The Price of Faith: Economic Costs and Religious Group Membership in Sub-Saharan Africa*

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Abstract

How do economic costs affect religious group membership, and how do religious organizations respond to exogenous changes in membership costs? We study these questions in the context of the Seventh-Day Adventist (SDA) church in Sub-Saharan Africa. The SDA church prohibits or strongly discourages tobacco, coffee, and tea production, leading opportunity costs of membership to vary based on local crop suitability and global prices. We construct a measure of SDA membership opportunity cost that varies over time and space. Using detailed church data alongside SDA member surveys, we analyze responses by both members and the church itself. We find that increased opportunity cost of membership leads to fewer new memberships, and more self-reports of struggle and doubt about spiritual beliefs among current members. In turn, the church pursues offsetting responses, establishing educational institutions (generating new benefits of membership) and potentially reducing emphasis on some religious tenets (reducing the costs of membership). This study provides new insights that individuals and religious organizations actively respond to economic incentives in the religious marketplace.

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1. Introduction

Religious institutions play a major role in shaping economic behaviors, social norms, and development outcomes worldwide (Iyer, 2016; Seabright, 2024). In recent decades, the rapid expansion of certain religious groups, particularly in developing regions like Sub-Saharan Africa, has drawn increasing attention from economists and policymakers alike (Pew Research Center, 2010). This growth raises many questions about the interplay between economic factors and religious affiliation. When people make decisions on joining religious groups, to what extent do they trade off benefits and costs in ways analogous to other decisions in economic life? In particular, how much do people weigh economic costs in deciding whether to join religious groups? And when members (and potential members) are faced with exogenous changes in the economic costs of membership, how do religious organizations respond?

In this paper, we study the extent to which peoples' decisions to join religious groups depend on the *opportunity costs* of joining. We also ask what religious organizations do in response, when there are changes in the opportunity costs of membership in their groups. In general, the traditions or ethical precepts of particular religious groups may impose opportunity costs on their members. For example, religions can prescribe the types of occupations in which adherents can and cannot work. Examples include the prohibition on usury in the early Christian church (Ihssen, 2012; Visser and McIntosh, 1998), as well as Hindu caste-based occupational prescriptions (Goghari and Kusi, 2023). In addition, they may prohibit consumption as well as production of certain foods, for example in Islamic *halal* (El-Zibdeh, 2009) and Jewish *kashrut* (Forst, 1993) dietary rules. These and other prohibitions impose opportunity costs (e.g., lost income from prohibited occupations, as well as non-monetary costs) on members of religious groups.

Studying the causal impact of opportunity costs on religious group membership presents significant methodological challenges. The first challenge is simply *measurement*: the opportunity costs of membership in a particular religious group can often be difficult to quantify. In addition, there are pervasive threats to causal identification. There may be *reverse causation*: changes in religious group membership may cause changes in the opportunity costs of membership. For example, a religious group facing an exogenous negative shock to its membership numbers may respond by loosening occupational or other restrictions so as to lower the opportunity costs of membership (leading to an upward bias in the association between opportunity costs and membership counts). *Omitted variable bias* is also a serious concern: third factors may determine both opportunity costs and religious group membership. For example, economic development may change opportunity costs of having to avoid certain occupations (e.g., in agriculture), and also change religious group membership (with unclear direction of bias).

We study the impact of opportunity costs on religious group membership in a context that allows us to address challenges in measurement as well as causal identification. We study one of the world's fastest-growing religions, the Seventh-Day Adventist (SDA) church, in Sub-Saharan Africa. The SDA church places heavy emphasis on healthy living, and thus prohibits or strongly discourages production of tobacco, coffee, and tea. The opportunity cost of joining the SDA church due to these production prohibitions varies over space (owing to variability in the suitability of land for these crops) and over time (as world prices of these "prohibited" crops change). We exploit temporal price variation and spatial crop-suitability variation to construct a time-varying and local measure of the opportunity cost of SDA membership in Sub-Saharan Africa.

Sub-Saharan Africa is an attractive context for our investigation. The region has a high prevalence of both Christian and Muslim religions and traditional religions, with substantial recent changes over time in religious composition, making it an ideal part of the world to study how economic incentives affect religious decisions. Sub-Saharan Africa also likely has greater sensitivity to crop price shocks than other areas of the world, giving us greater statistical power to detect effects of variation in opportunity costs.

The key right-hand-side (causal) variable in our analyses is a quantitative measure, in money terms, of the opportunity cost of membership in the SDA church in a particular location. The opportunity cost variable is the revenue given up per hectare from following SDA restrictions on the production of tobacco, coffee, and tea. We construct this measure at a fine-grained level (9 km by 9 km grid cells) using (time-invariant) data from FAO GAEZ on potential crop yields as well as FAO data on (time-varying, annual) export crop prices. The measure accounts for potential yields and prices for dozens of crops, and is the difference between "unconstrained" maximized revenue on a grid cell and "constrained" maximized revenue if one follows SDA prohibitions and avoids producing tobacco, coffee, or tea. For every 9-km grid cell in Sub-Saharan Africa, in each of 28 years from 1991 to 2019, we calculate the opportunity cost of SDA membership. We then take the mean across grid cells for localities for which we have SDA membership data, year by year; this results in a measure of the opportunity cost of membership that varies over space and time (i.e., at the locality-year level).

We conduct empirical analyses with annual outcome data at the level of sub-national localities for which the SDA provides public data on their membership counts (and other local-level statistics). The SDA church makes public unusually detailed demand (membership) and supply-side (church actions) data. The SDA church also made available to us the microdata of a survey of SDA members which we use to examine members' self-reported religious attitudes and behaviors. Our main analyses cover the years 1991-2019.

Our empirical analyses involve running panel regressions on annual data at the level

of localities in Sub-Saharan Africa. Our opportunity cost measure – agricultural revenue given up per hectare due to abiding by SDA crop restrictions – is constructed from the combination of time-invariant geographic/climate characteristics and world crop prices, and so is immune from reverse causality concerns (i.e., SDA membership counts cannot plausibly affect the opportunity cost variable). The key identification assumption is that the opportunity cost measure is uncorrelated with omitted variables that may also affect local membership counts. The main concern on this front is that the opportunity cost measure is highly correlated with local income, particularly in areas suitable for tobacco, coffee, or tea production.[1] If shocks to income in general affect religious group membership, this would confound our interpretation of the opportunity cost variable. We address this concern by including in the regression a measure of *unconstrained* maximized income at the local level, whose variation is driven by crop suitability and crop prices across *all* crops. SDA membership is unaffected by this variable, and the coefficient on our opportunity cost variable is also unaffected by inclusion of the unconstrained income variable. We conclude that our opportunity cost measure is not capturing effects of general income shocks, but instead should be narrowly interpreted as the impact of prohibitions from growing SDA-prohibited crops (tobacco, coffee, and tea).

We find that increases in opportunity costs lead to declines in new memberships in the SDA church. The effect is not particularly large, but also not trivial: a 10% increase in opportunity cost leads to a 0.4-0.5% decline in new memberships. In addition to declines in new memberships, individuals who remain as members of the church increasingly question their membership in the church when the economic costs of membership rise: they have greater propensity to report "spiritual struggle" in the SDA's own member surveys.

The modest magnitude of the decline in new memberships makes sense when considering supply-side responses: the church appears to respond to increases in opportunity costs in offsetting ways. First, we find that increases in opportunity cost lead to establishment of new educational institutions; these are likely to generate new (and local) benefits of membership, offsetting at least part of the increased opportunity costs of membership. In addition, the church may also respond to the increased opportunity costs directly by reducing the emphasis placed on the church's healthy-living prescriptions, which undergirds the prohibition on coffee, tobacco, and tea. Such reductions in emphasis are hard to measure at the location-year level of our analyses, but we can measure the result of any such changes in emphasis: church member adherence to healthy-living prescriptions. We find evidence from the SDA member survey that increases in opportunity costs lead to more violations of the church's prescriptions on healthy living – namely,

[1]Given the construction of the measure, it would be negatively correlated.

more consumption of alcohol and tobacco. This result provides indirect evidence that the church responds to higher opportunity costs by reducing the emphasis on religious prohibitions that cause those opportunity costs to begin with.

Our findings shed new light on the economics of religion in an important region of the world where religious change is substantial and ongoing. Individuals take opportunity costs of membership into account when deciding whether to join a new religion. Existing members experience spiritual doubt about their religion in response to the same increase in opportunity cost. At the same time, churches do not remain complacent, and respond dynamically to increases in opportunity costs by providing offsetting benefits and possibly reducing emphasis on the religious prescriptions that are the source of the opportunity costs in the first place. These results are all new in the context of the prior literature on the economics of religion.

Our work is related to a body of research on the economics of religion (see Iyer, 2016; Becker et al., 2021, 2023; Seabright, 2024, for reviews). First, we contribute to a literature examining the demand side of religion. An influential strand of studies has explored how economic conditions and shocks influence religious adherence (e.g., Barro and McCleary, 2003; Chen, 2003; Henrich et al., 2010; Durlauf et al., 2012; Ager and Ciccone, 2018; Bentzen, 2019a,b; Auriol et al., 2020; Dube et al., 2022; Pope, 2024). Related work has explored the drivers of religious conversion across countries (Barro et al., 2010; Barro and McCleary, 2024). In this paper, we examine how specific economic conditions – the opportunity costs of religious prohibitions – influence adherence and conversion in Sub-Saharan Africa.[2]

Our paper also contributes to the literature that studies religious prescriptions and taboos (e.g., Iannaccone, 1992; Stifel et al., 2011; Levy and Razin, 2012, 2014). A related body of work has explored how religious prescriptions influence identity and religiosity (Iannaccone, 1992; Bénabou and Tirole, 2011; Chen, 2010; Atkin et al., 2021). In this paper, we build on this work by providing new evidence revealing the causal impact of the opportunity cost of religious prescriptions on decisions to join a new religion, as well as on current members' attitudes and adherence to religious tenets.

