# *Demography as Early Warning:*
# *Gauging Future Political Transitions in the Age-structural Time Domain*

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## Abstract

This essay reviews the methods and products of an unclassified statistical early-warning program, grounded on theories and methods of political demography. The principal goal of this early-warning effort, which was initially developed within the Long Range Analysis Unit of the (U.S.) National Intelligence Council (NIC), has been to produce models that use publically available data to generate useful and replicable statistical warnings of intelligence-worthy state behaviors, up to two decades in advance. To provide an example of this "family" of early-warning models, this essay outlines the *Age-structural Model of Liberal Democracy* (ASMLD), which focuses on the relationship between population age structure (indicated by the country-level population's median age) and the probability that states will achieve and maintain high levels of democracy (i.e., liberal democracy; indicated by the assessment of FREE in Freedom House's annual survey). The ASMLD has produced several analytical successes. Among them, the ASMLD's output served as the basis for two published papers that identified North Africa as a probable site for democratization between 2010 and 2020, more than two years before the commencement of Tunisia's "Dignity Revolution". In this review, I (a) introduce the concept of the "age-structural time domain," which facilitates timed early warnings; (b) present the ASMLD's three basic functions (the general, gain, and loss functions) and discuss the implications of their functional forms; (c) outline a set of additional factors (observed and hypothesized) that mediate the age-structural relationships described by the ASMLD's basic functions; and (d) provide examples of two summary products (one a table, the other a map) that have been designed to summarize the model's regional early-warning results (examples provided show current results for the Middle East and North Africa). I recommend that the probabilistic output of age-structural models (like the ASMLD) be used to generate timed hypotheses of state behaviors, and to corroborate or counter-balance the predictions of other forms of strategic intelligence—but *not* as a sole-source decision-making tool.

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## Introduction

Not long ago, Middle East experts were blindsided by a pair of popular uprisings, first in Tunisia in December 2010 and then in Egypt in early 2011, that successfully upended what this community of analysts had assumed to be stable autocratic regimes. Writing in *Foreign Affairs,* Gregory Gause (2011) noted that Middle East scholars (himself included) had overestimated the depth of military allegiances from which these autocrats could draw support. In the same journal, Nassim Taleb and Mark Blyth (2011) identified the North African uprisings as a "black swan"—an event culminating the build-up of indeterminate underlying forces, the timing of which is typically impossible to forecast. No mention was made of two articles that, nearly three years previously, had called attention to the Arab-majority coastal states of North Africa as possible sites for the rise of democracy by 2020 (Cincotta, 2009, 2008).[2]

In a 2008 article, published in *Foreign Policy*, I wrote:

> The first (and perhaps most surprising) region that promises a shift to liberal democracy is a cluster along Africa's Mediterranean coast: Morocco, Algeria, Tunisia, Libya, and Egypt, none of which has experienced liberal democracy in the recent past. … Interpreting [this forecast] conservatively, we can expect there will be one, maybe two, in [this] group that will become stable liberal democracies by 2020 (Cincotta, 2008, pp. 81-83).[3]

When I presented these conclusions at a U.S. State Department-convened expert meeting in February 2008, and suggested that Tunisia—because of its sustained near-replacement fertility and the rapid maturing of that country's *population age structure* (the distribution

[2] I called attention to this omission in a response, submitted for publication, addressed to the editor of *Foreign Affairs* in 2012. It was rejected.

[3] A very similar quote appears in an article published by the Woodrow Wilson Center's Environmental Change and Security Project (Cincotta, 2009).

of population, by age)—was a likely launch point for democratization before 2020, most of the two dozen attending academics specializing on the Middle East and North Africa (including several natives of the region) burst into raucous laughter.[4] Thus, when confronted with a reasonable image of the near future, scholars with decades of experience in the region and dozens of publications detailing its political culture to their credit, found that image absurd.[5]

Of course, my forecast of "one, maybe two" North African liberal democracies before 2020—states assigned FREE status (rather than PARTLY FREE or NOT FREE) in Freedom House's annual global assessment of political rights and civil liberties—has yet to be realized, as stated (FH, 2014) (for a description of Freedom House's categorical system of classifying regimes, *see* Technical Note 1). While Tunisia's new constitution has brought it nearer to the liberal political system for which many of its citizens had hoped, further political liberalization in Tunisia (assessed by Freedom House as PARTLY FREE, from 2011-13), or in other states of the Maghreb, is by no means certain. Nonetheless, the fact remains: A rather simple technique, using a publically available indicator of the maturity of each country's age structure, correctly gauged the timing of

[4] One Middle East scholar laughed until he was in tears. Because the laughter did not subside, the session's chair ended the question and answer session. Later, when the group was polled by the convener, only two of the roughly two dozen scholars at the session believed that there were any lessons to be learned from this politico-demographic analysis.

[5] In October 2010, the Strategic Futures Group of the (U.S.) National Intelligence Council (NIC) organized a "high-impact, low-probability event exercise" with the objective of looking two years into the future. I submitted the following unclassified scenario: "A North African state, probably Tunisia, undergoes a "color revolution"—a swift and non-violent transition to liberal democracy. This may bring Islamists into power—or maybe not. However, the possibilities for spreading democracy through the region and for new political dynamics to play out in an age-structurally maturing Arab state could produce both risks and opportunities for the US." This forecast, submitted two months before the actual events unfolded, was my attempt to produce a narrative from the initial results of a rather simple statistical model with a much longer time horizon. As worded, the narrative was incorrect. If Tunisia eventually arrives at a liberal democracy (and it may), its transition will neither have been swift nor non-violent. I clearly overstepped the model's inference limits.

democratization in North Africa at a time when virtually all regional experts predicted the unbroken stability of its autocratic regimes.[6]

[Technical Note 1 near here]

Was the prediction a lucky guess? Or did it rely on data that were unavailable to these regional specialists? The answer to both questions is "No, not at all." That forecast was a product of an unclassified program of statistical early warning, initially fostered by the Long Range Analysis Unit (LRAU)[7] of the (U.S.) National Intelligence Council (NIC). That effort continues to focus on improving foreign-affairs policymakers' understanding of the timing of several intelligence-worthy state behaviors, including the risk of an onset of intra-state conflict, the evolution of democracy, and ups and downs of per-capita economic growth.

In this essay I begin with a brief introduction to the general features of this demography-based early-warning system. In this section, I introduce "age-structural time", a central component of politico-demographic models. This critical concept, coupled with the use of demographic projections, makes it possible to construct *forward-looking models*—models that can produce *timed* statistical early warnings up to two decades into the future, using publically available data.

