Growth of the Mormon Church

by

Roger Loomis

February 10, 2002

The keys of the kingdom of God are committed unto man on the earth, and from thence shall the gospel roll forth unto the ends of the earth, as the stone which is cut out of the mountain without hands shall roll forth, until it has filled the whole earth.

D&C 65:2

This is just laying the foundation; it is a little nucleus, and a few thousands are gathering to it year after year; but the work that is now commenced will increase, and continue to increase, like the stone that was hewn out of the mountain.

Orson Pratt, 1854

Introduction

In 1984 Sociologist Rodney Stark predicted that the Church of Jesus Christ of Latter-day Saints would grow at a rate of 30-50% per decade for the next several decades, reaching from 70 million to possibly as high as 280 million members by the year 2080.[1] From 1984 to 2000, the church actually grew at an average rate of 52% per decade, outpacing the upper bound on Stark's prediction. This has led some people to think that the upper bound of Stark's 2080 forecast is conservative.

This paper will discuss the nature of exponential growth and the prerequisites that the church must meet to sustain it. It will examine the evidence available for how well the church is meeting those prerequisites and will take a closer look at the church's growth pattern over the last 25 years. It will argue that the growth rate of the church is decreasing and will probably continue to decrease in the future, with the total membership of the church never coming close to 280 million.

Exponential Growth

Exponential growth is characterized by the speed of growth being proportional to the size of the thing that is growing—the bigger the thing gets, the faster it grows. This is another way of saying that the rate of growth is constant when the rate of growth is measured as the percentage increase over a fixed unit of time.

When something is growing exponentially, its size at any point in time is given by

---

[1] Stark, Rodney. 1984. "The Rise of a New World Faith." *Review of Religious Research* 26:18-27.

$$s(t) = A \cdot e^{d\,t} \tag{1.1}$$

A is the size of the thing at $t = 0$ and *d* is the continual growth rate.[2]

In the real world many things grow exponentially—things such as the number of bacteria in a petri dish, the amount of money in an account that earns compound interest, the size of my friend's Amway business, and of course the Mormon church. Invariably, exponential growth is only a temporary phenomenon. Sooner or later the bacteria run out of food, the money is withdrawn from the account, and the MLM network runs out of contacts. It's imaginable that the Mormon Church will grow at 50% per decade for the next 78 years and will reach 280 million in 2080, but if it were to then continue growing at that rate it would reach 16 billion in 2180 and 921 billion in 2280. At some point, circumstances *always* force exponential growth to stop.

When making long range forecasts of something that has been growing exponentially, the most important element of the forecast is estimating when the rate of growth will slow down. To do that, it is crucial to understand what internal properties cause it to grow exponentially, and what external environmental factors permit it to grow.

When exponential growth happens for an extended period of time, the internal driver of the growth is a mechanism where *like creates like*. In a savings account, money earns money. The new money that is earned is just as capable of producing more money as the money that created it. Thus the level of the account grows exponentially. When a bacterium in a petri dish splits, it creates two bacteria that have the exact same capacity to reproduce as the parent. Bacteria produce bacteria and the size of the colony grows exponentially.

On the other hand consider a hive of honeybees. In the beehive, the queen bee normally produces drones and workers, not queens. The drones and workers do not have the same capacity to reproduce as the queen. The population of the hive is limited to the number of bees that the queen can individually produce, so the number of bees in a hive would not grow exponentially.

The essential internal characteristic of exponential growth mechanisms is a process where like creates like. But what environmental factors are necessary for exponential growth to take place? The key environmental factor is a *relative lack of competition*. The reason why bacteria grow exponentially in a petri dish is because in that environment there is ample food and energy, no other organisms competing for the food and energy, and no predators preying on the bacteria.

---

[2] Stark expresses growth rates on a per-decade basis. If *d* is the rate of growth per decade, that can be converted to the continual growth rate d by the formula $(1+d)^{1/10} = e^{d}$. So if the church grows at a rate of 50% per decade, that is a continual growth rate of $d = \ln\left[(1+.5)^{1/10}\right] = .0405$.