Finally, we also contribute to the literature on the supply side of religion. Our paper is related to studies of how economic conditions and religious market structure affect religious conversions and adherence (Iannaccone, 1991; Finke and Stark, 2005; Gruber and Hungerman, 2008; Hungerman, 2014; Caicedo et al., 2023). Using detailed data on church personnel and the establishment of institutions (churches, schools, and health facilities), we study how economic costs influence the actions of the church. We also study,

[2]More broadly, our study also contributes to work on the religious landscape in sub-Saharan Africa (e.g., Nunn, 2010; Alesina et al., 2020; Le Rossignol et al., 2022).

indirectly, how a church's emphasis on adherence to particular religious prohibitions changes when the opportunity cost of those prohibitions changes.

This paper is organized as follows. In the next section, we provide an overview of recent trends in religion in Sub-Saharan Africa, as well as for the Seventh-Day Adventist Church in particular. Section 3 describes the data and Section 4 presents the empirical strategy. Section 5 presents our main results on the impact of the economic cost of membership on demand (membership) and supply, and explores heterogeneity in the impacts. Section 6 presents the results using surveys of SDA members to examine the impacts of changes in opportunity costs on SDA member attitudes and on adherence to religious tenets. Section 7 concludes.

2. Religion in Sub-Saharan Africa

The religious landscape of Africa has undergone significant transformations in recent decades, characterized by rapid growth and shifting denominational allegiances. Christianity and Islam, in particular, have seen substantial expansion across the continent, often outpacing population growth (Zurlo, 2024). This religious boom has been especially pronounced in Sub-Saharan Africa, where Christianity has experienced remarkable growth since the mid-20th century (Jenkins, 2011). By 2020, nearly two-thirds of sub-Saharan Africans identified as Christian, making it one of the most Christian-populous regions in the world (Zurlo, 2024).

This religious expansion has been accompanied by a rise in the diversity of Christian denominations and movements across Africa. Pentecostal and Charismatic churches have seen particularly rapid growth, often blending traditional African spiritual practices with Christian theology (Anderson, 2013). Concurrently, many mainline Protestant denominations and the Catholic Church have also experienced significant growth, albeit at a slower pace (Jenkins, 2016). This religious fervor has not been limited to Christianity; Islam has also seen substantial growth in certain regions, particularly in West and East Africa (Hill, 2009). The dynamic religious environment has had profound implications for social, economic, and political spheres across the continent, influencing everything from voting patterns to economic behaviors and social norms (Ellis and Haar, 2007).

Within this dynamic religious landscape, the Seventh-Day Adventist (SDA) Church has emerged as one of the fastest-growing Christian denominations in Africa (Adogame et al., 2008; Llywelyn, 2022; University of Aberdeen, 2020). From its initial footholds established in the early 20th century, the SDA Church has expanded rapidly across the continent, with particularly strong growth in Eastern and Southern Africa (Höschele, 2007). This growth has occurred despite, or perhaps partly because of, the church's

distinctive doctrines and lifestyle practices, which set it apart from many other Christian denominations in the region.

2.1. The Seventh-Day Adventist Church

The Seventh-Day Adventist Church, founded in 1863 in the United States, is a Protestant Christian denomination known for its emphasis on the Second Coming of Christ and observance of the Sabbath on Saturday (Land, 2005). Since its inception, the SDA Church has experienced significant global growth, becoming one of the fastest-growing Christian denominations worldwide. As of 2021, the church reports a global membership exceeding 21 million, with a substantial presence in Sub-Saharan Africa (Office of Archives, Statistics, and Research, 2022).

Central to SDA doctrine is the concept of holistic health and wellness, rooted in the belief that the human body is the temple of the Holy Spirit (General Conference of Seventh-day Adventists, 2024). This belief translates into a set of lifestyle practices and prohibitions that distinguish SDAs from many other Christian denominations. Among the most notable of these are strong discouragement of or prohibitions on the consumption and production of tobacco, coffee, and tea (General Conference of Seventh-day Adventists, 2022).

The SDA Church strongly discourages the use of tobacco in any form, viewing it as harmful to health and incompatible with Christian stewardship of the body (General Conference of Seventh-day Adventists, 2022). This prohibition extends beyond personal use to include the cultivation and production of tobacco. Similarly, the church advises against the consumption of caffeinated beverages, particularly coffee and tea, citing concerns about their addictive properties and potential negative health effects (Wilson, 2017). While not as strictly enforced as the tobacco prohibition, many devout SDAs abstain from these beverages and their production (Brody, 1986).

These prohibitions have significant economic implications, especially in regions where tobacco, coffee, or tea are important cash crops (Prowse, 2013). In parts of Sub-Saharan Africa, where these crops are often crucial to local economies, the decision to join the SDA Church may represent a substantial economic sacrifice for individuals and communities. Despite these economic challenges, the SDA Church has seen rapid growth in Sub-Saharan Africa (Office of Archives, Statistics, and Research, 2019).

3. Data

We study the impact of opportunity costs of membership in the SDA Church on new memberships and on church actions in response. We also are interested in impacts on

existing members' attitudes and adherence to religious tenets. Studying these questions requires assembling a range of datasets, many of which have not previously been used for research in economics.

3.1. Membership and Church Actions

We obtained data on membership in the SDA church from the SDA Office of Archives, Statistics, and Research (ASTR). The ASTR's public website offers a wealth of information, including official church publications and detailed datasets on the church's global presence, with data starting as early as 1863 for each available geographical area. Using the website's structure – which follows the church's organizational structure – we extracted yearly membership information at the lowest level of the SDA church's administrative divisions for each country.[3] For the remainder of this paper, we will refer to these sub-national divisions of varying sizes as SDA *localities*. For each locality, the data contains counts of the stock and flow of membership, including the number of baptisms, new membership gains, transfers, and member deaths, among others, for each year. Appendix Figure A1 displays an example of the web page for one locality, and Appendix Section A.1 provides definitions for each variable in the ASTR dataset.

The primary demand-side outcome variables in our analyses below are 1) total gains and 2) total losses. Total gains are defined as the total number of members added by all methods, including baptisms, former member baptisms, or professions of faith. Total losses are defined as the total number of members removed from membership rolls, either by dropping membership or by being recorded as missing.

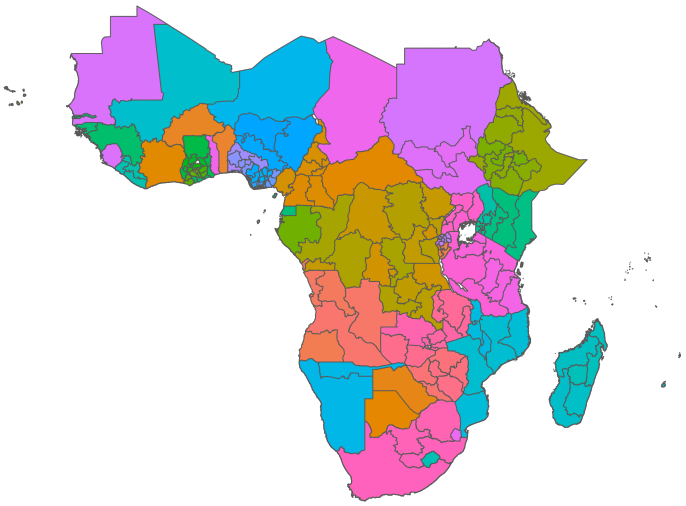
The primary supply-side outcome variables in our analyses are the number of churches, ministers, education institutions, and health institutions. We obtained the first two directly from the ASTR yearly statistics. Churches represent the total number of registered churches or "companies" (newer churches) for the locality in a given year. Ministers are the sum of different categories of ministers – "licensed" and "ordained" – in a given year.[4]

To obtain the counts of different types of institutions for our supply-side analysis, we systematically digitized the SDA Yearbooks – a yearly publication of the central branch of the SDA that serves as a directory of the SDA's organizational units and institutions (General Conference of Seventh-day Adventists, Archives, Statistics, and Research, 2023) – to extract the list of SDA institutions available year by year, using the listed addresses to geo-reference each institution and assign them to localities. We classified these institutions into education, health, and other institutions.

[3] Appendix A.1.2 presents a detailed description of the SDA administrative structure.

[4] See Appendix A.1 for variable details.