To give readers a more detailed view of this system, I review the progress of this effort's most developed model—the *Age-structural Model of Liberal Democracy* (ASMLD). To

[6] In October 2010 (two months before the beginning of demonstrations in Tunisia), I participated in an NIC-sponsored "high impact, low probability event" exercise, with a time horizon of two years (2011-12). Based upon the ASMLD output for the Middle East and North Africa, I submitted the following scenario: "a North African state, probably Tunisia, undergoes a color revolution—a swift and non-violent transition to liberal democracy. This may bring Islamists into power—or maybe not. However, the possibilities for spreading democracy through the region and for new political dynamics to play out in an age-structurally maturing Arab state could produce both risks and opportunities for the US."

[7] In 2010, the unit was reorganized, along with other units, to become the NIC's Strategic Futures Group, which works both on cross-cutting long-range issues (global trends research), as well as early warning.

do so, I outline the ASMLD's objectives and methods, and provide samples of its tabular and map-based summary products (drawn from an analysis of the Middle East and North Africa (MENA)). I then briefly review the ASMLD's current tabular and mapped output for the MENA region (generated in 2014), which looks into the future, from 2015 to 2025.

## Early Warning in Age-structural Time

Over the past two decades, economic and political demographers have proposed and tested theories that identify demographic changes as key factors in a range of economic and political transitions (Cincotta, 2012; Goldstone, 2012). Whether or not these are causally related, either directly or complexly, is a contentious topic that is the subject of debate among economic demographers and economists, and political demographers and political scientists.

The list of state-level effects that are associated with fertility decline and age-structural change is surprisingly long, and the effects are politically consequential. These country-level effects include: the onset of intrastate conflict (Möller, 1968; Mesquida and Weiner, 1999; Goldstone, 2002; Urdal, 2006; Cincotta and Leahy 2007); employment (Easterlin, 1968); women's participation in the workforce (Bauer, 2001); democratization and democratic stability (Cincotta, 2008, 2009, 2013; Weber 2012; Cincotta and Doces, 2012; Dyson, 2013); the accumulation of government and household savings (Higgins and Williamson, 1997; Lee and Mason, 2011); economic development (Williamson, 2001; Bloom et al., 2002); societal investments in education (Lee and Mason, 2011); and the accumulation of public debt (Eberstadt and Groth, 2010; Lee and Mason, 2011).

### *Analysis in the Age-structural Domain*

For defense and foreign policy analysts, the implications of these findings are noteworthy. They indicate that, for a number political and economic transitions, modern states appear to perform more predictably when these variables are monitored as a response to changes in the configurations of their age-structure, than they do when monitored in chronological time. Therefore, analysts should expect to improve aspects of their analyses by shifting countries onto the *age-structural time domain*—an X-axis measured in years of *median age* (the age of the "middle person," for whom 50 percent of the population is younger, and the other 50 percent is older).

For analysts tasked with early warning, shifting to age-structural time has a substantial advantage. Because UN demographers biennially generate demographic projections (demographic scenarios of the future) for each currently extant state, the future ceases to be a barrier to analysis. In other words, age-structural models that were originally fit to *historic data*—observations drawn from the demographic and political outcomes of countries that have already advanced through the age-structural transition—can statistically predict future trends by using projected (future) median ages as their inputs.

Unlike conventional historians and political scientists, analysts using age-structural methods need not be "stuck" in the chronological time domain. They can move back and forth, shifting from chronological time (the year) into age-structural time (the median age), in order to make a statistical prediction. And then they can re-transform their predictions, returning to chronological time—the domain in which intelligence consumers operate—to report their timed early warnings.

*The Significance of Median Age*

As a measure, median age is a gross simplification (reduction) of a complex multi-cohort distribution. Nonetheless, the measure provides a reasonable numerical characterization of age-structure's relative "maturity" when the population is fairly homogeneous, and when it has undergone relatively smooth (rather than abrupt or discontinuous) changes in fertility, mortality and net migration. Thus, for most countries, median age can be used to

mark its country-level population's progress through the course of the *age-structural transition* (Figure 1)—a process of distributional change, which political demographers contend is both a complex driver, and a bellwether, of social, political and economic development.

[Figure 1 about here, large graphic]

The global range of median ages has never been greater. At a median age of 15.0 years (MA 15.0), Niger experiences the most youthful country-level median age. At the other end of this spectrum is Japan's at MA 46.2, the world's most mature population (in graphics, I extend the age-structural time domain to MA 55.0, to provide for states that could someday reach median ages exceeding 50 years).

Median age is not the only indicator that has been used to assess the influence of population age structure on economic and political trends. Others include various "youth bulge measures" (*see* Stateveig, 2005), and "dependency ratios". Each focuses on a particular segment of the age structure for which it was developed, and each has its own mathematical peculiarities. Nonetheless, these indicators are significantly correlated to each other, as well as to median age. As an indication of age structural maturity, median age appears, to me (so far), to be the most neutral and broadly useful of those available.

*Data Sources*

The UN Population Division (UNPD) publishes estimates of the country-level median age, for each of the world's independent states and territorial isolates, in five-year intervals (1950, 1955, …, 2010). Because changes in median age are typically relatively small across these intervals (80% of all country-level populations change by less than 1.8

years in 5 years), intermediate years can be linearly interpolated with little fear of introducing a statistically meaningful error.

The UNPD also publishes demographic projections, which begin with the last estimated year and now proceed to 2100. Like other political demographers, I use future median ages that have been projected by the UNPD's *medium-fertility variant*.[8] The medium-fertility variant is not the only projection that the UNPD offers. The other standard projections—the high-, low-, and constant-fertility variants—provide a broad vision of future possibilities (Figure 2). The past record of UNPD projections, despite several methodological revisions, suggests that data generated by the medium-fertility variant can be assumed to be reasonably accurate, for most countries, for at least two decades into the future.

[Figure 2 here]

Whereas demographic surprises are relatively rare over a two-decade period, there have been enough unexpected changes and discontinuities to make political demographers cautious. Among the most consequential of recent demographic reversals are the post-World War II baby boom in the United States and Western Europe; Iran's rapid fertility decline following the end of the Iran-Iraq War in 1988; the emergence of AIDS mortality in Africa, beginning in the 1980s; and an unexpected wave of migration to Israel following the breakup of the Soviet Union, in the early 1990s.