The natural world is more complicated and competitive than the world in a petri dish. But exponential growth still occurs. This usually happens when something is filling a particular niche in the evolving ecosystem. A new plant that has a competitive advantage over the native plants might be introduced into a system. Its presence will grow exponentially, displacing native plants. But eventually the niche will be filled and new balance to the system reached. The alien plant will have displaced all of the plants that it was capable of displacing, and no longer be able to find more space with the properties that it needs to survive.

When something grows exponentially for an extended period of time you will always find these internal and external characteristics: It will be self-replicating producer multiplying in an environment where it has a competitive advantage.

With this understanding of what drives and permits exponential growth we will analyze the recent growth of the Mormon Church.

Homogeneity of Mormons

For the church to sustain exponential growth, the ability of the church to recruit and procreate new members must remain constant on a per-member basis. If the church gets more efficient over time at recruiting it will grow faster than exponential, and if it gets less efficient over time it will grow slower than exponential.

New members of the church can be broken down into 3 types. First are converts who join based upon the member-missionary efforts of a friend or relative. Second are people who join based upon the efforts of the full-time missionaries and the associated marketing support of the church. Third are children who are born into the church. We will examine the church's ability to produce each of these 3 types of new members at exponentially rates.

Converts from Member Referrals

Stark convincingly argues that religions grow through networks of friends and relatives in an application of the control theory of deviant behavior. "In effect, conversion is not about seeking or embracing an ideology; it is about bringing one's religious behavior into alignment with that of one's friends and family members."[3] That being the case, a convert outside of the geographical Mormon strongholds will have more opportunities to convert others because she will have more non-Mormons in her network. But by the same token, she will also have more pressure to abandon her new faith and remain in the behavioral patterns of her established network.

The question then is, in aggregate are new members homogenous with established members in regards of their propensity to convert their friends and relatives? To answer that, let's first look at the activity patterns of converts versus people born into the church. Sociologist Armand Mauss said that 75% of converts outside of the U.S. go inactive

[3] Stark, Rodney. *The Rise of Christianity*. Pages 16-17.

within a year of joining the church. That number is 50% for U.S. converts.[4] If somebody goes inactive within a year of joining, the chances of them ever returning to activity are probably quite low.

But what about the activity patterns of people born into the church? A BYU study said that of people born in the church, only 34% go inactive and stay inactive.[5] This study and the Mauss study aren't exactly comparable, but they do give an indication that converts and lifetime members are not homogenous in their propensity to be active in the church.

But does the fact that somebody is less active in the church imply that she is also a less-effective member missionary? Some would argue that active members have little need or time for non-member social contacts, and are thus less effective member-missionaries than the inactives.

I would argue that inactives are less-effective member missionaries. Consider the following anecdote from my mission. A totally inactive family referred us to a non-member family to teach. They were golden and kept all of their commitments. They believed everything we said, enjoyed reading the scriptures, were excited to get baptized, and went to church with us once. They did not like church and refused to make the commitment to attend regularly. But they still wanted to get baptized. They simply wanted to be totally inactive believers like the friends that referred them.

In situations like this the people may or may not end up getting baptized. But according to Stark's model, the investigator is in the process of adapting the behavior patterns of the people who referred them. While it is true that inactive people have more non-members in their networks to potentially convert, it is also true that, according to the model, any conversions from those referrals will follow the example of the person referring them and go inactive.

If new members are more likely to go inactive than established members and thus be ineffective at bringing in more *active* recruits, then they are not homogenous with the church as a whole.

Converts from the Efforts Full-time Missionaries

In order for the number of annual conversions due to the efforts of the full-time missionaries to grow exponentially, two things must happen. First, the percentage of members who are serving full-time missions must remain constant so that the number of

---

[4] http://www.lasvegassun.com/sunbin/stories/lv-other/2001/may/04/511782072.html

[5] 44% go inactive for a period of a year or more but eventually return to activity, and 22% remain active their entire lives. http://fhss.byu.edu/adm/hickman_lecture.htm

missionaries will grow exponentially as the church grows exponentially. Second, the productivity of the missionaries must remain constant.

