democracy has been created. More specifically,

under a political regime $g \in \{o, d\}$ if W_t is the wealth to transferred from a parent to an offspring to be used in time t, then the offspring experiences a wealth $\lambda^g W_t$ where $\lambda^g = 1 + \mu^g$ if $W_t \geq \Omega$ and $\lambda^g = 1 - \mu^g$ if $W_t < \Omega$. Assume $\mu^o > \mu^d > 0$ so that $\lambda^o > \lambda^d > 1$ for an elite and $\lambda^o < \lambda^d < 1$ for a nonelite.

Combining the three effects on the creation and use of wealth the following law of motion results

$$W_{t+1} = (1 + \gamma_t) \left[\lambda^g W_t + \upsilon_t - \beta c_t\right]. \tag{2}$$

This is subject to the restriction that

$$\begin{aligned} \beta c_t &\leq \lambda^g W_t + \upsilon_t & (3) \\ \lambda^g W_t &= \begin{cases} (1 + \mu^g) W_t & \text{if } W_t \geq \Omega \\ (1 - \mu^g) W_t & \text{if } W_t < \Omega \end{cases}. & (4) \end{aligned}$$

The restriction (3) is equivalent to assuming that there is no borrowing or saving available. Specifically, an individual may freely use financial markets during one's life, but there is no intergenerational borrowing and lending. Any loans taken out must be fully collateralized.

Consequently, an individual's problem is to solve

$$\max_k \quad U(k)$$

subject to

$$W_{t+1} = (1 + \gamma_t) \left[\lambda^g W_t + \upsilon - \beta c_t\right]$$

$$\beta c_t \leq \lambda^g W_t + \pi$$

$$\text{where} \qquad \lambda^g = \begin{cases} 1+\mu^g & \text{if } W_t \geq \Omega \\ 1-\mu^g & \text{if } W_t < \Omega \end{cases}$$

$$k = \{c_t\}_{t=0}^{\infty}$$

$$\text{and } U(k) = \sum_{\tau=t}^{\infty} \delta^{\tau-t} u(c_\tau).$$

5 Optimal Consumption & Bequests

Consider, first, the model where there are no shocks to wealth. This is done to assess the impact of the transfers from the *demos* to the elite on the optimal mix of consumption and savings in an individual's lifetime and on the steady-state levels of consumption and wealth.

5.1 Without Shocks

Let $V(\lambda_t^g W_t)$ denote the maximum, discounted utility that can be received by the agent when his inherited wealth level is W_t and the tax he experiences is λ_t^g. Furthermore, suppose the growth rate of wealth is known and is equal to $\sigma > 0$, $Prob(\gamma = \sigma) = 1$. Additionally, suppose the level adjustment to wealth is known and is equal to $\pi > 0$, $Prob(\upsilon = \pi) = 1$. Hence,

$$V(\lambda_t^g W_t) = \max_{c_t} \left\{ u(c_t) + \delta V(\lambda_{t+1}^g W_{t+1}) \right\}. \tag{5}$$

Since $W_{t+1} = (1+\sigma)(\lambda_t^g W_t + \pi - \beta c_t)$ (5) can be rewritten as

$$V(\lambda_t^g W_t) = u(c_t) + \delta V(\lambda_{t+1}^g (1+\sigma)(\lambda_t^g W_t + \pi - \beta c_t)). \tag{6}$$

To derive an explicit solution to the model assume $u(c) = \ln c$. Furthermore, suppose the value function takes the form $V(W) = \theta_0 \ln(\lambda^g W + \pi) + \theta_1$.[4]

[4]Of course, this is a guess at the functional form of the value function. It will be justified that this is a valid form.