[8] In the UNPD's current methods, UN demographers identify this scenario, the medium-fertility variant, as the most likely, given the range of trajectories followed by other countries during similar fertility transitions. The low-fertility and high-fertility variants are generated by varying the endpoint of the fertility trajectory, by 0.5 child, downward for the low-fertility variant, upward for high-fertility variant—as was the method in prior revisions. The constant-fertility variant is produced by maintaining fertility, during the projection period, at the last estimated level.

There is also a reason to be cautious about using the median age as a "developmental marker". The UNPD's published estimate of the country-level median age may obfuscate the presence of significantly large minorities that display population dynamics differing substantially from the majority. For example, in the six Arab-majority states of the Gulf Cooperation Council (GCC)[9], the relative sizes of male cohorts, from 25 to 40 years of age, are heavily influenced by the presence of temporary labor migrants. Rather than use the UNPD's estimates and projections of median age for all residents in the GCC states, I use unpublished estimates and projections of citizen residents, only (which excluded temporary labor migrants), from the US Census Bureau's International Program Center (USCB-IPC, 2011).

*Modeling Objectives*

Three principal objectives structure the age-structural models that have been (and are being) designed for this early-warning program. The first objective is to provide analysts with a graphic understanding of the probability of the political or economic event, or status, occurring over age-structural time. The second objective is to improve the model's predictability and add theoretical nuance to the model by adding other predictive factors—through trials and observations, statistical experimentation, and testing—that might help explain the observed pattern of occurrence and the behavior of deviant cases. The final objective is to devise products that provide analysts and their audiences with the means to easily read and interpret model results. These products help maintain a running record of early warning predictions, and provide a basis for assessing the model and dealing with its failures.

[9] The six states of the GCC are: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates (UAE). The age structures of these states are strongly weighted by temporary labor migrants who are socially and politically segregated from the citizen resident populations. Unpublished estimates and projections of the median age of citizen residents in these states were obtained from the US Census Bureau's International Program Center.

*Age-structural Models in the Strategic Intelligence Environment*

Like all models, age-structural early warning models have hefty limitations. They are neither designed to make pin-point forecasts, nor are they recommended as a sole-source decision-making tool. I recommend that the output of age-structural models be employed in an environment that includes other forms of strategic intelligence—such as regional and country analyses—to corroborate or counter-balance methods that rely on unreplicable expert analyses or unfalsifiable theories.

Age-structural models have several useful strengths in an analytical environment dominated by political scientists and historians. Perhaps most importantly, these models are methodologically distinct from the normative methods of either political science or history; their outputs truly represent a separate "analytical voice". If the outputs of an age-structural model support other disciplinary perspectives, it is not because of methodological commonalities. In addition, age-structural models are replicable and testable. Analysts can check their results, keep a record of their successes and failures, and over time, can acquire a decent grasp of the model's inference limitations. That is not typically true of qualitative forms of strategic analysis that are usually brought to bear on long-range topics.

**An Example: the ASMLD**

The Political Demography Program's most successful early-warning model, to date, is the *Age-structural Model of Liberal Democracy* (ASMLD). Focused on *liberal democracy*—a form of state government granting and protecting unambiguously high levels of political rights and civil liberties—the ASMLD is designed to statistically predict the timing and stability of an assessment of FREE, the highest category of "freedom status" (for a description of the calculation of freedom status, *see* Tech. Note 1)

assigned to states in Freedom House's annual global survey of political rights and civil liberties (FH, 2013).[10] Like other models developed by this program, the ASMLD operates on the age-structural time domain—i.e., along an X-axis measured in median age—and it deals only with states that have a population greater than 500,000 residents.

The ASMLD's early warning output has been communicated most frequently to audiences by region, and in narrative form (in oral presentations with slides, and in written commentaries). So far, two summary products have been developed to lead intelligence consumers through the results of an ASMLD regional analysis. The first is a regional summary table, an 8 column tabular form that also serves the analyst as a log of dated predictions. The second product is a mapped summary of these data, which provide a more graphic representation of these outputs. Both products are discussed at the end of this essay, and are accompanied by a sample regional table for the Middle East and North Africa (MENA), using data available in 2014, and by a mapped summary of those data.

*Three Early-Warning Functions*

To describe the dynamics of the transition to high levels of democracy, the ASMLD was designed to generate a set of three *naïve probabilities*: (1) the probability of being assessed as FREE in Freedom House's annual survey; (2) the annual probability of gaining FREE, applicable only to states that were not assessed as FREE (assessed as PARTLY FREE or NOT FREE) in the previous year; and (3) the annual probability of a state losing FREE, applicable only to states that were assessed as FREE the previous year. Based solely on the country-level median age of a state's population, a naïve probability provides analysts with only a "first approximation" of the best estimate of the true probability. Why is it considered naïve? Because the basic functions of the ASMLD ignore other influences—political, social, economic, structural and external factors. These factors are not unimportant (I discuss them in the next section, entitled *Additional*

[10] An analysis using very high polity scores (+8 to +10) to indicate liberal democracy, produced very similar results (Cincotta and Doces, 2012). Polity scores were drawn from the Polity IV data set (Marshall et al., 2014).

*Factors*). However, they distract from the underlying dynamics that the ASMLD portrays.

This set of naïve probabilities is generated by ASMLD's three basic functions: the *general function*, the *gain function*, and the *loss function*. Because they exist in the age-structural time domain, each of these functions employs median age as its independent variable (Figure 3). Each function has been fit (parameterized) using logistic regression analysis (*see* Maynard, 2002).

The general function portrays the most fundamental of the ASMLD's three relationships. Starting from MA-15 and ending at MA-47, its logistic curve describes the probability that a state, with a minimum population of 500,000, will be observed with FREE status in Freedom House's annual assessment at a given median age. As the curve indicates (Figure 3a), the naïve probability of states with a very youthful country-level population being assessed as FREE is very low. For example, at a median age of 15, Niger's current median-age-related probability of FREE is 0.07. For today's most mature country-level population, Japan, the median-age related probability is very high. According to the ASMLD's general function, at a median age near 46 years, Japan's probability of being assessed as FREE is 0.96.

[Figure 3 about here]

Classically shaped logistic curves (often described as Gompertz functions), like the general function, are commonly characterized by identifying the point on the X-axis at which there is a 0.50 probability of a response (indicated on the Y-axis). In the case of the ASMLD's general function, the response is an assessment of FREE, and that "half-a-chance benchmark" is identified as $\text{FREE}_{50}$. Over repeated tests, using both linear and non-linear models (*see* Cincotta, 2009, 2012), $\text{FREE}_{50}$ has been recorded at a median age of 28.9 years.