Figure 1: SDA Localities: 2020



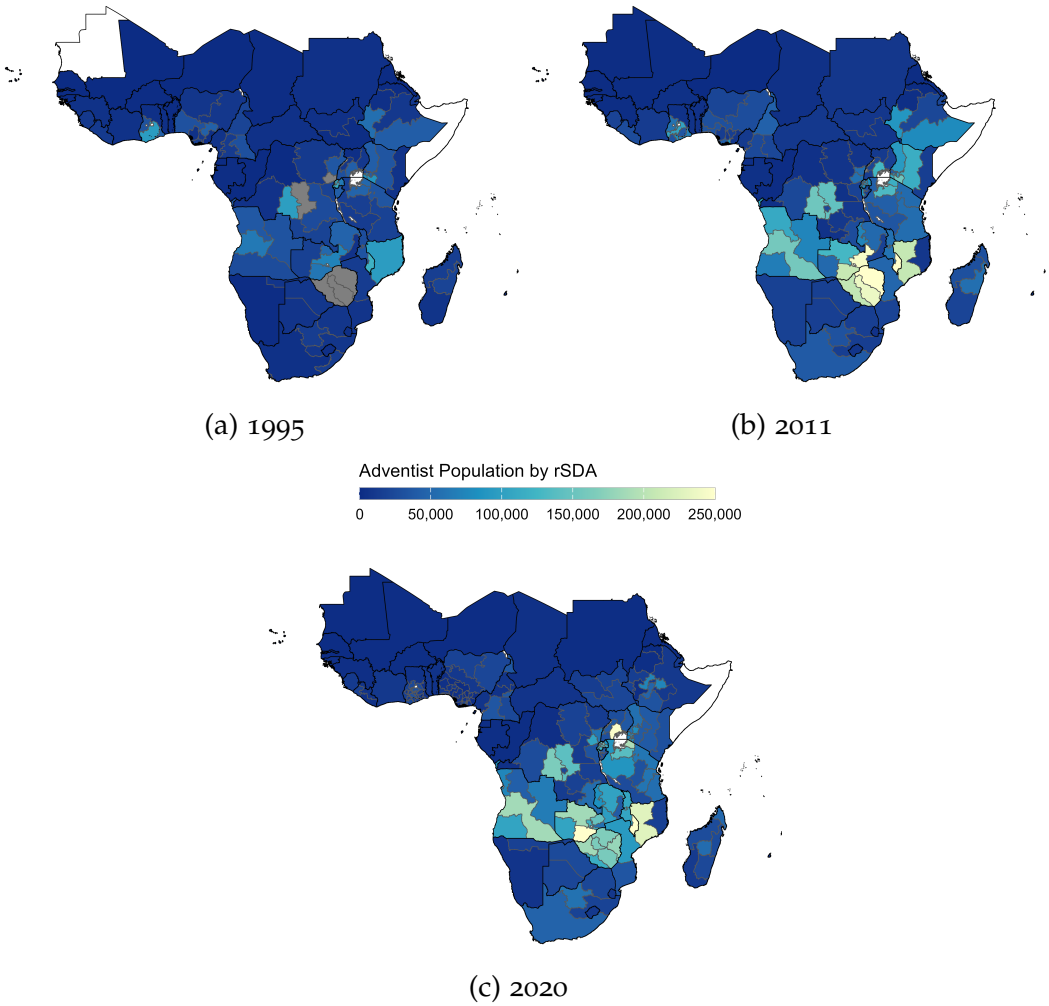
Notes: The figure presents a map of the 2020 SDA sub-national locality designations.

We focus on localities from 1991 onwards (through 2022 inclusive) due to completeness of data and widespread availability of data at the level of sub-national localities in Sub-Saharan Africa. To map each of these localities to countries' administrative divisions, we extract information from the SDA Yearbooks, a yearly publication of the central branch of the SDA that serves as a directory of the SDA's organizational units and institutions. These yearly publications contain lists of the geographic regions encompassed by each SDA organizational unit. Localities have slowly reorganized as their membership grows, usually splitting into smaller localities. This process naturally leads to an unbalanced panel. We follow each locality for as many years as it exists with the same geographical boundaries as indicated in the SDA Yearbooks. We use this information to construct unique shapefiles identifying these localities across time by combining the data with the GADM shapefiles from the Global Administrative Areas (Global Administrative Areas, 2022).[5] Figure 1 provides a map of the 195 SDA localities for 2020.[6] Figure 2 presents maps on the population size of Adventist membership across SDA sub-national localities for 1995 (a), 2011 (b), and 2020 (c).

[5]Appendix A.2 contains a detailed description of the definition and construction of geographic definitions of SDA localities.

[6]Appendix Table B2 provides summary statistics for the religious membership data.

Figure 2: SDA Population



(a) 1995 (b) 2011

(c) 2020

3.2. Opportunity Cost of Religious Membership

We aim to create a measure of the opportunity cost of adhering to SDA prohibitions on the production of tobacco, coffee, and tea that varies both over time and at the locality level. To do so, we use data on (time-invariant) locality-specific potential crop yields and (time-varying) global crop prices.

First, we use information that details at a very granular level – 9 km by 9 km grid cells – the time-invariant spatial variation in the suitability of the land for 38 different crops. These data come from the Global Agro-Ecological Zones (GAEZ v4) dataset of the Food and Agriculture Organization (FAO) of the United Nations in cooperation with the International Institute for Applied Systems Analysis.[7] Crop yield data are in kilograms of production per hectare.

[7]GAEZ is a multi-stage model that combines geographic, soil, and climate data to produce estimates of potential yields for specific crops. See Appendix A.3 for details.

The second component needed to construct the opportunity cost measure is time-varying crop export prices from 1990 onwards.[8] The prices are provided by the FAO's Food and Agricultural Trade Dataset (Food and Agriculture Organization of the United Nations (FAO), 2024), which includes export values and quantities at the country-year level. To mitigate the influence of country-specific economic shocks and capture broader regional trends, we use a weighted average of prices for Sub-Saharan Africa derived from export values and quantities.[9] Appendix Figure B3 presents a time series of average regional prices for prohibited crops (coffee, tea, and tobacco), and Appendix Figure B4 presents a time series of average regional prices for a subset of non-prohibited crops. These crop price data (and all data in money terms in this paper) are expressed in real 2010 US dollars.

With these two components – the (time-invariant) potential crop yields measures and (time-varying) annual crop prices – we calculate the opportunity cost of adhering to SDA crop prohibitions. This opportunity cost measure is the revenue given up per hectare from avoiding the production of tobacco, coffee, and tea. Specifically, let p index pixels (grid cells), t index years, and k index crops from the set of 38 crops (K) for which we have both export prices ($p_{k,t}$) and crop suitability ($s_{k,p}$). We first define the "unconstrained" maximum revenue as:

$$R_{p,t}^{max} = \max_{k \in K} \left(p_{k,t} \cdot s_{k,p} \right)$$

that is, the maximized revenue per hectare on a pixel (from selecting the revenue-maximizing crop from all possible crops for cultivation, given time-invariant crop yields and time-varying crop prices). Figure 3 presents maps of the highest unconstrained revenue-yielding crop across pixels for various years.

We then define the "constrained" maximum revenue as:

$$R_{p,t}^{constrained} = \max_{k \in K \setminus \{\text{tobacco, coffee, tea}\}} \left(p_{k,t} \cdot s_{k,p} \right)$$

that is, the maximized revenue per hectare if one follows SDA prohibitions and does not produce tobacco, coffee, or tea. Figure 4 presents a map of pixels that have prohibited crops as the revenue-maximizing crop, for different years.

We then calculate the opportunity cost of adhering to SDA production prohibitions for each pixel by taking the difference between the unconstrained and constrained maximized revenue variables. We define the opportunity cost of SDA membership as:

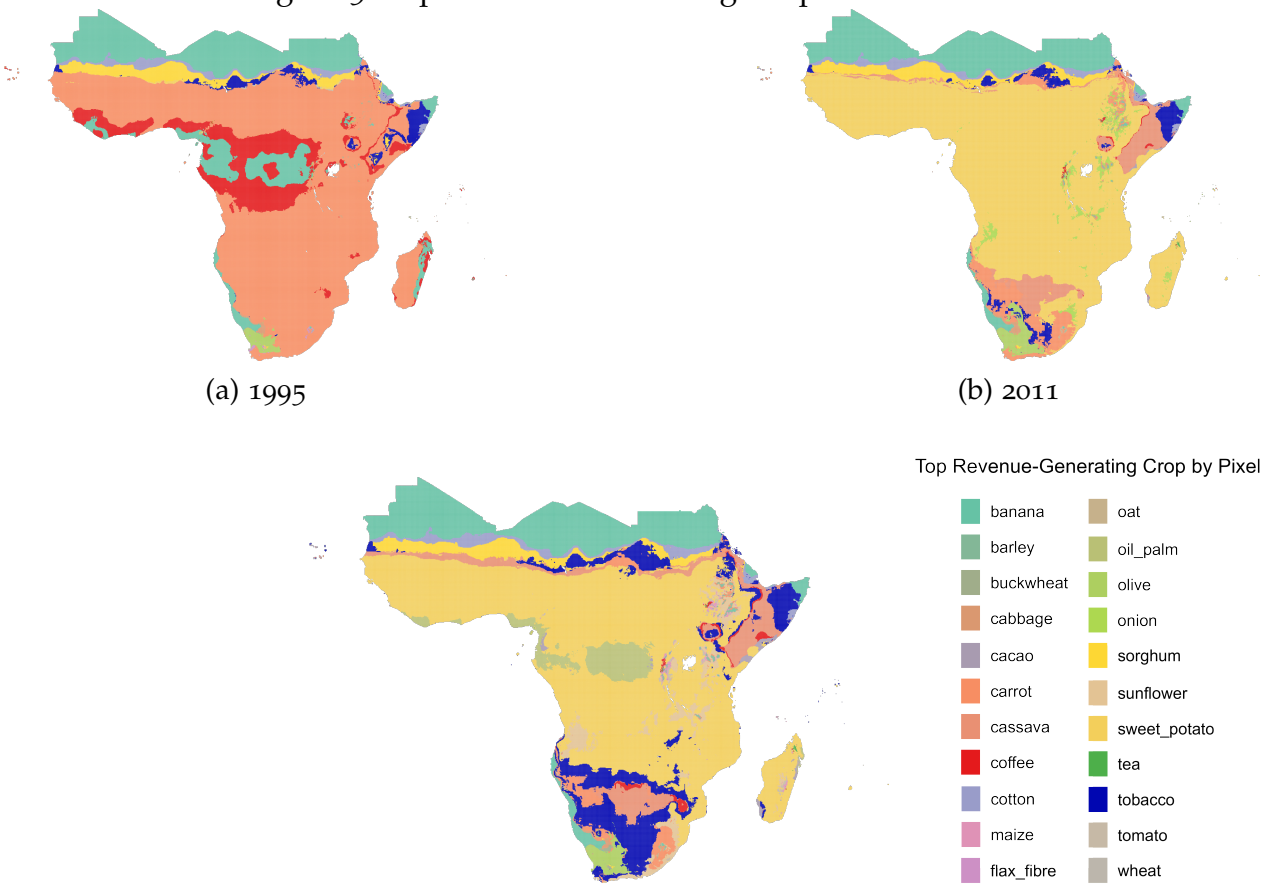
$$\textit{SDA Cost}_{p,t} = R_{p,t}^{max} - R_{p,t}^{constrained}$$

where positive values of $\textit{SDA Cost}_{p,t}$ indicate higher opportunity costs of religious membership. For pixel-years where the maximum revenue-generating crop is not a prohibited