Consequently, the optimal consumption level in period t, c_t^*, solves

$$\frac{1}{c_t^*} = \frac{\beta\delta\theta_0}{\lambda_t^g W_t + \pi - \beta c_t^*},$$

which simplifies to

$$\frac{\lambda_t^g W_t + \pi}{\beta\left(1 + \delta\theta_0\right)} = c_t^*. \tag{7}$$

It is straightforward to verify by inserting (7) into (6) and using the functional forms given that

$$\theta_0 = \frac{1}{1-\delta}$$

and

$$\theta_1 = \frac{1}{1-\delta}\left(\frac{\delta}{1-\delta}\ln\left(\delta\left(1+\sigma\right)\right) - \ln\frac{\beta}{1-\delta}\right).$$

Hence, the optimal consumption is

$$c_t^* = \frac{\left(1-\delta\right)\left(\lambda_t^g W_t + \pi\right)}{\beta}. \tag{8}$$

Additionally, the steady state level of wealth and consumption can be derived. From (2) and (8) the law of motion for wealth reduces to

$$W_{t+1} = \left(1+\sigma\right)\delta\left(\lambda_t^g W_t + \pi\right).$$

Define $\overline{W}$ as the steady-state wealth level, or rather, the level where $W_{t+1} = W_t \equiv \overline{W}$. This simplifies to

$$\overline{W} = \frac{\left(1+\sigma\right)\delta\pi}{1 - \left(1+\sigma\right)\delta\lambda^g} \tag{9}$$

so long as $\left(1+\sigma\right)\delta\lambda_t^g < 1$. At this steady-state wealth level it follows from (8) that the steady-state level of consumption, $\overline{c}$, is

$$\overline{c} = \frac{\left(1-\delta\right)\pi}{\beta\left(1 - \left(1+\sigma\right)\delta\lambda^g\right)}. \tag{10}$$

Figure 1: Consumption Without Transfers or Shocks

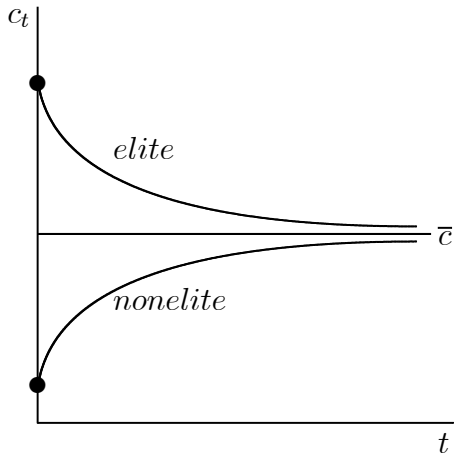
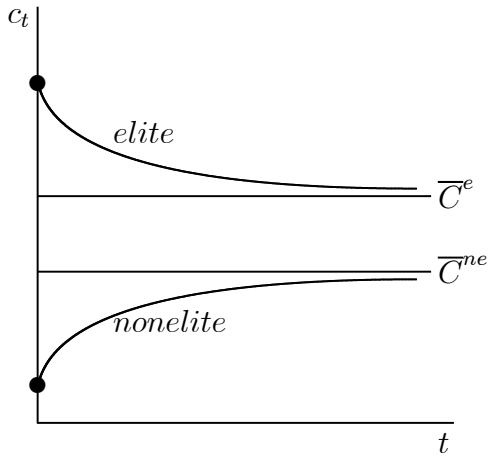


Figure 1 depicts the evolution of consumption over the generations for an individual with a high initial wealth and an individual with a low initial wealth when there is no transfers; $\lambda^g = 1$ for all wealth levels.

This result provides some interesting conclusions. First, regardless of the initial wealth level and, specifically, whether the individual is an elite or a nonelite in society, without transfers the wealth inequality reduces over the generations so that in the steady state all individuals have and consume an equal amount. Both the optimal consumption and the steady-state consumption decrease as the weight an individual puts on his offspring's well-being, δ, increases. Thus, more concern about one's offspring leads to more intertemporal savings. Similarly, both decrease as β, the proportion of consumption that deteriorates wealth, increases.

An important observation of the previous analysis is that if there are no transfers from the nonelites to the elites, then the steady-state wealth

Figure 2: Consumption With Transfers, No Shocks



level and consumption level are the same for all individuals. Instead, as can be seen in (9) and (10) a transfer has an impact on the outcome in this framework. Suppose, then, that $1 > \mu^o > \mu^d > 0$. It follows from (10) that the steady-state level of consumption for the elites, $\overline{c}^e$, is higher than the level for the nonelites, $\overline{c}^{ne}$. Figure 2 depicts the evolution of consumption for an elite and a nonelite individual.