ASMLD's gain function assumes an altogether different shape. As median age increases, it predicts a slowly increasing probability of a transition to FREE from a status of either PARTLY FREE or NOT FREE. The shape of the gain function indicates that, by and large, states with a very youthful country-level population represent unlikely candidates for gaining FREE status from lower levels. However, their chances are *not* negligible. Each decade, beginning in the 1970s—when Freedom House began its survey—a handful of youthful states have, indeed, risen to FREE status. Those transitions have been largely ephemeral; the probability of losing FREE at a youthful median age is also very high, and it declines as the median age rises (loss function, in Figure 3b), somewhat like a reflection of the gain function.

The break-even point ($\alpha$), at a median age of 26.3 years—where the gain and loss functions intersect—is a point of critical importance for both analysts and foreign affairs policymakers. It identifies the median age (and the age-structural configuration) where the probability of an annual gain of FREE first surpasses the probability of its loss. Since the early 1970s, few states that have remained at a median age younger than $\alpha$ have maintained FREE for a decade or longer.

For many Latin American states, their age-structurally "precocious" climb to FREE during the 1970s and '80s proved to be a costly political venture. Nearly all that attained Free, lost that status. About half of the states that tumbled from these democratic heights ended up, within two years, of being rated NOT FREE or at low levels of PARTLY FREE. In fact, more than a few encountered substantial political violence in the wake of their reversal (Cincotta 2012, 2013). Just two states, Costa Rica and Jamaica—both with relatively small populations—have, so far, weathered all of their youthful years (below MA-26) at a constant assessment of FREE.

Rather than a geographically dispersed wave of ideational change that occurred in chronological time (Huntington, 1991), the ASMLD portrays the past four decades of episodic political liberalization as a response to age-structural maturation. Triggered by

fertility decline, this post-World War II advance in median age occurred first in southern Europe, then in East Asia and the Caribbean, then in Latin America, and most recently in northern and southern Africa. Thus, the current global pattern of states assessed with FREE status reflects age-structural differences between regions (Figure 4) and country-by-country variation in several additional mediating factors, particularly in regime type.

[Figure 4 here]

*Additional Mediating Factors*

So far, twelve factors have been determined to alter—slow down, deter, or speed up — the transition to FREE, or to destabilize it. For several of these factors, I have consistently noted observational and statistical evidence of their impact on the timing of political liberalization. For some, additional supporting evidence appears in academic literature. Other factors remain hypothetical, and therefore in need of further elaboration, repeated statistical trials and observations, experimentation, and out-of-sample testing.

On their own, the ASMLD's naïve probabilities provide reasonable predictions under relatively "uncomplicated" political conditions. In other words, probabilities that have been generated from the general function—using median age alone, and without considering additional factors—are likely to give a fairly accurate picture of the proportion assessed as FREE among a group of states in which no state: (a) is governed by an ideological monopolistic regime (such as the regimes of Iran, Cuba and China); or (b) is fighting a major intra-state conflict (more than 1000 battle-related deaths per year)[11]; or (c) is bordered by a militarily intimidating autocratic neighbor (conditions experienced by the Eastern European states during the Cold War). However, an absence of those conditions is rarely the case. Based on repeated observation and statistical experiments,

[11] Data on intra-state conflict were drawn from UCDP/PRIO Armed Conflict Data Set (Themner and Wallensteen, 2013).

these conditions, and others—including the availability of oil and mineral rents; rule by a charismatic founding figure; and the presence of a demographically and politically rising, youthful minority—appear to delay and deter the onset and stability of FREE (Cincotta 2013).

On the other hand, several characteristic factors appear to improve the chances of political liberalization among states that have passed the break-even point, $\alpha$, and are still assessed as NOT FREE or PARTLY FREE. Here regime type matters most. Political transitions to democracy typically occur "on time" among states ruled by non-ideological military "caretaker regimes" and weakly ideological neo-authoritarians, particularly when there is little or no political violence (somewhat contrary to the lore on revolutions) (Cincotta 2013). Population size also matters. Smaller populations, particularly those under 3 million residents, seem to achieve FREE sooner, and maintain it longer (Weber, 2013).

While several Muslim-majority states have previously been assessed as FREE (Indonesia was assessed as FREE from 2004 to 2012), there are currently far fewer of these states with FREE status then the ASMLD predicts. Given recent progress in education and declines in family size in Tunisia, Lebanon, Turkey, Iran, and Indonesia—all of which have passed $\alpha$—the current absence of even a single state with FREE status among this age-structurally advanced group is unexpected.

When it comes to democratization, monarchies are perhaps the most interesting of all regime types. None have survived in their absolute authoritarian form beyond MA-35, and most have been deposed well before that point in age-structural time. Where monarchies have survived beyond that median age, they have done so as constitutional monarchies, having mediated the democratic transition by incrementally trading their executive, legislative and military powers—and often much of their wealth—over time, for a lesser, ceremonial role.

[Technical Note 2 near here]

*Early Warning with the ASMLD*

To illustrate the ASMLD's application to early warning, I have chosen to focus on its two summary products: the ASMLD's *regional early warning output table*, and its corresponding supplemental map-based output. As examples, I use an output table (Table 1) and a map (Map 1) recently developed for an analysis of twenty countries of the Middle East and North Africa (MENA).

The output table provides intelligence consumers with a large proportion of the model's relevant output, along with additional considerations that the analyst feels relevant. Alongside the independent state's name (col. 1), the table lists: (col. 2) the current freedom status; (col. 3) current median age (in years); (col. 4) the ASMLD's naïve probability of FREE in the current year; (col. 5) the ASMLD's naïve probability in a relevant future year (in this case, in 2025); (col. 6) the year that the median age will pass $\text{FREE}_{50}$ (MA-28.9), according to the UNPD's medium fertility variant projection; (col. 7) a list of inhibiting and destabilizing factors relevant to the state; and (col. 8) a list of influential political actors in the neighborhood.

The ASMLD's output table is sorted using $\text{FREE}_{50}$ (col. 6). Regional output tables, when sorted by this measure, typically feature the states assessed with FREE status at the very top of the list. Most of those assessed as NOT FREE are listed near the bottom, and those with PARTLY FREE are typically scattered more loosely across the mid-section of the table. That distribution is, indeed, apparent in the MENA table. What does the output table tell us? It provides just enough to structure an informed discussion.