[8] Appendix Table A.4 describes the concordance between GAEZ crops and FAO products.

[9] Appendix Table A.5 provides a detailed description of the construction of export prices.

Figure 3: Top Revenue-Generating Crop Across Pixels



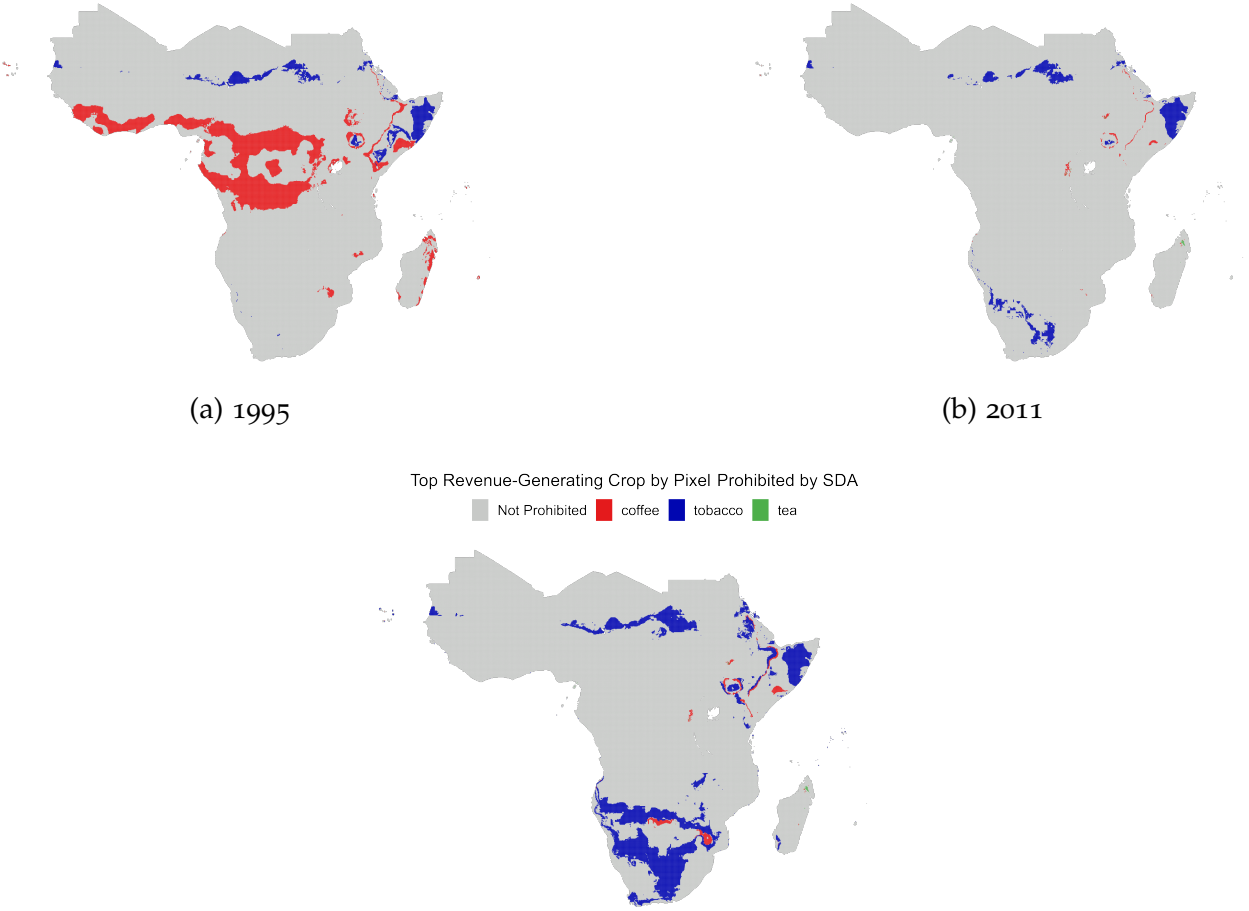
(a) 1995

(b) 2011

(c) 2020

crop, our measure is zero, implying that adhering to SDA prohibitions does not incur any opportunity cost in those cases. Figure 5 presents maps of this opportunity cost measure ($SDA\ Cost_{p,t}$) across pixels for various years.

Figure 4: Top Revenue-Generating Prohibited Crop for SDA



(a) 1995

(b) 2011

(c) 2020

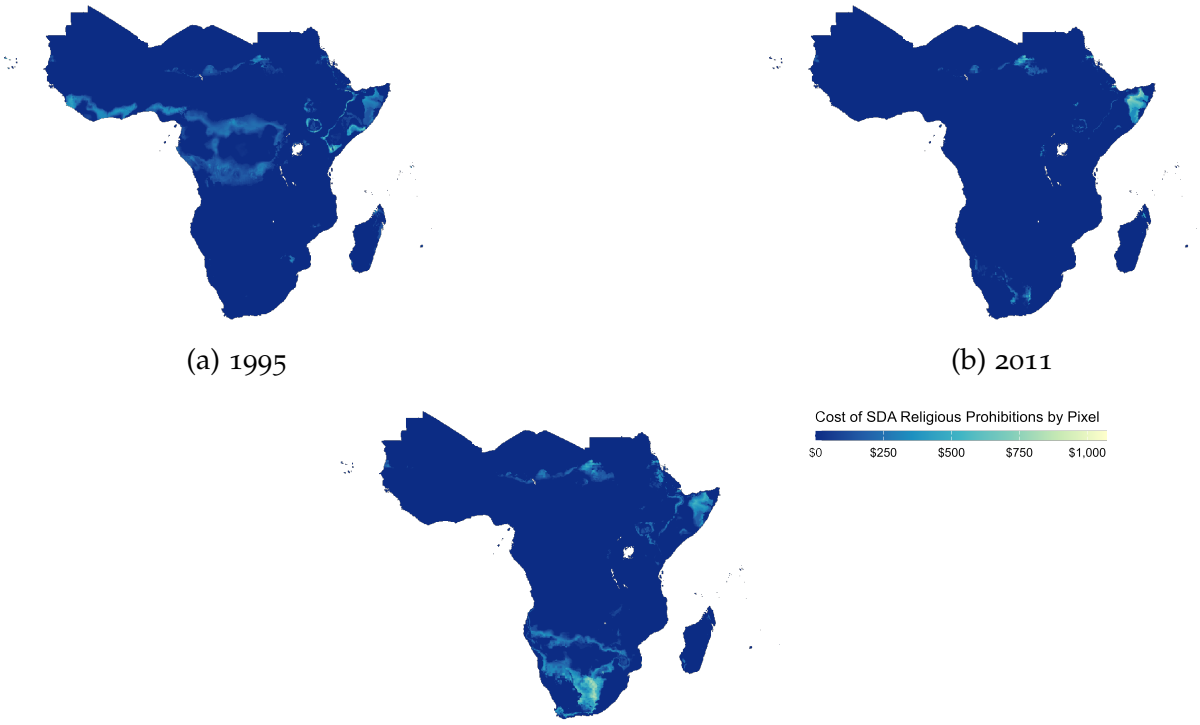
We aggregate this measure to the SDA locality level for each year. We take the average of the opportunity cost measure across pixels in a locality (indexed by l), where the average is weighted by pixel-level population.[10] This is interpreted as the opportunity cost of following SDA crop-production prohibitions in a given locality and year ($SDA\ Cost_{l,t}$). Figure 6 presents the opportunity cost measure across SDA localities for multiple years.

3.3. SDA Member Surveys

The SDA church conducts worldwide surveys of its members, collecting information on their individual and household demographic characteristics; religious behaviors, roles,

[10]To avoid placing weight on areas with little to no population, we use 1980 pixel-level population data from HYDE version 3.2.1 (Klein Goldewijk et al., 2017) to calculate the population-weighted average cost for each locality.