To make sense of the analysis it must be that the wealth threshold differentiating the elite and nonelite individuals is between the steady-state wealth levels of the two groups, $\overline{W}^n > \Omega > \overline{W}^{ne}$. If not, then in the long run all individuals would be elites or all would be nonelites. Also, notice that the steady-state wealth level is independent of the threshold used. The elite do not necessarily improve their consumption by making the requirements to be part of the elite more difficult. Increasing Ω to be closer to $\overline{W}^n$ acts simply to decrease the number of families that are in the ranks of the elite.

Transfers insert a wedge between the steady-state levels of consumption and wealth. Democracy decreases the size of this wedge reducing the well-being of the elite and improving the well-being of the nonelite. It is clear, then, that the demos is interested in democracy, but it is yet unclear why the elite would be interested in providing this power.

5.2 With Shocks

If there is a positive probability that an individual's offspring changes status, either dropping from the elite to the nonelite or rising from the nonelite to the elite, then optimal consumption may depend on both current status and the probability of one's offspring experience such a shift. Define $V^e(W)$ as the maximum, expected, discounted value to being an elite if wealth is W. Similarly, define $V^{ne}(W)$ as the maximum, expected, discounted value to being an nonelite when wealth is W. It follows that

$$V(W) = \begin{cases} V^e(W) & \text{if } W \geq \Omega \\ V^{ne}(W) & \text{if } W < \Omega \end{cases}.$$

Suppose the realization, υ, is determined by the cumulative distribution function $F(\upsilon)$ as previously described, while the growth rate is known, $Prob(\gamma = \sigma) = 1$. Define $\widetilde{\upsilon}$ as the value of υ that sets $W_{t+1} = \Omega$. It follows from (2) that

$$\widetilde{\upsilon} = \frac{\Omega}{1+\sigma} - \lambda_g W_t + \beta c_t. \tag{11}$$

The threshold $\widetilde{\upsilon}$ may be either positive or negative depending on one's wealth level and current consumption. Hence, if $\upsilon_t > \widetilde{\upsilon}$, then one's offspring will be a member of the elite. Consequently, $F(\widetilde{\upsilon})$ is the probability the offspring

will not be an elite, while $1 - F(\widetilde{v})$ is the probability he will be one. Thus,

$$V(W_t) = \max_{c_t} \left\{ u(c_t) + \delta \left[\int_{v=\underline{v}}^{\widetilde{v}} V^{ne}(W_{t+1}) + \int_{v=\widetilde{v}}^{\overline{v}} V^{e}(W_{t+1}) \right] \right\} \tag{12}$$

The differentiation of (12) is not instructive and is in the Appendix. The optimal consumption is the c_t^* that solves

$$\frac{1}{c_t^*} = A(W_t, \widetilde{v}^*) f(\widetilde{v}^*) + BF(\widetilde{v}^*) + C[1 - F(\widetilde{v}^*)] \tag{13}$$

where $\widetilde{v}^*$ is derived from (11) with $c_t = c_t^*$. As stated, the derivation of $A(W_t, \widetilde{v}^*)$, B, and C are given in the Appendix. Intuitively, though, $A(W_t, \widetilde{v}^*)$ captures the change in the expected value for the marginal agents whose status switches, B is the marginal cost of additional consumption on the agent's offspring's lifetime utility if he falls out of the ranks of the elites, and C is the marginal cost if he remains an elite. If $\mu^g = 0$, so that there are no transfers, then $B = C$.

What effect does a change in the size of the transfer, as in a shift from oligarchy to democracy, have on the optimal amount of consumption? An increase in the transfer from the nonelite to the elite increases the marginal cost (lost utility to one's offspring) if his heir falls to the status of a nonelite, but decreases the marginal cost if his offspring remains an elite (these derivations are given in the Appendix). As a consequence, two potential scenarios can arise if a society transitions from an oligarchy to a democracy. First, the decrease in μ^g, from μ^o to μ^d, may decrease an elite's consumption, c_t^*. An individual of an elite status extracts less from the nonelite. This leaves less to consume and less to be bequeathed to one's offspring. This decrease leads to a diminished steady-state level of wealth, as was shown in Section 6.1 when there is no uncertainty, and a decrease in the steady-state level of

consumption. Alternatively, it is possible that the decreased transfer leads to more consumption by an elite. Democracy improves the quality of life of the nonelite and, consequently, provides protection to his offspring if they happen to fall in rank. In other words, democracy provides an insurance to one's children. As a result, the agent does not need to self-insure as much against this unfortunate state and, consequently, expands his lifetime consumption. Thus, the extension of the franchise may increase an elite's consumption.