Chart 1 shows that the first condition is met—the number of missionaries has in fact stayed around .55% of total church membership.

However, chart 2 shows that the converts-per-missionary has been decreasing steadily since 1989—as time goes forward missionaries appear to be getting less and less effective. It's difficult to say how many conversions are due to the efforts of the missionaries and how many are due to the efforts of members. I wish I could do a regression of converts on both missionaries and total church membership, but because the number of missionaries and the size of the church are so tightly correlated I would face an insurmountable multicollinearity problem. For the purposes of this section I am going to assume that the decrease in converts-per-missionary is due in part to the efforts of missionaries and not just to the efforts of member-missionaries.

It's hard to imagine a more homogenous group of people than the Mormon missionaries. They all dress alike, are approximately the same age, follow the same rule book, and use the same strategies and tactics to gain converts. However, this component of the exponential growth of the church is concerned with their homogeneity in their propensity to gain converts, not their appearance and standards.

Approaching this as an Economist would, the Church tries to distribute missionaries around the world in a way that meets 2 conflicting objectives—to maximize the number of baptisms constrained by a desire to give a minimum level of coverage to all geographic areas where the church has a presence. Once that balance is reached, the Economist would predict that the marginal effectiveness of additional missionaries would be lower than the average effectiveness of those already in the field. This is because the new missionary will be assigned to the marginal areas—the areas of the world that the church didn't believe were worth the cost of a missionary—until that marginal missionary arrived. If one subscribes to this theory, that in itself would be enough to stunt exponential growth (unless the dynamics were such that a growing church could keep a growing number of missionaries productive).

Chart 3 shows the number of converts the church has baptized each year. The yellow line is the number of baptisms needed to sustain exponential growth at a rate of 50% and the blue line is the actual number of converts. Before 1990 it appears that the number of converts were following the exponential growth pattern, perhaps with a cyclical component. But in 1990 the number of converts hit a ceiling of 331,000 that has not since exceeded.

This shows that the theory of the marginal effectiveness of missionaries is not enough to explain the level of baptisms because the marginal effectiveness of additional missionaries would have to be zero to explain this.

One part of the problem is that there are two distinct classes of missionaries. The first class is the young men and women who rigorously follow the rules with the objective of gaining convert baptisms. The second class is retired couples who work fewer hours and usually have a primary objective other than gaining convert baptisms. There has been a big push for the last several years for retired couples to go on missions, and no doubt some of the increase in number of missionaries is due to more couples.

But that still doesn't explain why the number of baptisms hasn't gone up, at least a little. Consider the following anecdote.

From December of 89 to March of 90 I served as a missionary in the town of Guernica in the providence of Buenos Aires, Argentina. At the time Guernica had about a dozen active members and met in a branch located in the near-by town of Alejandro Korn. There was only one set of missionaries in Guernica, and they were effectively baptizing people.

Three years later in March of 1993 I returned and married a girl from that town. By that time Guernica had about 50 active members with its own chapel. In 1994 a second set of missionaries was added. From 1994 until now, the efforts of 2 sets of missionaries in that town have resulted in no appreciable gain in the number of active members--for every person those missionaries baptized, somebody went inactive.

This leads me to believe that in at least some areas of the world, the church is beyond the stage of exponential growth and is approaching its carrying capacity.

Why the first condition is met merits further consideration. In the previous section I suggested that the new converts to the church are less dedicated than the established membership. If that is true and the church is getting more and more bloated with undedicated new members, why is it successful at maintaining .55% (.0055) of the total church population as full time missionaries? To the extent that converts come from the efforts of missionaries and not members, maintaining this ratio is all the church needs to do to satisfy the internal requirements of exponential growth.