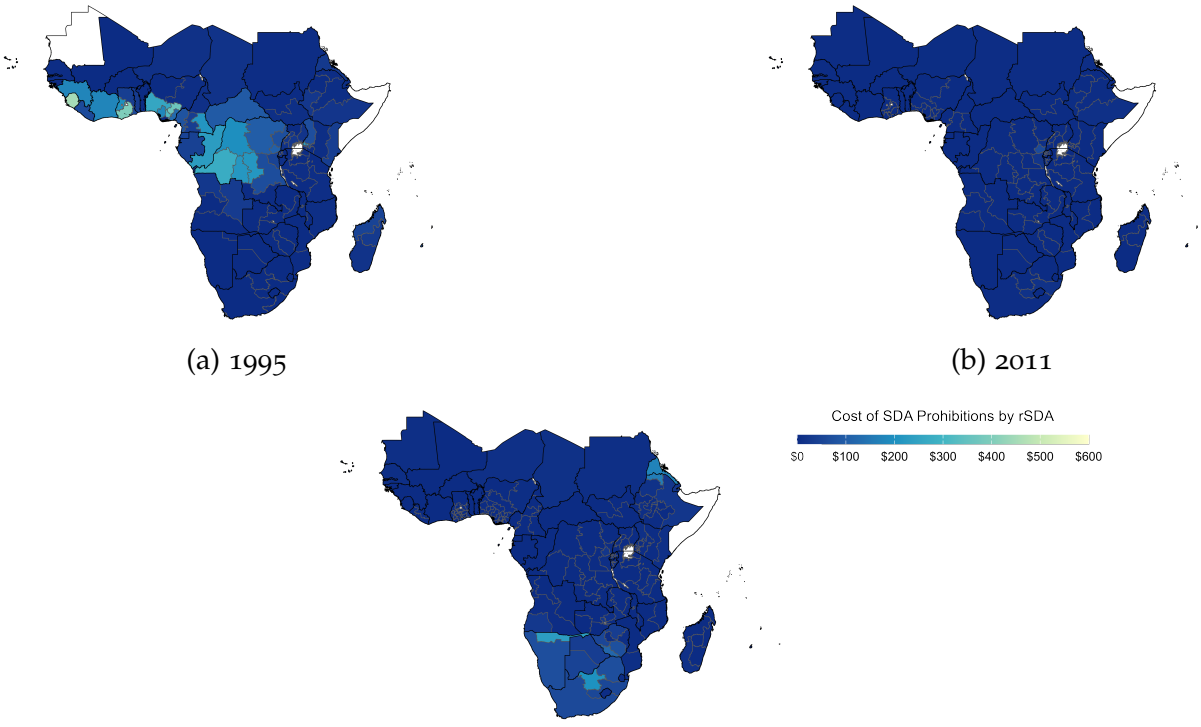
Figure 5: Pixel-level Cost of SDA Religious Crop Prohibitions



(a) 1995 (b) 2011

(c) 2020

Figure 6: Cost of SDA Religious Prohibitions by SDA Locality



(a) 1995 (b) 2011

(c) 2020

attitudes, and experiences; beliefs; and health. We focus on variables reflecting member beliefs and attitudes, such as members' spiritual struggle, as well as their usage of alcohol and tobacco. We use two rounds of the Global Church Member Survey (GCMS) conducted in 2017 and 2022. The lowest administrative division available in the GCMS that is comparable across multiple rounds is the respondent's country of residence, so our analyses of the GCMS data are conducted at that geographic level.

The primary outcome variables in our analyses from the GCMS survey are "spiritual struggle", alcohol usage, and tobacco usage. Spiritual struggle represents the average score of the answers to three questions (each on an integer 1-5 scale) on: whether they feel "spiritually lost", whether their "faith has been shaken", or whether they feel like they "have lost some important spiritual meaning". Alcohol and tobacco usage are binary variables that indicate whether the SDA member has consumed tobacco or alcohol during the reference period of the survey. Appendix A.6 provides further details on the GCMS and the variables we use. Appendix Table B4 presents summary statistics.

3.4. Additional Data Sources

We use several additional data sources. We use data from Li et al. (2020) to measure average nighttime light intensity in 1992 at the locality level to measure the level of economic development at the beginning of our sample. Appendix A.7 provides additional information on the construction of the nighttime light measures. We also use data from the Global SPEI Database (Vicente-Serrano et al., 2010) to measure yearly drought severity for localities. Appendix A.8 describes the construction of our drought measure. Finally, we use pixel-level estimates of population in 1980 from the HYDE version 3.2.1 data (Klein Goldewijk et al., 2017)

4. Empirical Strategy

We seek to estimate the effect of changes in the local, time-varying opportunity cost of adhering to SDA crop-production prohibitions on outcomes such as new SDA memberships as well as church actions at the locality level. In this section, we discuss our main estimating equation. We also provide evidence to validate the opportunity cost measure by showing that it predicts changes in crop production at the national level within Sub-Saharan Africa.

4.1. Estimating Equation

We estimate the effects of changes in the opportunity cost of SDA crop-production prohibitions using the following regression equation:

$$\log(y_{lt}) = \beta \log(\textit{SDA Cost}_{l|t,t-k}) + \nu_l + \phi_t + \epsilon_{lt} \quad (1)$$

where l indexes SDA sub-national localities, and t indexes years; y_{lt} is our outcome variable of interest (e.g., SDA membership in locality l in year t); $\textit{SDA Cost}_{l|t,t-k}$ measures the average opportunity cost of abiding by SDA crop prohibitions – the difference in potential revenue per hectare from following SDA restrictions on the production of tobacco, coffee, and tea, relative to the revenue per hectare from not being constrained by the prohibitions (as defined in Section 3.2) – in locality l between year $t-k$ and year t;[11] ν_l are locality fixed effects to account for all time-invariant differences across localities, such as geography or ecological factors that do not vary over time. ϕ_t represent year fixed effects to account for time-varying shocks that are common to all localities, such as global price shocks. ϵ_{lt} is the error term. We present standard errors clustered at the country level.

The coefficient of interest is β, the elasticity of our outcome measure (e.g., new SDA members) with respect to the opportunity cost measure. When examining impacts on membership, we hypothesize that $\beta < 0$, that is increasing the opportunity cost of SDA membership decreases new SDA memberships.

The main identifying assumption is that $E[\epsilon_{lct} \mid \textit{SDA Cost}_{lc|t,t-k}] = E[\epsilon_{lct}] = 0$. That is, the opportunity cost of SDA prohibitions is uncorrelated with omitted variables that may also affect SDA membership at the locality level conditional on locality and time fixed effects.

To increase the plausibility of the identifying assumption, we make several analytical choices to increase confidence that the independent variable of interest (the measure of the opportunity cost of following SDA crop prohibitions) is plausibly exogenous. We also provide empirical tests supporting the validity of this identifying assumption.

First, we construct the measure using time-varying global prices instead of using local crop prices which could influence both religious adherence and agricultural production. Second, we use cross-sectional ecological measures of potential crop yields from the FAO GAEZ that are based on geographic and climate characteristics instead of using observed crop production measures at the locality level. We then construct our opportunity cost measure as the difference between the *unconstrained* maximum potential revenue and the *constrained* maximum potential revenue if a locality follows SDA prohibitions and avoids producing tobacco, coffee, or tea. Taken together, these two choices imply that the opportunity cost measure we use is constructed using exogenous cross-sectional and time-varying measures.

[11] Because agricultural decisions and their economic consequences often have lagged effects, we allow the effect of $\textit{SDA Cost}_{r|t,t-k}$ to incorporate lags and measure average costs over time (e.g., between year $t-k$ and year t, where $k \in \{1,2,3\}$).

Furthermore, an important concern when using shocks to potential agricultural revenues is that our opportunity cost measure will be highly correlated with local income in areas suitable for tobacco, coffee, or tea production. To address this concern, we also show results where we include the measure of *unconstrained* maximized revenue at the local level, whose variation is driven by crop suitability and crop prices across *all* crops. This allows us to study how SDA membership responds to general income shocks; it allows us to assess whether our opportunity cost measure is simply capturing the effects of general income shocks or whether it is capturing the impacts of the cost of crop prohibitions.

4.2. Validating the Opportunity Cost Measure

A natural first question is: does the opportunity cost measure reflect production realities on the ground? This is a novel measure, not previously used in the economics literature, so it is important to confirm that it is associated in a reasonable way with actual production of crops (across space and over time).

In conducting this validation exercise, first note another interpretation of the opportunity cost variable defined in Section 3.2. While we emphasize its interpretation as the opportunity cost of giving up the opportunity to produce tobacco, coffee, and tea, it can also be interpreted as simply the potential *revenue gain* from producing tobacco, coffee, and tea relative to all other crops. In other words, it quantifies the increase in potential revenue one could earn from devoting land to producing tobacco, coffee, and tea in a particular year, compared to devoting land to the production of any other crop. This measure naturally takes on only positive values (it is bounded at zero) because one can always forgo the production of tobacco, coffee, or tea if it does not produce any revenue gain. Looking at the opportunity cost measure in this way, we should expect it to be *positively* correlated with production of tobacco, coffee, and tea.

We validate our opportunity cost measure by examining how changes in it are associated with country-level production of crops that are "prohibited" (tobacco, coffee, and tea) and "non-prohibited" (all other crops). We conduct regression analyses using annual, country-level agricultural production data from the FAO.[12] The results presented in Appendix Table B5 show that the opportunity cost variable does predict changes in agricultural production in the expected direction: increases in opportunity cost are associated with increases in the production of prohibited crops – tobacco, coffee, and tea – and decreases in the production of other crops. Thus, our measure predicts changes in the composition of production of prohibited vs. non-prohibited crops.

[12]We use annual country-level crop production measures because locality-level data on agricultural production are not available.