This result is proven using a few simplifying assumptions. First, assume for values of υ near υ^* that $F(\upsilon)$ is relatively flat. Specifically, assume $f(\upsilon) \approx 0$ for $\upsilon \in [\upsilon_L, \upsilon_H]$ where υ^* for both $\mu^g = \mu^o$ and $\mu^g = \mu^d$ are within the interval.[5] Second, assume the probability of becoming a nonelite in the next period is less than $\frac{1}{2}$ for all elites, or rather, $F(\upsilon^*) < \frac{1}{2}$ even if $\mu \approx 0$. Finally, a threshold value of μ^g, denoted $\widetilde{\mu}$, differentiates the environments where the two scenarios exist and is derived in the Appendix.

Proposition 1 *If the transfers from the nonelite to the elite are not too severe, $\mu^o < \widetilde{\mu}$, then the optimal consumption, c_t^*, for an elite is greater under democracy than under oligarchy.*

The proof of the proposition is in the Appendix. The result requires that the transfers are not too great. If those in power extract large amounts of resources from the powerless, then their steady-state level of consumption is high and the steady-state level of consumption of the nonelites is low. Consequently, there would be little chance that their offspring would experience a shock to the family's wealth large enough to drop him from the high status. If the transfers under oligarchy are not so great, then the potential to

[5] This corresponds to a range of wealth levels for an elite, $[W_L, W_H]$.

become a member of the unrepresented *demos* is not that small. The following corollary describes the influences on the magnitude of the increase in consumption.

Corollary 1 *If $\mu^o < \tilde{\mu}$, then the increase in c_t^* is greater if the weight placed on the offspring's well-being (δ) is greater and if the rate at which consumption deteriorates wealth (β) is greater.*

Again, the proof is in the Appendix. The intuition of the results is rather straightforward. The marginal cost of consumption is greater if the value put on the offspring is greater and if the deterioration of consumption is greater. This higher marginal cost leads to a lower level of optimal consumption. The insurance provided for one's offspring allows for an even greater increase in consumption.

6 The Choice to Provide Democracy

Given the previous results would the elite be interested in extending the franchise? Providing democracy increases current consumption even when transfers from the nonelite decrease. Thus, steady-state consumption decreases, which lowers the quality of life of one's offspring if they remain within the class of elites. Alternatively, steady-state consumption increases if the offspring falls to the ranks of the nonelite. Each elite faces a tradeoff when considering whether or not to support the implementation of a democracy. What affects the balance between these two tradeoffs?

The elites with lower levels of wealth, or rather, those closer to the threshold level of wealth, are those who benefit the most from the provision of

democracy. First, since they consume less the marginal utility generated from additional consumption is greater and, therefore, democracy has a bigger impact on their lifetime utility. Second, the elite with lower levels of wealth face a higher probability that their offspring will not be an elite. Thus, the expected value of his heir's discounted utility is greater. Consequently, the elite with the lowest levels of wealth will be the one's most likely in favor of the switch to democracy.

Whether or not democracy is provided depends on the mechanism used to make such a decision. What is interesting to note is that the richest of the elite, even if they are currently uninterested in democracy, converge over time towards the same steady-state level of consumption and wealth as the other elites. Thus, if an elite with a wealth level at the steady state prefers a democracy over an oligarchy, then even if unanimous consent is required to extend the franchise or even if in the current period not enough elites are interested in democracy, then there exists a future generation/time period in which (near) unanimous consent of all elites to institute democracy will be reached. If at the steady-state wealth level an elite prefers the oligarchy, then unanimous consent will not be reached.