Starting from the top, the table indicates that Cyprus arrived at FREE very nearly when expected—close to the $\text{FREE}_{50}$ point. For Israel, that was not the case. This odd result is consistent with Israel's unusual demographic history. Tunisia, Lebanon, Turkey and Iran have age structures indicative of a group of countries, globally, of which Freedom House has judged roughly 50 percent as FREE. Directly behind them are Morocco, Algeria, Libya, and Bahrain, each due to reach $\text{FREE}_{50}$ from 2020 to 2022—perhaps a second wave of hope for a more successful resurgence of democratization, beginning in the next decade. Well behind them is Egypt, which is projected to reach $\text{FREE}_{50}$ in 2029, roughly 19 years after Tunisia reached that point—a numerical indication that Egypt's run at democratization was quite premature.

[table 1 around here]

Quite surprisingly, Saudi Arabia's citizen-resident population (discounting its temporary labor migrants) is projected to cross $\text{FREE}_{50}$ in 2026, ahead of Egypt. What might that mean for the Saudi monarchy? Will it give up some of its powers to a popular legislature or relax its suppression of civil liberties? Demographic changes of this nature have generally been indicative of changes at the family level, in terms of educational attainment, family size and women's status. For this oil rich rentier state, it is very hard to tell what this important demographic transformation will bring (although it is worth noting that the relationship between ruler and ruled in the kingdom will have changed).

For the remainder of MENA, $\text{FREE}_{50}$ is a long way off. In these—the most chronically youthful of the Arab-majority states—analysts should expect the continuation of the region's varied forms of autocracy, and that any form of insurrection would be unlikely to produce a liberal regime. The ethnically fractured states of Iraq and Yemen (near the bottom of the table) remain among the region's most vulnerable to episodic outbursts of political violence, and even to protracted civil war.

## Conclusions

The focus of demographic early warning models has been on generating "timed expectations"—on providing analysts and policymakers with a statistical means to anticipate intelligence-worthy political events and state behaviors using a set of forward-looking models. There are good reasons to continue this effort. Studied in chronological time, the timing of dramatic political changes has often befuddled country and regional specialists, and caught diplomats by surprise. When viewed over the age-structural time domain (measured in years of median age), however, some of these processes appear quite predictable, and much less mysterious than the current academic literature might portray.

Age-structural models perform some early warning tasks rather well. They are their best when tasked with identifying groups of states among which a significant fraction bears a high likelihood of change. When given a time horizon in which to concentrate, they can often identify a window of future years where changes are likely to happen (I use plus and minus five years from a central point). Whereas the predictions of age-structural models can suffer from the method's own demographic blind-spots, those predictions offer an independent perspective—one that is typically unprejudiced by personal experiences with, or feelings about regimes and societies under study, and are unlikely to be influenced by the conventions and social dynamics of an established disciplinary group.

Still, as early warning tools, age-structural models have substantial limitations. Users need to keep in mind that these models are fundamentally statistical, and are therefore subject to substantial *inference limits*—i.e., constraints on what an analyst can say, with absolute certainty, using the model's output. These limits are imposed by the uncertainties inherent in demographic projections and in the modeled relationships, and most of all, by the necessity of focusing on the outcomes of a relatively small number of

states (when dealing with large numbers would produce the fewest errors). Thus, age-structural models are neither meant to be employed as sole-source decision making tools, nor are they designed to displace other forms of early warning.

Perhaps the greatest strength that age-structural models bring to foreign-affairs early warning is "the science" that analysts, through testing and modification, can bring to them. Whereas intelligence professionals commonly complain that, in the world of foreign affairs narratives, no poorly predictive theory is ever abandoned, nor is a failed prediction or missed event enough to question deeply held assumptions or force the revision of a discipline's core methodologies.

Yet, in scientific pursuits, failure is a necessary instrument of the advancement of knowledge. When encountered, in the course of the scientific method, failures ultimately eliminate poorly predictive theories and pressure methodologists to make major modifications. Age-structural models are intended to be compatible with the scientific method—they are transparent, testable, and can be repeated elsewhere and by others. In the intelligence business, those are rare qualities, indeed.

## About the Author

*Richard Cincotta, Ph.D.* is a Wilson Center Global Fellow at the Stimson Center in Washington, DC, USA. A political demographer, he formerly served as the Director of Demographic and Social Science Programs at the National Intelligence Council's (NIC's) Long Range Analysis Unit (2006-09), and was a contributor to the NIC's *Global Trends* (GT) *2025* and *GT2030* reports. His current research focuses on the demographic and age-structural transitions, and he has published on their relationships to the politics of ethno-religious population shifts, to the onset of civil conflict, to regime type and political stability, and to natural resource dynamics. His publications on these topics appear in *Foreign Policy*, *Current History*, *Nature* and *Science*. Dr. Cincotta has lived and worked in Sub-Saharan Africa, East Asia, South Asia, North Africa, Western Europe, Australia, and Canada, including five years in research positions in Morocco, India, and China. Prior to his Ph.D. in population ecology (Colorado State University, 1986) and post-doctoral research in anthropology (Binghamton U., 1987-88), he served in the US Navy as a communications intelligence specialist (1969-73).

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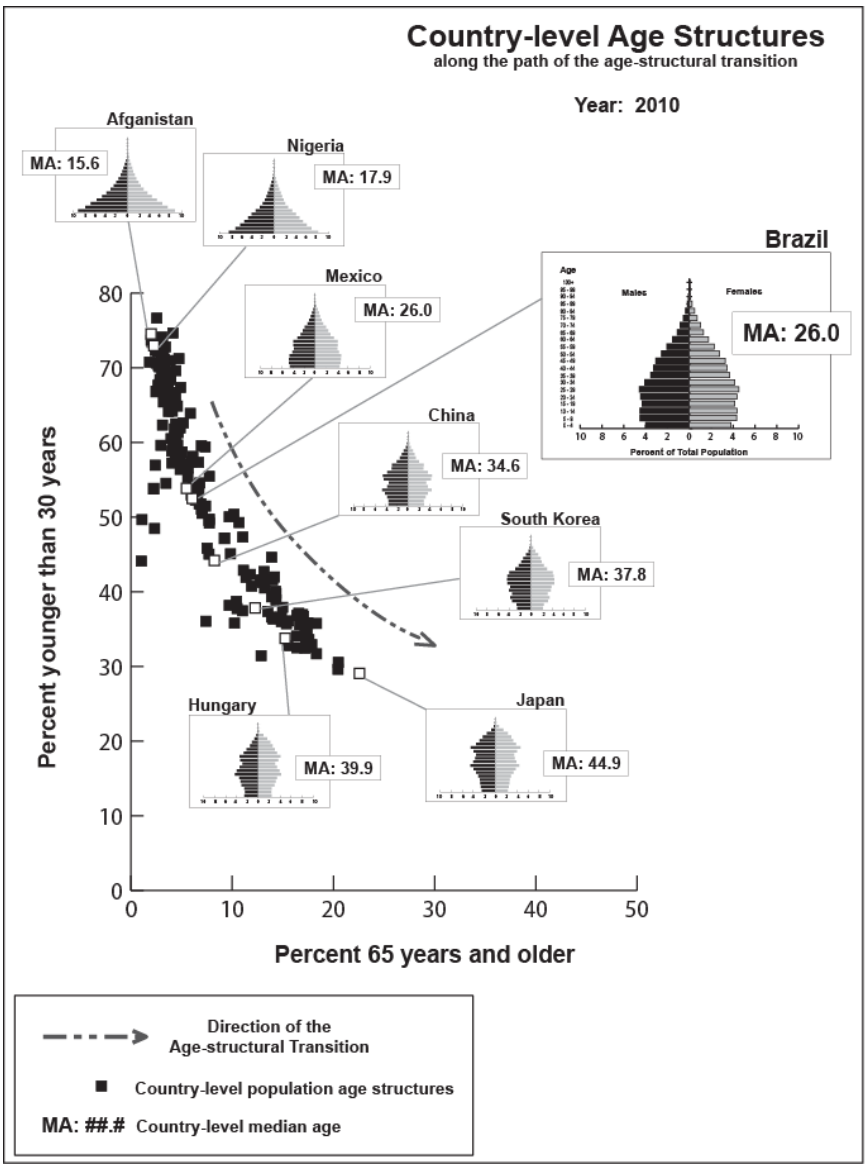