5. Empirical Results: Impacts on Religious Demand & Supply

We now present our empirical estimates of the impact of opportunity costs of SDA crop-production prohibitions on demand-side outcomes (new SDA memberships) and supply-side outcomes (church actions).

5.1. Demand

We first examine the impacts of the SDA opportunity cost measure on new memberships in the SDA church. Table 1 presents the estimates for equation (1) for log total gains in membership (Panel A) and for log total losses in membership (Panel B) as the dependent variables. Because opportunity costs could influence religious membership with a delay, columns (1)-(3) examine the impact of the average SDA opportunity cost over the previous one, two, and three years, respectively. Results in Panel A reveal that increases in SDA opportunity costs lead to decreases in new SDA memberships. A 10% increase in the SDA cost is associated with approximately a 0.5% decrease in total gains.[13] Coefficients in Panel B, which present the estimates for the impacts of opportunity costs on total losses of *existing* members (as opposed to gains of new members in Panel A), are not statistically significantly different from zero.[14]

Taken together, our findings suggest that the economic costs associated with religious prohibitions have a tangible impact on individuals' decisions to join religious groups. The decision to become a new member of the SDA church appears to be significantly influenced by the economic sacrifices required, highlighting the role of opportunity costs in decisions to affiliate with new religious groups.

As discussed in Section 4, a potential concern with the estimates in Table 1 is that the opportunity cost measure might be picking up general changes in incomes via agricultural revenues. To explore this concern, Appendix Table B7 shows the results when we control for general changes in agricultural revenue that, unlike our opportunity cost measure, are not restricted to include non-prohibited crops – the $R_{p,t}^{max}$ variable defined in Section 3.2. The estimates of the SDA opportunity cost measure are robust to the

[13] Appendix Table B6 shows estimates that further include country-year fixed effects, which account for any time-varying effects that are common to all localities in the same country (e.g., national-level economic conditions, government policies, or other national-level factors that may affect religious group membership). In these regressions, the sample size and set of countries included are reduced because some SDA administrative areas (the localities in our analyses) are entire countries. The inclusion of country-year fixed effects leads to estimates that are very similar in terms of magnitude but are slightly less statistically precise to those found in Table 1.

[14] Interestingly, coefficients in Panel B are negative, suggesting that increases in SDA opportunity costs decrease exits from the SDA church for existing members. This would be consistent with predictions from club goods models of religion, where increases in the cost of membership are likely to increase the religious commitment of existing members (e.g., Iannaccone, 1992).

Table 1: Impact of the Opportunity Cost of Religious Membership on Religious Demand: SDA Membership

	Dependent Variable:		
	Panel A: *Log Gains*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	-0.041^{**}		
	(0.016)		
$\ln(\text{SDA Cost}_{t,t-2})$		-0.054^{***}	
		(0.019)	
$\ln(\text{SDA Cost}_{t,t-3})$			-0.045^{**}
			(0.021)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.847	0.847	0.847
Outcome Mean	6.964	6.964	6.964
Outcome SD	1.832	1.832	1.832
	Dependent Variable:		
	Panel B: *Log Losses*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	-0.072^{*}		
	(0.041)		
$\ln(\text{SDA Cost}_{t,t-2})$		-0.057	
		(0.048)	
$\ln(\text{SDA Cost}_{t,t-3})$			-0.064
			(0.054)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.725	0.725	0.725
Outcome Mean	4.093	4.093	4.093
Outcome SD	2.648	2.648	2.648

Notes: Observations are SDA localities in Sub-Saharan Africa between 1994 and 2022. Standard errors clustered at the country level are presented in parentheses. *Log Gains* is the log plus one of the number of reported baptisms, professions of faith, and former member baptisms in the SDA locality in a given year. *Log Losses* is the log plus one of the number of dropped and missing members in the SDA locality in a given year. *SDA Cost*$_{t,t-k}$ measures the average opportunity cost of abiding by the SDA crop prohibitions: the agricultural revenue per hectare given up per hectare if *constrained* by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$. See Data Appendix A for more information. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

inclusion of $R_{p,t}^{max}$ as a control, suggesting that the SDA opportunity cost measure is not just picking up changes in local incomes. Instead, it specifically captures the economic trade-offs imposed by religious prohibitions.

5.2. Supply

We now turn to exploring supply-side responses to changes in opportunity costs: how the SDA church responds to changes in the economic incentives facing their members. Our key outcome variables are the supply of SDA personnel and of institutions serving members. We present estimates of equation (1) in Table 2 with log churches (panel A) and log ministers (panel B). We find little evidence of supply-side responses in terms of churches and personnel. The estimates are generally small in magnitude and not statistically significant, indicating that changes in the opportunity costs of religious membership do not significantly influence the number of churches or the allocation of ministers.

We now turn to other types of institutions established by the SDA church: education and health institutions. Table 3 presents estimates of equation (1) with log education institutions (panel A) and log health institutions (panel B) as the dependent variables. The estimates in Panel A suggest a positive impact of SDA opportunity costs on the number of education institutions in an SDA locality: a 10% increase in SDA opportunity costs is associated with approximately a 1.6% increase in the number of education institutions. This finding suggests that the church responds to higher opportunity costs by enhancing their educational activities, potentially as a strategy to provide new benefits offsetting the economic burdens faced by members.

In general, the results in Tables 2 and 3 suggest that there are modest supply-side responses to increases in the opportunity costs of membership: mainly, an increase in educational facilities. While the SDA church does not appear to substantially alter its institutional presence in terms of churches and personnel in response to economic opportunity costs faced by its potential and existing members, it does adjust its provision of auxiliary services – in particular, the establishment of educational institutions.[15] The establishment of new education institutions likely generates additional, local benefits of membership, potentially offsetting part of the increased opportunity costs of membership.

[15]In Appendix Tables B8 and B9, we present estimates that control for the unconstrained agricultural revenue. The results remain largely unaffected by the inclusion of this control, reinforcing the conclusion that the observed patterns are not driven by general income changes but are specific to the opportunity costs associated with SDA membership.

Table 2: Impact of the Opportunity Cost of Religious Membership on Religious Supply: Churches & Religious Personnel

	Dependent Variable: Panel A: *Log Churches*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	0.003		
	(0.009)		
$\ln(\text{SDA Cost}_{t,t-2})$		0.007	
		(0.010)	
$\ln(\text{SDA Cost}_{t,t-3})$			0.009
			(0.012)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.962	0.962	0.962
Outcome Mean	5.156	5.156	5.156
Outcome SD	1.324	1.324	1.324
	Dependent Variable: Panel B: *Log Ministers*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	−0.004		
	(0.012)		
$\ln(\text{SDA Cost}_{t,t-2})$		−0.011	
		(0.017)	
$\ln(\text{SDA Cost}_{t,t-3})$			−0.014
			(0.018)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.942	0.942	0.942
Outcome Mean	2.118	2.118	2.118
Outcome SD	1.647	1.647	1.647

Notes: Observations are SDA localities in Sub-Saharan Africa between 1994 and 2022. Standard errors clustered at the country level are presented in parentheses. *Log Churches* is the log plus one of the number of reported churches and companies in the SDA locality in a given year. *Log Ministers* is the log plus one of the number of licensed and ordained ministers in the SDA locality in a given year. *SDA Cost*$_{t,t-k}$ measures the average opportunity cost of abiding by the SDA crop prohibitions–the agricultural revenue per hectare given up per hectare if *constrained* by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$. See Data Appendix A for more information. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Impact of the Opportunity Cost of Religious Membership on Religious Supply: Education, Health & Other Institutions

	Dependent Variable:		
	Panel A: *Log Education Institutions*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	0.015^{**}		
	(0.006)		
$\ln(\text{SDA Cost}_{t,t-2})$		0.016^{**}	
		(0.006)	
$\ln(\text{SDA Cost}_{t,t-3})$			0.016^{**}
			(0.007)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.823	0.823	0.822
Outcome Mean	0.253	0.253	0.253
Outcome SD	0.443	0.443	0.443
	Dependent Variable:		
	Panel B: *Log Health Institutions*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	0.007		
	(0.007)		
$\ln(\text{SDA Cost}_{t,t-2})$		0.001	
		(0.009)	
$\ln(\text{SDA Cost}_{t,t-3})$			-0.003
			(0.010)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.891	0.891	0.891
Outcome Mean	0.728	0.728	0.728
Outcome SD	0.783	0.783	0.783

Notes: Observations are SDA localities in Sub-Saharan Africa between 1994 and 2022. Standard errors clustered at the country level are presented in parentheses. *Log Education Institutions* is the log plus one of the number of reported education institutions in the SDA locality in a given year in the SDA annual yearbooks. *Log Health Institutions* is the log plus one of the number of reported health institutions in the SDA locality in a given year in the SDA annual yearbooks. *SDA Cost*$_{t,t-k}$ measures the average opportunity cost of abiding by the SDA crop prohibitions–the agricultural revenue per hectare given up per hectare if *constrained* by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$. See Data Appendix A for more information. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.3. *Heterogeneity by Religious Group Size & Economic Conditions*

We next examine whether there is heterogeneity in the patterns observed in Section 5.1 regarding the impacts of the opportunity cost of religious membership on religious demand. In particular, we examine whether there is heterogeneity in responses by the size of the local SDA population or by economic conditions.