A few points regarding the model need pointing out. First, the model assumes that the wealth level required to be an elite is exogenous. Thus, the model is better thought of as one where shocks to wealth are idiosyncratic rather than aggregate shocks. With idiosyncratic shocks the wealth level required to be an elite can remain fixed while families oscillate above and below the threshold. Furthermore, the optimal consumption plan derived in the previous section assumes that the current political regime is perma-

nent. Therefore, the decision to implement democracy is a one-time-only, irreversible decision. As Acemoglu and Robinson (2001) illustrate the ability for the elite to stage a coup to remove the democracy has important implications on the decision to provide it in the first place. One may think of the exogenous shocks to wealth as capturing the possibility of revolutions and coups in the future destroying one's wealth.

7 Conclusion

The objective of the work presented here is to provide another explanation for the origination of democracy. The historical emphasis is on the creation of democracy in ancient Athens. A number of cleaver, well-reasoned theories exist for the extension of the franchise, but it is unclear whether they fully explain the initial creation of democracy. Given the evidence presented of significant volatility in wealth across the generations a model is presented where an elite faces a tradeoff when determining his optimal lifetime consumption: consumption in his lifetime improves his well-being but reduces the amount he can bequeath to his heir (whom he cares about). With exogenous shocks to this transfer of wealth the possibility exists that his offspring will fall from the ranks of the elite. Thus, increased consumption also increases the probability of the unfortunate state befalling his offspring. Under an oligarchic regime the elite extract more than under a democracy and, hence, democracy provides insurance for one's heir. It is shown that there exist environments under which an elite's consumption is higher with this insurance and would prefer democracy to oligarchy. Thus, in addition to class conflict, conflict between the elite, and internal incentive motivations for democracy, the ex-

tension of the franchise can be motivated by insurance across the generations.

In the model presented democracy may not be implemented immediately if there exists a blocking coalition of elite with high levels of wealth. Even in such a case it may be that over time the elite of future generations may become interested in such a choice. This "eventual enfranchisement" arises since the elite's wealth and consumption levels converge to the steady state as the generations elapse.

Why the theory presented focuses on explaining the origin of democracy in Athens one would be remiss not to attempt to explain the nonprovision of it in the other Greek *poleis*. Unfortunately, little evidence exists of the economic structure and political organization of others. Sparta was organized into a dyarchy with two kings, one from each of the two prominent families and a council of elite. They transformed their society to actively suppress the nonelite *helots* and *perioikoi*. Hence, they were able to ensure a steady supply of consumption goods and elite status. Mechanisms, then, could potentially be employed to stabilize wealth while maintaining nondemocracy. There were no formal insurance markets in ancient Greece, but it is unclear why the Athenian elite were unable or unwilling to develop an alternative mechanism to protect their offspring.

The framework presented can be extended upon. A formal voting game can be included in the analysis to address how the mechanism used by the elite to determine the extension of the franchise affects its success. Furthermore, this voting mechanism could be formally modeled in the consumption-bequest model to more thoroughly develop the origination of democracy. Finally, the transfer from the nonelite to the elite and the threshold differen-

tiating the two classes are taken as exogenous. One may want to investigate how the manipulation of these two variables by the elite affect the provision of democracy. This, though, is left for future consideration.

8 Appendix

The first objective of the Appendix is to derive the optimal consumption for an individual in the presence of exogenous shocks to wealth.

An individual of status $s \in \{e, ne\}$ has a Bellman Equation of

$$V^s\left(\lambda_t^g W_t\right) = \max_{c_t}\left\{u\left(c_t\right) + \delta\left[\int_{\upsilon=\underline{\upsilon}}^{\widetilde{\upsilon}} V^{ne}\left(\lambda_{t+1}^g W_{t+1}\right) + \int_{\upsilon=\widetilde{\upsilon}}^{\overline{\upsilon}} V^{e}\left(\lambda_{t+1}^g W_{t+1}\right)\right]\right\}.$$

Using the verified functional form for V this is equivalent to

$$= \max_{c_t}\left\{\ln c_t + \delta\int_{\underline{\upsilon}}^{\widetilde{\upsilon}}\left[\theta_0 \ln\left(\lambda_{t+1}^g W_{t+1}\right) + \theta_1\right] dF\left(\upsilon\right) + \delta\int_{\widetilde{\upsilon}}^{\overline{\upsilon}}\left[\theta_0 \ln\left(\lambda_{t+1}^g W_{t+1}\right) + \theta_1\right] dF\left(\upsilon\right)\right\}.$$