Figure. 1. The relative positions of the world's country-level populations in 2010 along the age-structural transition. Age-structural distributions and median ages are provided for eight countries. Source data: UNPD, 2013.

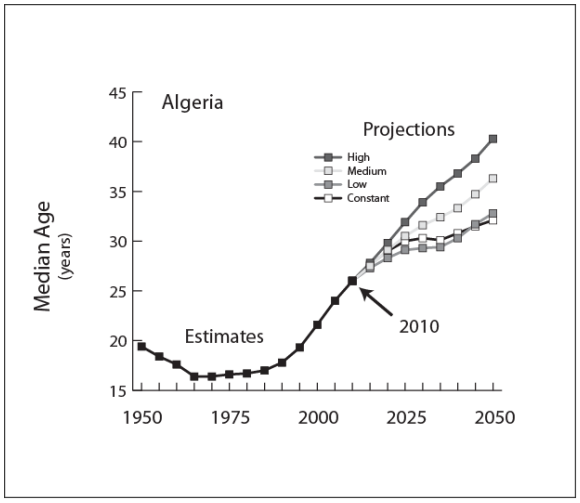



Figure 2. The trajectory of UNPD estimates and projections of median age for Algeria, 1950 to 2050. Estimates are from 1950 to 2010. The UNPD estimates are high, medium, low, and constant fertility variants. Source data: UNPD, 2013.

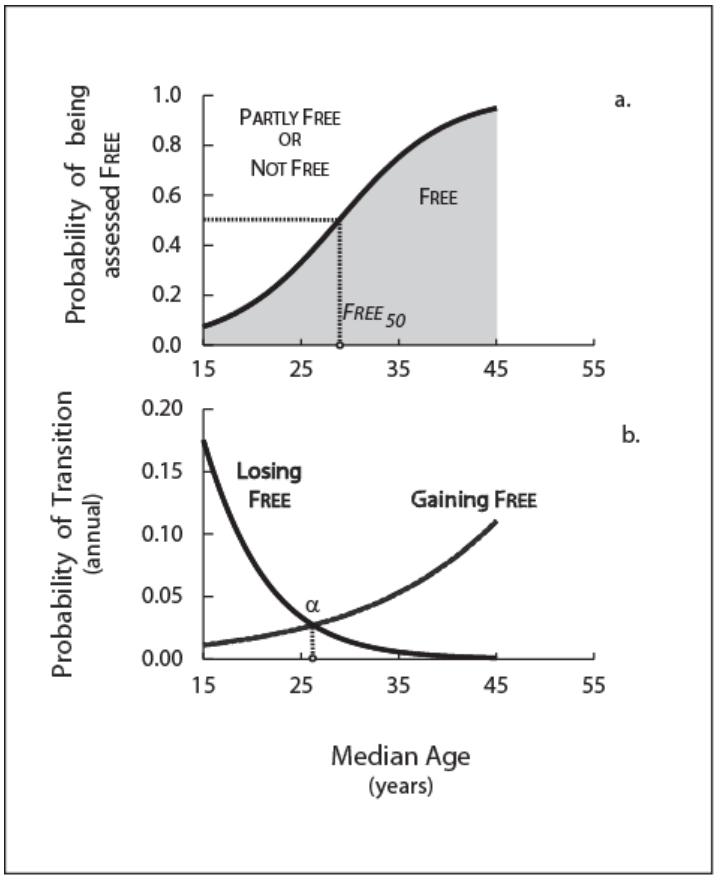



Figure 3 (a. & b.). The three functions that comprise the *Age-structural Model of Liberal Democracy* (ASMLD). The ASMLD's *general function* (a.), and its *gain function* and *loss function* (b.) are plotted on the age-structural time domain (X-axis), measured in years of median age. The model indicates that, as country-level age structures mature, one should expect states to rise to an assessment of FREE (in Freedom House's annual survey) in the vicinity of $\text{FREE}_{50}$ (a.). A rise to FREE before $\alpha$ (b.) is unlikely to be stable.