First, we explore whether the number of SDA members in a locality attenuates the impacts of the opportunity cost of membership as the value of joining a religious group may be larger when the local social group makes up a larger share of the population (Iannaccone, 1992; Barro and McCleary, 2024; Seabright, 2024). Appendix Table B10 presents estimates that include the interaction of our opportunity cost measure with the percent of the population in a locality that is an SDA member (which ranges from 0 to 100) in the first year a locality is observed in our sample. We find that denser local SDA membership attenuates the impacts of higher opportunity costs of religious membership: the estimates in Panel A suggest that the negative impacts of a 10% increase in the opportunity cost of membership on total gains are fully offset when SDA membership is greater than approximately 15%. Panel B explores the impacts on total losses. The evidence suggests that the density of SDA membership does not significantly influence the impacts of opportunity costs of membership for existing members. These results suggest that the density of religious networks can offset part of the impacts of increases in the economic costs of membership for new members.

Second, we examine whether economic shocks to agriculture via droughts attenuate the impacts of changes in the opportunity cost of membership, since religious membership often offers critical economic insurance for shocks in developing countries (Bentzen, 2019a,b; Auriol et al., 2020). Appendix Table B11 presents estimates for the interaction of our opportunity cost measure with measures of drought severity in that year for the locality. We find that droughts attenuate the impacts of higher opportunity costs of religious membership: experiencing a drought decreases the elasticity of the opportunity cost of religious membership on total gains by approximately 0.02-0.03. The estimates provide evidence that the economic costs of membership are seen as less costly for new members when individuals face concurrent economic shocks.

6. Results: Impacts on SDA Member Attitudes and Adherence

We next examine the impacts of the SDA opportunity cost measure on SDA member attitudes. We use data from the SDA Global Church Member Survey (GCMS) on SDA members and examine two main sets of outcomes. First, we examine how changes in the cost of prohibitions impact the spiritual well-being of SDA church members. Second, we

examine the impacts on members' participation in prohibited activities such as tobacco consumption and alcohol use, which offers a window into the emphasis placed by the church on adhering to its prescriptions related to healthy living.

6.1. Estimating Equation

The SDA Global Church Member Survey (GCMS) does not include information on respondents' sub-national localities, only their countries. We therefore conduct these analyses at the country level, and similarly aggregate our opportunity cost measure to the country level.

To examine the impacts of opportunity costs on outcomes in the SDA GCMS, we estimate the following modification of equation (1):

$$\log(y_{ict}) = \beta_1 \log(\textit{SDA Cost}_{c|t,t-k}) + \nu_c + \phi_t + \mathbf{X}_{ict}\Gamma + \epsilon_{ict} \tag{2}$$

where i indexes individuals, c indexes countries, and t indexes years. y_{ict} is our outcome variable of interest (e.g., SDA member attitudes in country c in year t). $\textit{SDA Cost}_{c|t,t-k}$ is the country-level measure of the average opportunity cost of abiding SDA crop prohibitions in country c between year $t-k$ and year t. ν_c represent country fixed effects to account for time-invariant differences across countries, such as geography or cultural factors that do not vary over time. ϕ_t represent survey-year fixed effects to account for time-varying shocks that are common to all countries, such as global price shocks. $\mathbf{X}_{ict}$ is a vector of individual-level covariates (age, age squared, gender, and education level). ϵ_{ict} is the error term. We present standard errors clustered at the country level.

Appendix Table B4 presents summary statistics for outcomes in the SDA GCMS survey data.

6.2. Results on SDA Member Attitudes and Adherence to Prescriptions

We first examine the impacts of the opportunity cost of membership on spiritual attitudes. Table 4 presents estimates of equation (2) where the dependent variable is the sum of scores for survey questions noted as reflecting spiritual struggle. The estimates suggest that individuals who remain as members of the SDA church are more likely to report higher spiritual struggle scores when the economic costs of membership rise. This suggests that higher opportunity costs of religious adherence can lead to existing members to question their membership in the church.

We also examine whether the church responds to increased opportunity costs by reducing the emphasis placed on the church's healthy living prescriptions. These prescriptions include prohibitions on alcohol and tobacco consumption, as well as strong discouragement of consumption of caffeinated beverages such as coffee and tea. While such

Table 4: Impact of the Opportunity Cost of Religious Membership on Spiritual Struggle for Members

	Dependent Variable: Spiritual Struggle		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	0.019*		
	(0.011)		
$\ln(\text{SDA Cost}_{t,t-2})$		0.032*	
		(0.016)	
$\ln(\text{SDA Cost}_{t,t-3})$			0.031*
			(0.015)
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	32,914	32,914	32,914
Num Countries	34	34	34
Adjusted R^2	0.261	0.261	0.261
Outcome Mean	2.877	2.877	2.877
Outcome SD	1.067	1.067	1.067

Notes: Observations are individual respondents in the SDA Global Church Member Survey (GCMS) in Sub-Saharan Africa. Standard errors clustered at the country level are presented in parentheses. All regressions control for respondent age, age squared, and gender, and an indicator variable equal to 1 if the respondent is missing age or gender information. *Spiritual Struggle* is the average of three variables in which members report their level of agreement (integer scale from 1-5; 1=strongly disagree, 3=neutral, and 5=strongly agree) with statements related to spiritual struggle (feeling "spiritually lost", that their "faith has been shaken", and that they "have lost some important spiritual meaning"). See Appendix A.6 for additional details on the SDA GCMS data. *SDA* $Cost_{t,t-k}$ measures the average country-level opportunity cost of abiding by the SDA crop prohibitions–the agricultural revenue per hectare given up per hectare if *constrained* by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$ (see Appendix A). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

reductions in emphasis are hard to measure at the location-year level of our analyses, we can measure the result of any such changes in emphasis: church member adherence to healthy-living prescriptions.

Table 5 presents estimates of equation (2) where the dependent variables are consumption of alcohol (panel A) and of tobacco (panel B). (The SDA GCMS surveys do not ask about coffee or tea consumption, or production of any good.) We find that higher opportunity costs lead to more violations of the church's prescriptions on healthy living – namely, a higher likelihood of reporting alcohol and tobacco consumption. This result provides indirect evidence that the church may respond to higher opportunity costs by reducing its emphasis on religious tenets that underlie those opportunity costs in the first place – in particular, its prescriptions for healthy living.

Table 5: Impact of the Opportunity Cost of Religious Membership on Adherence to Church Prescriptions

	Dependent Variable: Panel A: Alcohol Usage		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	0.004*		
	(0.002)		
$\ln(\text{SDA Cost}_{t,t-2})$		0.007**	
		(0.003)	
$\ln(\text{SDA Cost}_{t,t-3})$			0.007**
			(0.003)
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	32,513	32,513	32,513
Num Countries	34	34	34
Adjusted R^2	0.055	0.055	0.055
Outcome Mean	0.075	0.075	0.075
Outcome SD	0.263	0.263	0.263
	Dependent Variable: Panel B: Tobacco Usage		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	0.002		
	(0.001)		
$\ln(\text{SDA Cost}_{t,t-2})$		0.003	
		(0.002)	
$\ln(\text{SDA Cost}_{t,t-3})$			0.004*
			(0.002)
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	32,286	32,286	32,286
Num Countries	34	34	34
Adjusted R^2	0.008	0.008	0.008
Outcome Mean	0.028	0.028	0.028
Outcome SD	0.165	0.165	0.165

Notes: Observations are individual respondents in the SDA member survey data in Sub-Saharan Africa. Standard errors clustered at the country level are presented in parentheses. All regressions control for respondent age, age squared, and gender, and an indicator variable equal to 1 if the respondent is missing age or gender information. *Alcohol Usage* is a binary variable that takes a value of 1 when the member reports consuming alcohol in the past 12 months, and 0 otherwise. *Tobacco Usage* is a binary variable that takes a value of 1 when the member reports using tobacco in the past 12 months, and 0 otherwise. $\textit{SDA Cost}_{t,t-k}$ measures the average country-level opportunity cost of abiding by the SDA crop prohibitions–the agricultural revenue per hectare given up per hectare if *constrained* by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$. See Data Appendix A for more information. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

7. Conclusion

This study provides new insights into how economic factors influence religious group membership and how religious organizations adapt to changing economic incentives. We focus on the Seventh-Day Adventist (SDA) church in Sub-Saharan Africa, and demonstrate that increases in the opportunity cost of membership – driven by SDA prohibitions on tobacco, coffee, and tea production – lead to declines in new memberships and higher spiritual struggle among existing members about their religion. Simultaneously, the SDA church responds by offsetting these increased opportunity costs: it increases the provision of education institutions, and seems (based on indirect evidence) to reduce emphasis on the religious tenets that generate the opportunity costs in the first place.

Our findings contribute to the growing literature on the economics of religion by quantifying how economic considerations enter into individuals' decisions to join religious groups. Our results suggest that potential converts weigh the economic costs of religious prohibitions against the benefits of membership (say, in the spiritual and social realms). Our work also sheds new light on how religious organizations respond to exogenous changes in membership costs.

The study's focus on Sub-Saharan Africa – a region experiencing rapid religious change and economic development – provides insights into the interplay between economics and religion in developing countries. As these nations continue to evolve economically, understanding how individuals make religious choices and how religious organizations adapt in response to changing economic incentives should be of interest to policymakers and researchers alike.

While our study focuses on the Seventh-Day Adventist church, our methodological approach can guide future studies of other religious groups, since religions typically have tenets, traditions, or other rules that create opportunity costs for members. Future research could extend this approach to other religions and regions to develop a further understanding of the economic factors that influence religious affiliation and organizational behavior.

In conclusion, this study demonstrates that economic factors play a role in shaping religious landscapes, particularly in developing countries. By illuminating the varied relationships between economic costs, individual religious choices, and organizational responses, our findings contribute to a deeper understanding of the economics of religion.