Inserting the law of motion for wealth, an individual is interested in selecting the c_t to maximize

$$\begin{aligned} &\ln c_t \\ &+\delta\int_{\underline{\upsilon}}^{\widetilde{\upsilon}}\left[\theta_0 \ln\left(\left(1-\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t + \upsilon - \beta c_t\right]\right) + \theta_1\right] dF\left(\upsilon\right) \\ &+\delta\int_{\widetilde{\upsilon}}^{\overline{\upsilon}}\left[\theta_0 \ln\left(\left(1+\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t + \upsilon - \beta c_t\right]\right) + \theta_1\right] dF\left(\upsilon\right). \end{aligned} \tag{A1}$$

To differentiate this consider, first, the first integral.

$$\begin{aligned} &\frac{d}{dc}\left(\delta\int_{\underline{\upsilon}}^{\widetilde{\upsilon}}\left[\theta_0 \ln\left(\left(1-\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t + \upsilon - \beta c_t\right]\right) + \theta_1\right] f\left(\upsilon\right) d\upsilon\right) \\ = &\frac{d}{dc}\left(\delta\int_{\underline{\upsilon}}^{\widetilde{\upsilon}}\left[\theta_0 \ln\left(\left(1-\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t + \upsilon - \beta c_t\right]\right) + \theta_1\right] d\upsilon \int_{\underline{\upsilon}}^{\widetilde{\upsilon}} f\left(\upsilon\right) d\upsilon\right) \\ = &\frac{d}{dc}\left(F\left(\widetilde{\upsilon}\right)\delta\int_{\underline{\upsilon}}^{\widetilde{\upsilon}}\left[\theta_0 \ln\left(1-\mu^g\right)\left(\left(1+\sigma\right)\left[\lambda_t^g W_t + \upsilon - \beta c_t\right]\right) + \theta_1\right] d\upsilon\right) \end{aligned}$$

$$
\begin{aligned}
= \; & f(\widetilde{\upsilon})\frac{d\widetilde{\upsilon}}{dc}\delta\int_{\underline{\upsilon}}^{\widetilde{\upsilon}}\left[\theta_0\ln\left(\left(1-\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t+\upsilon-\beta c_t\right]\right)+\theta_1\right]d\upsilon \\
& +F(\widetilde{\upsilon})\,\delta\frac{\theta_0\left[\theta_0\ln\left(\left(1-\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t+\widetilde{\upsilon}-\beta c_t\right]\right)+\theta_1\right]}{\left(1-\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t+\widetilde{\upsilon}-\beta c_t\right]}\left(-\left(1-\mu^g\right)\left(1+\sigma\right)\beta\right).
\end{aligned}
$$

First, $\frac{d\widetilde{\upsilon}}{dc}=\beta$. Also, notice from (11) that the value of $\widetilde{\upsilon}$ depends on the status of the individual. Denote $\widetilde{\upsilon}^e$ as the value in which (11) holds when the individual's status is e, while $\widetilde{\upsilon}^{ne}$ is the value when the status is ne. It follows that $\widetilde{\upsilon}^{ne}>\widetilde{\upsilon}^e$. Hence, for an individual of status s this simplifies to

$$
\begin{aligned}
= \; & f(\widetilde{\upsilon}^s)\,\beta\delta\int_{\underline{\upsilon}}^{\widetilde{\upsilon}}\left[\theta_0\ln\left(\left(1-\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t+\upsilon-\beta c_t\right]\right)+\theta_1\right]d\upsilon \quad \text{(A2)} \\
& -F(\widetilde{\upsilon}^s)\,\frac{\theta_0\beta\delta\left[\theta_0\ln\left(\left(1-\mu^g\right)\Omega\right)+\theta_1\right]}{\Omega}
\end{aligned}
$$

Now consider the second integral in (A1).