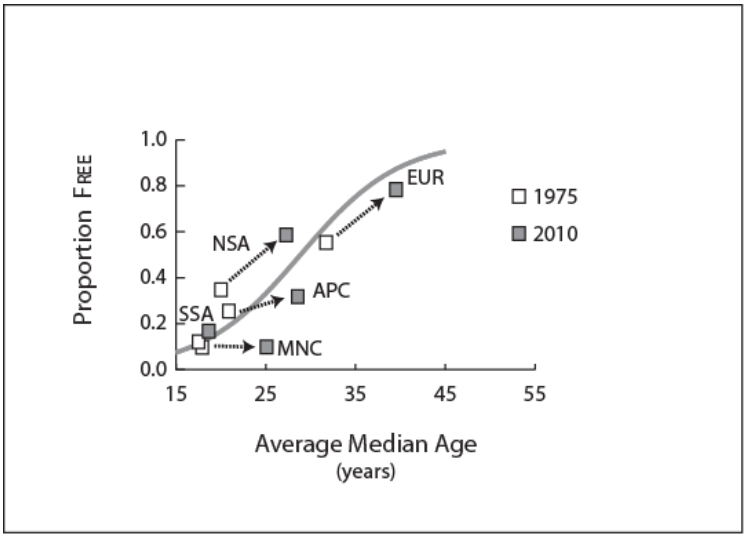
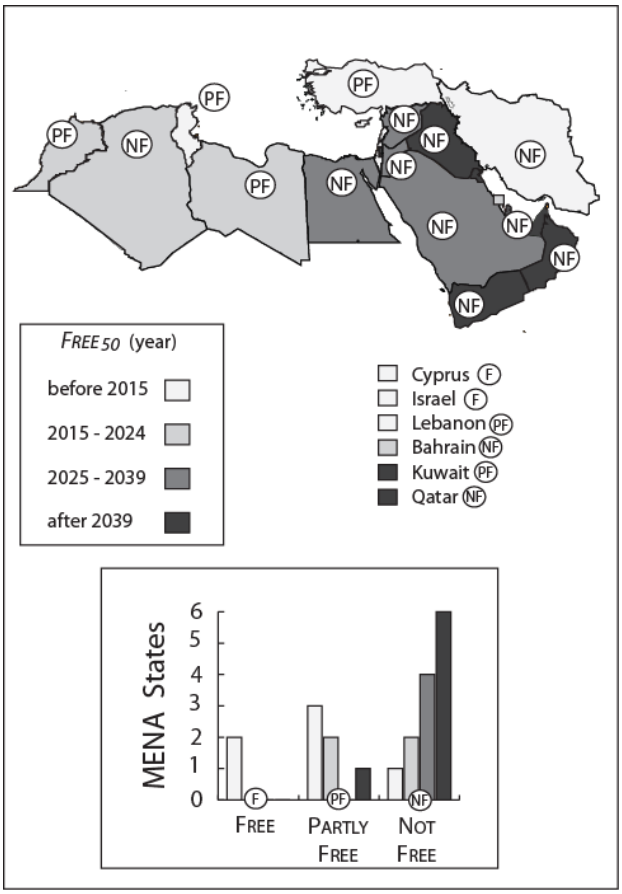



Figure 4. Changes in the regional proportions of states assessed as FREE (Y-axis), between 1975 and 2010, in five world regions: Asia-Pacific (APC) Europe (EUR), Middle East-North Africa-Central Asia (MNC), North and South America (NSA), and sub-Saharan Africa (SSA). The ASMLD's general function represents the expected path of these changes. Source data: Freedom House, 2014; UNPD, 2013.

| Source: | *Data (FH, 2014)* | *Data (UNPD, 2013)* | *ASMLD Output* | *ASMLD Output* | *Data (UNPD, 2013)* | *State-specific factors* | *State-specific factors* |
|---|---|---|---|---|---|---|---|
| (1) **Independent State** North Africa & Middle East | (2) **Freedom status** Dec. 2013 | (3) **Median age 2013** (years) | (4) **Probability of FREE 2013** (probability) | (5) **Probability of FREE 2025** (probability) | (6) **$FREE_{50}$** (median age = 28.9 years) (year) | (7) **Factors inhibiting democratization or destabilizing democracies*** 2013 | (8) **Influential Internal and External Actors** 2013 |
| Cyprus | FREE | 35.2 | 0.76 | 0.88 | 1984 (FREE since 1986) | Partition* | UN Peacekeeping Mission (UNFICYP) |
| Israel | FREE | 30.1 | 0.56 | 0.61 | 2006 (FREE before 1972) | Youthful minorities* (*Haredim, Israeli Arabs, Settlers*), Recurring conflict (*Hamas, Hezbollah*)* | — |
| Tunisia | PARTLY FREE | 30.3 | 0.56 | 0.77 | 2010 | Islamists (moderates, *Ennahda*) | — |
| Lebanon | PARTLY FREE | 29.8 | 0.54 | 0.81 | 2011 | Youthful minority (*Shiites*), Islamists, Ethnic tensions, spillover from Syrian Civil War | Hezbollah (supported by Iran and Syria) |
| Turkey | PARTLY FREE | 29.4 | 0.52 | 0.71 | 2012 | Youthful minority & Armed conflict (*Kurds*), Ruling Islamists (moderates, *AKP*) | — |
| Iran | NOT FREE | 28.5 | 0.48 | 0.74 | 2014 | Political monopoly, Ruling Islamists (conservatives) | Clerical Elite |
| Morocco | PARTLY FREE | 27.0 | 0.42 | 0.58 | 2020 | Sporadic intra-state conflict (*Polisario*) | Monarchy |
| Algeria | NOT FREE | 26.9 | 0.41 | 0.58 | 2020 | Armed conflict (*AQM*), Oil & mineral rents | Military |
| Libya | PARTLY FREE | 26.6 | 0.40 | 0.58 | 2020 | Sporadic intra-state conflict, Oil & mineral rents | Military |
| Bahrain [a] | NOT FREE | 26.1 | 0.38 | 0.55 | 2022 | Ethnic tensions, Oil & mineral rents | Monarchy, Saudi Arabia |
| Saudi Arabia [a] | NOT FREE | 23.3 | 0.27 | 0.47 | 2026 | Oil & mineral rents | Monarchy |
| Egypt | NOT FREE | 25.2 | 0.34 | 0.46 | 2029 | Youthful minority (*Sinai Bedouin*) & Armed conflict | Military |
| Syria | NOT FREE | 22.4 | 0.24 | 0.39 | 2030-35 | Ethnic tensions, Armed conflict (*civil war*) | Iran |
| Jordan | NOT FREE | 23.4 | 0.27 | 0.36 | 2035-40 | Ethnic tensions | Monarchy |
| Oman [a] | NOT FREE | 21.5 | 0.21 | 0.31 | >2040 | Oil & mineral rents | Monarchy |
| Kuwait [a] | PARTLY FREE | 20.0 | 0.17 | 0.26 | >2040 | Oil & mineral rents | Monarchy |
| Qatar [a] | NOT FREE | 20.4 | 0.18 | 0.25 | >2040 | Oil & mineral rents | Monarchy |
| Yemen | NOT FREE | 19.1 | 0.14 | 0.24 | >2040 | Ethnic tensions & Armed conflict | — |
| Iraq | NOT FREE | 19.7 | 0.16 | 0.23 | >2040 | Ethnic tensions & Armed conflict | Iran, Saudi Arabia, Turkey |
| UAE [a] | NOT FREE | 18.5 | 0.13 | 0.18 | >2040 | Oil & mineral rents | Monarchy |