My experience has led me to believe that the missionaries baptize a disproportionate number of teenagers. This shouldn't be surprising—teenagers are more likely to be open to new philosophies are in the process of expanding their social networks. Furthermore, they are more likely to look up to the missionaries as spiritual mentors. If this is true, then the reason why the church has been able to keep sending out more and more missionaries is because the missionary program baptizes a higher percentage of potential missionaries than the percentage of potential missionaries the church has as a whole. The other factor worth considering is whether or not more established Mormons are going on missions. The church has put a lot of pressure on older couples to go on missions, as well as relentless pressure for all young men to serve. Some of the growth in the missionary force is due to more elder couples going, and some of it is also probably due to a higher percentage of established members going. The successful economy of the 90's possibly allowed some to go that wouldn't have in less prosperous times.

The church has two big issues with conversions from the efforts of missionaries. The first is finding people to teach. The second is establishing relationships between the members of the church and the investigators. It is extraordinarily common for investigators to develop bonds with a particular missionary and begin the conversion process of bringing their religious behavior into alignment with his. But as soon as that missionary gets transferred the investigator looses interest in the church, whether it be before or after his or her baptism. So even if the church continues to get more missionaries, it has got to do a better job of absorbing investigators into the social network.

Children Born into the Church

We know that there are many people who join the church, discontinue participating in it, and yet remain on the rolls. The strength of the church isn't the number of people whose names are on the rolls, but rather the number of people who subscribe to its teachings and are dedicated to it. Unfortunately the church does not make public many of the statistics (such as number of temple recommend holders) that could help us gauge the dedication level of its membership.

Perhaps the best statistic available to gauge the strength of the church is the "Increase in Children of Record" statistic. If someone is at least marginally dedicated to the church, when their children are a month or two old they will take the child to church for a blessing and the child's name will be recorded by the church (The child won't be counted as a member until they join the church by being baptized when they are older). If their name is on the rolls of the church but they don't participate, they most likely won't take their children to get blessed and recorded by the church.

Chart 4 shows the number of children the church has blessed in each of the last several years.[6] The blue line is the number of children actually blessed, and the pink line is the number it needed to bless in order to sustain 50% per decade growth rates. Interestingly, the church exceeded that exponential growth rate until 1983, at which time the number of children blessed started to go down.

This is a surprising observation. Since 1983 the total membership of the church has gone up by 100%, so for exponential growth we'd expect the number of children being blessed each year to go up by 100%. But rather than going up by 100% it has gone down by 34%.

Certainly lower across-the-board birth rates are a part of this phenomenon. About 75% of the new members since 1983 are converts, and we wouldn't expect converts to have as many children as the traditional Mormon families, as large families is more of a cultural convention than a doctrinal one. Also it is possible the demographics of the new

[6] From 1989 through 1996 the church did not make this number public, so I interpolated for those years.

membership have something to do with it. But this could also indicate that the percentage of Mormons that take their religion seriously enough to have their children blessed is going down. Be the reason for the declining birthrate what it may, it indicates that birthing is not carrying its weight in growing the church exponentially.

Competition

The Mormon religion is but one of many religions and life philosophies competing for the dedication of individuals. It is beyond the scope of this paper to investigate the specific strengths and weaknesses of the LDS faith. However, we can measure how well it is competing in the market of religion.

The following religions all have faster growth rates than the LDS Church:

1. Seventh-day Adventists
2. Assemblies of God (Pentecostal)
3. Pentecostals
4. Jehovah's Witnesses
5. Evangelical Christians[7]

Of these 5 movements, only the Jehovah Witness movement is smaller than Mormonism in total membership. There is no way the Mormon Faith can grow exponentially to hundreds of millions of members without cutting deep into the current and projected memberships of these other faiths.

The size of the LDS Church does not grow in a petri dish--it grows in a world with many different religions that are engaged in fierce competition for the dedication of people. If we look at the size of these various religions and the rates at which they are growing, it is hard to construe the LDS Church as the one that has the competitive advantage.