$$
\begin{aligned}
& \frac{d}{dc}\left(\delta\int_{\widetilde{\upsilon}}^{\overline{\upsilon}}\left[\theta_0\ln\left(\left(1+\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t+\upsilon-\beta c_t\right]\right)+\theta_1\right]f(\upsilon)\,d\upsilon\right) \\
= \; & \frac{d}{dc}\left(\delta\int_{\widetilde{\upsilon}}^{\overline{\upsilon}}\left[\theta_0\ln\left(\left(1+\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t+\upsilon-\beta c_t\right]\right)+\theta_1\right]d\upsilon\int_{\widetilde{\upsilon}}^{\overline{\upsilon}}f(\upsilon)\,d\upsilon\right) \\
= \; & \frac{d}{dc}\left(\left[1-F(\widetilde{\upsilon})\right]\delta\int_{\widetilde{\upsilon}}^{\overline{\upsilon}}\left[\theta_0\ln\left(\left(1+\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t+\upsilon-\beta c_t\right]\right)+\theta_1\right]d\upsilon\right) \\
= \; & -f(\widetilde{\upsilon})\frac{d\widetilde{\upsilon}}{dc}\delta\int_{\widetilde{\upsilon}}^{\overline{\upsilon}}\left[\theta_0\ln\left(\left(1+\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t+\upsilon-\beta c_t\right]\right)+\theta_1\right]d\upsilon \\
& +\left[1-F(\widetilde{\upsilon})\right]\delta\frac{\theta_0\left[\theta_0\ln\left(\left(1+\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t+\widetilde{\upsilon}-\beta c_t\right]\right)+\theta_1\right]}{\left(1+\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t+\widetilde{\upsilon}-\beta c_t\right]}\left(-\left(1+\mu^g\right)\left(1+\sigma\right)\beta\right).
\end{aligned}
$$

Again, using the value of $\widetilde{\upsilon}^s$ from (11) this reduces to

$$
\begin{aligned}
& -f(\widetilde{\upsilon})\,\beta\delta\int_{\widetilde{\upsilon}}^{\overline{\upsilon}}\left[\theta_0\ln\left(\left(1+\mu^g\right)\left(1+\sigma\right)\left[\lambda_t^g W_t+\upsilon-\beta c_t\right]\right)+\theta_1\right]d\upsilon \quad \text{(A3)} \\
& -\left[1-F(\widetilde{\upsilon})\right]\frac{\theta_0\beta\delta\left[\theta_0\ln\left(\left(1+\mu^g\right)\left(1+\sigma\right)\Omega\right)+\theta_1\right]}{\Omega}.
\end{aligned}
$$

Using (A2) and (A3) the derivative of (A1) is

$$\begin{aligned}
&\frac{1}{c_t} + f(\widetilde{\upsilon})\,\beta\delta \int_{\underline{\upsilon}}^{\widetilde{\upsilon}} \left[\theta_0 \ln\left(\left(1-\mu^g\right)(1+\sigma)\left[\lambda_t^g W_t + \upsilon - \beta c_t\right]\right) + \theta_1\right] d\upsilon \\
&-F(\widetilde{\upsilon})\,\frac{\theta_0\beta\delta\left[\theta_0 \ln\left(\left(1-\mu^g\right)\Omega\right) + \theta_1\right]}{\Omega} \\
&-f(\widetilde{\upsilon})\,\beta\delta \int_{\widetilde{\upsilon}}^{\overline{\upsilon}} \left[\theta_0 \ln\left(\left(1+\mu^g\right)(1+\sigma)\left[\lambda_t^g W_t + \upsilon - \beta c_t\right]\right) + \theta_1\right] d\upsilon \\
&-\left[1-F(\widetilde{\upsilon})\right]\frac{\theta_0\beta\delta\left[\theta_0 \ln\left(\left(1+\mu^g\right)(1+\sigma)\Omega\right) + \theta_1\right]}{\Omega}.
\end{aligned}$$

Define the following

$$\begin{aligned}
A(W_t, \widetilde{\upsilon}) &= \beta\delta \int_{\widetilde{\upsilon}}^{\overline{\upsilon}} \left[\theta_0 \ln\left(\left(1+\mu^g\right)(1+\sigma)\left[\lambda_t^g W_t + \upsilon - \beta c_t\right]\right) + \theta_1\right] d\upsilon \quad \text{(A4)} \\
&\quad -\beta\delta \int_{\underline{\upsilon}}^{\widetilde{\upsilon}} \left[\theta_0 \ln\left(\left(1-\mu^g\right)(1+\sigma)\left[\lambda_t^g W_t + \upsilon - \beta c_t\right]\right) + \theta_1\right] d\upsilon \\
B &= \frac{\theta_0\beta\delta\left[\theta_0 \ln\left(\left(1-\mu^g\right)\Omega\right) + \theta_1\right]}{\Omega} \\
C &= \frac{\theta_0\beta\delta\left[\theta_0 \ln\left(\left(1+\mu^g\right)(1+\sigma)\Omega\right) + \theta_1\right]}{\Omega}
\end{aligned}$$