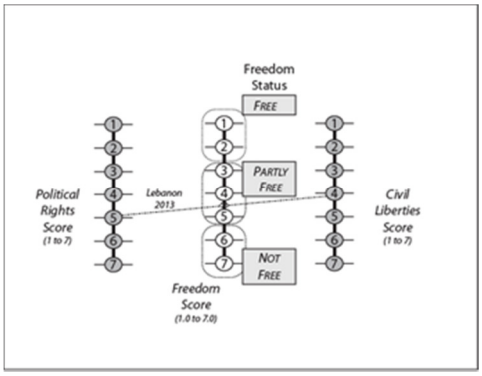
Table 1. The Age-structural Model of Liberal Democracy (ASMLD) *regional summary output table* for the Middle East and North Africa (MENA). Independent states (col. 1) are sorted by the year (col. 6) that they are estimated or projected to surpass $FREE_{50}$ (median age of 28.9 years)—the point at which the ASMLD predicts a 0.50 probability of being assessed FREE (in Freedom House's annual assessment). For the states of the Gulf Cooperation Council [a], the median age (col. 3) is that of the citizen-resident population (excluding labor migrants), and was used to generate probabilities of FREE (col. 6).




Map 1. The ASMLD's mapped summary focuses on the year at which each state's population is estimated or projected to pass $\text{FREE}_{50}$ (a median age of 28.9 years). Each state's current freedom status is also indicated, on the map, as FREE (F), PARTLY FREE (PF), or NOT FREE (NF). A bar chart summarizes the distribution of the region's states, among the three freedom status categories, according to $\text{FREE}_{50}$. Source data: Freedom House, 2014; UNPD, 2013.

**Technical Note 1.**

**Freedom Status: What it means to be FREE**




Since 1972, Freedom House has scored each state's *political rights* (PR) and *civil liberties* (CL) on a seven-point whole-number scale, where 1 represents the maximum amount of freedom and 7 represents the scale's minimum. For each political entity, PR and CL scores are averaged to produce a *freedom score* (ranging from 1.0 to 7.0). Using its freedom score, each entity is then assigned a *freedom status*, of which there are three: FREE, which is assigned to entities with freedom scores from 1.0 to 2.5; PARTLY FREE, for scores from 3.0 to 5. 0; and NOT FREE, for scores from 5.5 to 7.0. In research using the ASMLD (and in much of the democracy literature), a state with a status of FREE is assumed to be a "liberal democracy", a status of PARTLY FREE is assumed to identify a "partial democracy", and NOT FREE is used to indicate an "autocracy".

For example (see the figure, above), in Freedom House's most recent assessment (FH, 2014) Lebanon's 2013 PR score is 5 and its CL score is 4. These scores average to a freedom score of 4.5, which is assigned PARTLY FREE by Freedom House's schema.

Freedom House updates its PR and CL scores annually, several weeks after the end of the calendar year. Its assessment covers each of the world's independent states and disputed territories, and its data and methods are publically available. For a critical comparison with other scores, see Munck and Verkuilen (2002).

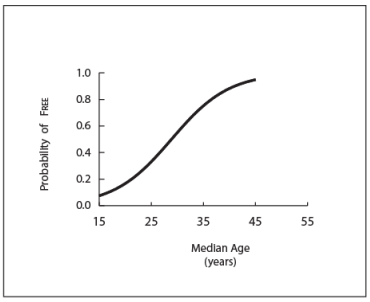
**Technical Note 2.**

**The ASMLD's Basic Functions: General, Gain, and Loss**

Each of the model's three basic functions assumes a form that has been fit by a logistic regression algorithm. In these functions, *p* is the probability of the occurrence of one of two possible outcomes. In the case of the *General Function*, the possible outcomes are "currently FREE" (1) or "currently PARTLY FREE or NOT FREE" (0). For the *Gain Function*, the outcomes of "became FREE" (1) or "remained PARTLY FREE or NOT FREE" (0) are confined to states that were not reported as FREE in the previous year. For the *Loss Function*, the analysis is confined to states that are reported as FREE in the previous year, and either "lose that status of FREE" (1), or "remain FREE" (0). Each function's independent variable is the country-level median age (MA). States covered by these functions have a population greater than 500,000.

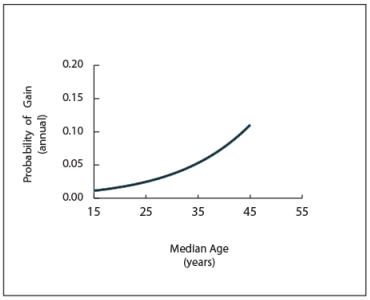
1. The *General Function*, ***F***(MA),
   where $p_F$ equals the probability of being FREE:

$$\boldsymbol{F}(\text{MA}) = p_F = \frac{e^{(-5.230 + 0.181(MA))}}{1+e^{(-5.230 + 0.181(MA))}}$$



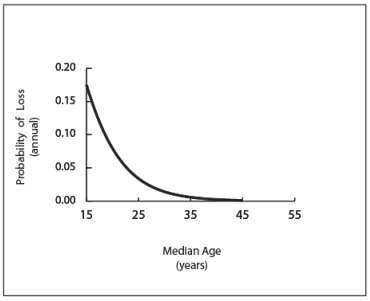

2. The *Gain Function*, ***g***(MA),
   where $p_g$ equals the probability of becoming FREE

$$\boldsymbol{g}(\text{MA}) = \boldsymbol{p}_g = \frac{e^{(-5.666 + 0.080(MA))}}{1+e^{(-5.666 + 0.080(MA))}}$$




3. The *Loss Function*, ***l***(MA)
   where $p_l$ equals the probability of losing FREE

$$\boldsymbol{l}(\text{MA}) = \boldsymbol{p}_l = \frac{e^{(1.154 - 0.180(MA))}}{1+e^{(1.154 - 0.180(MA))}}$$




Each of the three functions assumes the form: $p = e^{\xi}/(1+e^{\xi})$. Each is fit using an intermediate variable, $\xi$ (the logit), which is estimated by the equation: $\xi = \beta_0 + \beta_1(\text{MA})$, where MA is a state's country-level median age, and both $\beta_0$ and $\beta_1$ are maximum likelihood coefficient estimates. The coefficients $\beta_0$ and $\beta_1$ are: for the *General*, -5.230, and 0.181; for the *Gain Function*, -5.666, and 0.080; and for the *Loss Function*, 1.154, -0.180.