Without a significant competitive advantage over other religions, Mormonism cannot grow to become a major world religion, but rather will be constrained to filling a relatively small niche in the religious ecosystem.

Membership Model

Deterministic Model

We said in equation (1.1) that when something is continuously growing at an exponential rate it can be represented by

$$s(t) = A \cdot e^{d\ t}$$

[7] http://gatheringofisrael.com/gospelclock/

In this formula, the variable d can be thought of as the *force of growth*—as long as d is a constant then the size of the church $s(t)$ will grow exponentially, but the larger d, the faster the exponential growth.

The constant d can be calculated by the formula

$$d = \ln\left[\frac{s(t+1)}{s(t)}\right] \tag{4.1}$$

Over a 1-year period, the growth of the church can be broken down into 3 components, growth due to convert baptisms is denoted *b*, growth due to children of record being baptized is denoted *c*, and decrements due to people leaving the church through death, excommunication, or voluntary name removal are denoted *d*. Thus the number of members at time $t+1$ is equal to

$$s(t+1) = s(t) + b + c - d \tag{4.2}$$

Substituting (4.2) into (4.1) results in the formula

$$d = \ln\left[\frac{s(t)+b+c-d}{s(t)}\right] \tag{4.3}$$

Which is equivalent to

$$e^{d} = \frac{s(t)+b+c-d}{s(t)} \tag{4.4}$$

So for the church to grow at a constant exponential rate, the following must be constant for all years:

$$\frac{b}{s(t)} + \frac{c}{s(t)} - \frac{d}{s(t)} \tag{4.5}$$

That is nothing other than the annual growth rate, broken down into 3 components.

But what if the value of d changes from year to year, or for that matter, from moment to moment? Let $d(t)$ be the value of d at any given point in time. Assuming that the function $d(t)$ is continuous, formula (1.1) can be generalized as[8]

$$s(t) = A \cdot \exp\left[\int_0^t d(s)\ ds\right] \tag{4.6}$$

---

[8] $\exp[x] = e^{x}$

Stochastic Model

Assume the function $d(t)$ is of the form

$$d(t) = a + bt + e \tag{5.1}$$

Where e is normally distributed with a constant variance. If the church is growing at a constant exponential rate, then b will be equal to 0. The question is, what are the correct values of a and b ?

Table 1 shows 18 years of membership data. If we set $t = 0$ to the year 1983, then running a least-squares regression results in $a = 0.051883$ and $b = -0.0011220$. Table 2 shows the ANOVA for the regression and chart 5 shows the fitted line and the measured delta.

The null-hypothesis is that $b = 0$. This is the scenario where the church is growing at a constant exponential rate of $d = a$, and the year-to-year variations from that are due to random fluctuations. The F-statistic of 4.65 with 16 and 1 degrees of freedom means that we can reject that hypothesis at the 95% significance level. In other words, we can be 95% certain that the decrease in d over this time period has not been to random chance, but rather to an underlying trend.

There are 2 anomalous points on chart 5, corresponding to the years 1989 and 1990. Why did d almost double in 1989 and then go back down? To answer this, let's look at Chart 6 (Table 3), the 3 components of the annual growth rate (value of formula (4.5)) over the same time period.

The light blue area is the percentage growth of the church due to children of record being baptized. The purple area (down to the axis) is growth due to convert baptisms. The red area is the percentage of people who leave the church each year for any reason. So, the area from the top of the light blue to the top of the red line is the net-amount that the church grew each year.

During the 18 years on the chart, there were 4 years that the number of decrements was negative(!). For example, on January 1 1989 there were 6.72 million members of the church. 75 thousand children of record joined the church, and 318,940 converts joined. This would lead us to believe that there were 7.114 million members on Dec 31 1989, less that year's decrements. But the reported membership for Dec 31 was 7.3 million. In other words, even though only 394,000 people joined the church that year, the reported number of members grew by 580,000.