Therefore, the optimal consumption can be described by the following expression

$$\frac{1}{c_t^*} = f(\widetilde{\upsilon}^*)\,A(W_t, \widetilde{\upsilon}^*) + F(\widetilde{\upsilon}^*)\,B + \left[1-F(\widetilde{\upsilon}^*)\right]C. \tag{13}$$

It is instructive to consider how the functions adjust with changes in the exogenous parameters of the model.

$$\begin{aligned}
\frac{dB}{d\mu^g} &= -\frac{\theta_0\beta\delta\theta_0}{\left(1-\mu^g\right)\Omega} < 0 \quad \text{(A5)} \\
\frac{dC}{d\mu^g} &= \frac{\theta_0\beta\delta\theta_0}{\left(1+\mu^g\right)\Omega} > 0
\end{aligned}$$

Proof of Proposition 1. The optimal consumption, c_t^*, is derived from (13) as illustrated in the text. Let R denote the right-hand-side of (13).

Consider, then, $\frac{dR}{d\mu}$. Since it is assumed that $f(\upsilon^*) \approx 0$, then it follows that $R = F(\upsilon^*) B + [1 - F(\upsilon^*)] C$. Therefore, $\frac{dR}{d\mu} = F(\upsilon^*) \frac{dB}{d\mu} + f(\upsilon^*) B \frac{d\upsilon^*}{d\mu} + [1 - F(\upsilon^*)] \frac{dC}{d\mu} - f(\upsilon^*) C \frac{d\upsilon^*}{d\mu}$, which simplifies to

$$\frac{dR}{d\mu} = F(\upsilon^*) \frac{dB}{d\mu} + [1 - F(\upsilon^*)] \frac{dC}{d\mu}.$$

As derived in (A5) this simplifies to

$$\begin{aligned} \frac{dR}{d\mu} &= -F(\upsilon^*) \frac{\theta_0 \beta \delta \theta_0}{(1-\mu^g)\Omega} + [1 - F(\upsilon^*)] \frac{\theta_0 \beta \delta \theta_0}{(1+\mu^g)\Omega} \\ &= \frac{\beta\delta}{(1-\delta)^2 \Omega} \left(\frac{1 - F(\upsilon^*)}{1+\mu} - \frac{F(\upsilon^*)}{1-\mu} \right) \\ &= \frac{\beta\delta}{(1-\delta)^2 \Omega} \left(\frac{1}{1+\mu} - F(\upsilon^*) \frac{2}{(1+\mu)(1-\mu)} \right). \end{aligned}$$

Since υ^* is a decreasing function of μ for an elite (see (11) for verification), then so long as $F(\upsilon^*) < \frac{1}{2}$ when $\mu = 0$ there exists a threshold value, denoted $\widetilde{\mu}$. With this threshold if $\mu^o > \widetilde{\mu}$ then $\frac{dR}{d\mu} < 0$, while if $\mu^o < \widetilde{\mu}$ then $\frac{dR}{d\mu} > 0$. It follows immediately from (13), then, that if $\frac{dR}{d\mu} < 0$ then $\frac{dc_t^*}{d\mu} > 0$, while if $\frac{dR}{d\mu} > 0$ then $\frac{dc_t^*}{d\mu} < 0$. ■

Proof of Corollary 1. Since $\frac{dR}{d\mu} = \frac{\beta\delta}{(1-\delta)^2\Omega} \left(\frac{1}{1+\mu} - F(\upsilon^*) \frac{2}{(1+\mu)(1-\mu)} \right)$ as shown in the proof of Proposition 1, if the term within the parentheses is negative, then the magnitude of the decrease in $\frac{dR}{d\mu}$ is determined by $\frac{\beta\delta}{(1-\delta)^2\Omega}$. Since this is increasing in both δ and β the result arises. ■

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