There are only 2 possible explanations. One explanation is that 580,000+ people really did get baptized that year but for some reason they weren't all counted in the baptismal statistics. The other explanation is that people that weren't previously counted as members had their status changed to members that year, without the benefit of baptism. The second explanation is more likely. It's possible that the church previously assumed that everyone in a set of long-lost members was dead, but retroactively decided to assume they were alive. Or it's possible that they decided to include un-baptized children as members. In other words, the way members and non-members were delimited was changed.

Be the explanation what it may, it is an anomalous data point that adds no value to the study. There are at least two ways it could be handled. We could try to guess when in the previous years those names were inadvertently removed from the membership count and replace them in those years. Or we could simply remove that observation from the regression. The first method of restating previous membership levels would cause the church growth levels to be higher in each year before 1989 were members would be added. This would show a more radical drop in the growth rates. The problem with this is we don't know how many people should be added to each year, and would thus be distorting the data.

If we remove 1989 as a data point the slope of the regression line is more flat, (-0.000913) but at a lower y-intercept (0.04787). Chart 7 compares the two regression lines. By removing the one datum the F statistic more than doubles to 10.358, giving a strong indication that the underlying growth rate of the church is in fact slowing down.

Growth Predictions

If we extrapolate the fitted force of growth lines from the previous section and calculate the resulting size of the church, the membership grows approximately linearly for the next 15 or so years and then begins to slow down. Including the 1989 anomaly in the fitted growth line the church will max out at 17.5 million members. Excluding the 1989 anomaly the membership will peak at 18.5 million. Chart 8 shows these patterns.

In (5.2) we suggested that the force of growth of the church is of the form

$$d(t) = a + bt + e$$

This was the appropriate model to use to test the hypothesis that the growth of the church is exponential. Now that we have rejected that hypothesis, we need to consider if this is a functional form that we should extrapolate.

The biggest drawback of this form is that its slope remains constant as $d(t)$ approaches zero. This seems a bit unlikely—intuitively it is more appealing for the growth rate to asymptotically approach zero. Consider the following function form:

$$d(t) = a \cdot e^{bt} \tag{5.3}$$

This meets the criteria of the declining rate of growth gently approaching zero, and is the simplest form with that property to regress. The law of parsimony would suggest that we look at how this fits.

Interestingly, using this functional form the estimates of a and b with and without the 1989 anomalous datum are quite close, with F statistics of 7.86 and 13.4 respectively. Chart 9 shows the growth of the church according to this model and table 4 shows the ANOVA (for the regression including the 1989 anomaly). Chart 10 shows a graph of the error terms. From 1983 to 1990 there is some strong autocorrelation. This might be explained by the unexplained growth of 1989 and 1990 being corrections for understated growth in the previous years. From 1991 to 2000 there is no apparent autocorrelation or heteroscedasticity; at least in the later years the model fits the data well and appears to meet the necessary assumptions of constant, uncorrelated errors.

Using membership data from 1844 to the present Duwayne Anderson fit the total membership of the church to a logistics curve.[9] Chart 11 compares my predictions to Anderson's and Stark's.

Conclusion

For the church to grow exponentially it must do two things: first it must baptize new members that are just as productive at generating new members as the established members. Second it must be in an environment where it has a competitive advantage. The church is doing a good job of baptizing people who are willing to go on missions, but a poor job of baptizing people who have lots of children that they raise in the church. It probably isn't doing a very good job of producing new members who are active in the church and thus part of a growing social network. Many other religions are growing faster than Mormonism, and it is unclear how Mormonism would have a competitive advantage over those religions.

Despite increasing the member base and missionary force by 50% over the last decade, the church has been unsuccessful at increasing the number of baptisms by even 1%. When we look at the actual growth rate of the church from 1983 to 2000 there is strong statistical evidence that the slowing growth is due to an underlying trend rather than random fluctuations.

Looking forward the question is will the growth rate continue to go down, bottom out, or rebound? The above factors lead me to believe that it will continue to go down, but at slower rates, reaching about 30 million members by the year 2080.

[9] http://www.lds-mormon.com/churchgrowthrates.shtml