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Online Appendix for

The Price of Faith: Economic Costs and Religious Group Membership in Sub-Saharan Africa

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9 October 2024

Contents

Appendix A. Data Appendix

A.1. Office of Archives, Statistics, and Research (ASTR) Data

Figure A1: Sample Page from Office of Archives, Statistics, and Research (ASTR) Website of the Seventh-Day Adventist Church

Central Malawi Conference | *Yearly Statistics (1995-2022)*

(Back to Field Summary)

Click for chart, and for description

Year	Churches	Companies	Beginning Membership	Baptisms	Former Member Baptisms	Professions of Faith	Transfers In	Transfers Out	Deaths	Dropped	Missing	Total Gains	Total Losses	Adjust	Net Growth	Ending Membership	Growth Rate	Accession Rate	Death Rate	Ordained Ministers	Licensed Ministers
1995	103		29492	4327			412	449	243	378		4739	1070		3669	33161	12.44%	14.67%	0.82%	25	15
1996	105		33161	5559			694	1899	338	1145		6253	3382		2871	36032	8.66%	16.76%	1.02%	25	14
1997	105	214	36032	4934			1153	1546	235	1460		6087	3241		2846	38878	7.90%	13.69%	0.65%	25	13
1998	132	322	38878	4012		66	635	827	336	751	59	4713	1973	-14698	-11958	26920	-30.76%	10.49%	0.86%	14	29
1999	140	351	26920	6108		509	751	1888	304	734	117	7368	3043	258	4583	31503	17.02%	24.58%	1.13%	19	25
2000	171	338	31503	4716		236	961	1429	267	866	655	5913	3217	0	2696	34199	8.56%	15.72%	0.85%	22	28
2001	178	382	34199	4340		508	859	999	285	1307	983	5707	3574	-470	1663	35862	4.86%	14.18%	0.83%	23	28
2002	172	387	35862	4170		185	615	1323	401	1244	1132	4970	4100	356	1226	37088	3.42%	12.14%	1.12%	23	28
2003	169	384	37088	3734		399	771	742	231	2521	946	4904	4440	0	464	37552	1.25%	11.14%	0.62%	25	31
2004	173	388	37552	5981		382	1039	1617	299	1391	617	7402	3924	0	3478	41030	9.26%	16.94%	0.80%	48	10
2005	172	393	41030	4035		194	681	1044	312	841	352	4910	2549	-1521	840	41870	2.05%	10.31%	0.76%	38	20
2006	172	394	41870	4404		75	1140	1133	311	1262	287	5619	2993	-1763	863	42733	2.06%	10.70%	0.74%	46	27
2007	200	424	42733	4966		337	1091	1048	859	1276	603	6394	3786	318	2926	45659	6.85%	12.41%	2.01%	35	17
2008	205	417	45659	6056		228	857	633	238	1007	679	7141	2557	-877	3707	49366	8.12%	13.76%	0.52%	36	17
2009	214	406	49366	5528		70	1136	1249	245	1406	910	6734	3810	213	3137	52503	6.35%	11.34%	0.50%	46	19
2010	229	416	52503	8600		145	813	1547	344	1425	1545	9558	4861	-1248	3449	55952	6.57%	16.66%	0.66%	36	24
2011	227	414	55952	7802		240	1062	1502	297	1323	1204	9104	4326	-464	4314	60266	7.71%	14.37%	0.53%	30	24
2012	242	446	60266	7345		70	1248	1783	261	1223	728	8663	3995	-992	3676	63942	6.10%	12.30%	0.43%	37	13
2013	249	487	63942	6867		154	1379	2384	210	1469	1044	8400	5107	908	4201	68143	6.57%	10.98%	0.33%	6	19
2014	251	504	68143	6424		62	773	1365	291	1144	2454	7259	5254	115	2120	70263	3.11%	9.52%	0.43%	36	12
2015	259	523	70263	9281		70	871	1305	264	1854	1016	10222	4439	312	6095	76358	8.67%	13.31%	0.38%	57	11
2016	270	554	76358	10625		65	871	1222	266	1110	155	11561	2753	0	8808	85166	11.54%	14.00%	0.35%	59	9
2017	299	556	85166	9362	74	109	682	1495	275	2208	428	10227	4406	0	5821	90987	6.83%	11.12%	0.32%	57	9
2018	308	576	90987	7337	0	35	446	1169	267	871	418	7818	2725	0	5093	96080	5.60%	8.10%	0.29%	58	10
2019	352	579	96080	8440	0	30	1218	1555	227	986	320	9688	3088	0	6600	102680	6.87%	8.82%	0.24%	59	8
2020	363	603	102680	5307	0	251	953	1130	246	1271	73	6511	2720	0	3791	106471	3.69%	5.41%	0.24%		
2021	391	623	106471	9639	0	22	1089	1535	325	1157	262	10750	3279	-451	7020	113491	6.59%	9.07%	0.31%		
2022	396	626	113491	5811	400	688	1673	1733	275	678	346	8572	3032	0	5540	119031	4.88%	5.73%	0.24%		

Notes: The data table shows yearly statistics for the Central Malawi Conference from 1995 to 2022. The Central Malawi Conference corresponds to a *locality* in our sample and is part of the Malawi Union Conference. The Malawi Union Conference was called Malawi Union Mission before 2015, denoting a higher level of support from a supervisory body, as explained in A.1.2. The Central Malawi Conference was denoted Central Malawi Field before 2005 for the same reasons. Website accessed: «https://www.adventiststatistics.org/stats_y_stats.asp?FieldID=C10071&view=y_stats&StartYear=1900&EndYear=2022&submit=Build+Table» on September 2, 2024

A.1.1. Variable Definitions

- Year: Year in which the statistical values were reported.
- Churches: Total number of registered churches for the specified year and field.[16]
- Companies: Total number of registered companies for the specified year and field.[17]
- Beginning Membership: Membership at the beginning of the year.
- Baptisms: Number of additions by baptism reported for the given year.

[16] A local church is a mature congregation that has representation in conference sessions.

[17] A company is a congregation that has not yet achieved maturity and has not formally been organized as a local church.

- Former Member Baptisms: Number of additions by baptisms of former members (previously removed by dropped or missing).
- Professions of Faith: Number of additions by profession of faith[18] reported for the given year.
- Transfers In: Number of additions by transfer of membership into this conference during the year.
- Transfers Out: Number of losses by transfer of membership out of this conference during the year.
- Deaths: Number of losses by death.
- Dropped: Number of memberships dropped by individual request.
- Missing: Number of members reported missing.
- Total Gains: Total number of members added by all methods. Total Gains = Baptisms + Former Member Baptism + Profession of Faith + Transfers In.
- Total Losses: Total number of members removed by all methods. Total Losses = Dropped + Missing + Death + Transfers Out.
- Adjust: Used historically to note adjustments needed to ensure consistency because of reporting errors or subsequent corrections. 'Adjustments' can also be used by fields to report membership corrections that do not necessarily fit in other columns.
- Net Growth: Shows the net growth during the year. Formula: Net Growth = Ending Membership - Beginning Membership.
- Ending Membership: Membership reported at the end of the given year.
- Ordained Ministers: Number of ordained ministers.[19]
- Licensed Ministers: Number of licensed ministers.[20]

For our analyses, we define *Total Gains* (or simply *Gains*) as the sum of Baptisms, Former Member Baptisms, and Professions of Faith and exclude transfers in. Likewise, we define *Total Losses* (or *Losses*) as the sum of Dropped and Missing, and again exclude transfers out (as transfers are likely more due to reorganizations in SDA structures).

[18] A profession of faith is an alternative to baptism for individuals to become members. It is reserved for people who previously belonged to another church and had already been baptized by immersion.

[19] An ordained minister is a licensed minister with years of experience that has proved themselves in pastoral ministry.

[20] A licensed minister is a minister that has received a license, which means one that has started out their pastoral track but is still inexperienced.

A.1.2. SDA Organizational Structure

We conduct our analyses at the lowest geographical level of organization of the SDA Church. This corresponds to the public data available from the SDA's Office of Archives, Statistics, and Research (ASTR).

The organizational structure of the Seventh-day Adventist Church (North American Division of Seventh-day Adventists, 2024) consists of four main elements that operate within a global framework.

- Local Church: The foundational unit of the Church, composed of individual members. A Local Church is officially recognized by the constituency session of a local Conference or Mission, which grants it status as a Seventh-day Adventist Church. (The SDA's ASTR does not provide data at the level of "local churches", but only at the next level above the local church level.)

- Local Conference/Mission: A group of Local Churches within a defined geographic area. A Local Conference is granted official status by the constituency session of a Union Conference or Mission. The term "Conference" indicates a high level of self-governance, whereas "Mission" denotes an organization that receives direct support from a supervisory body.

- Union Conference/Mission: This is a grouping of local Conferences and/or Missions within a specific geographic territory. A Union Conference/Mission is granted official status by the General Conference's constituency session. The Union's membership consists of local Conferences and Missions.

- General Conference: The highest organizational level, encompassing all Union Missions, Union Conferences, and other directly attached fields globally. The General Conference provides supervision and assistance to the Church's operations worldwide.

The General Conference (the SDA's highest organizational level) is divided into "divisions" or regional offices. The SDA divisions are the following: East-Central Africa Division (ECD), Euro-Asia Division (ESD), Inter-American Division (IAD), Inter-European Division (EUD), North American Division (NAD), Northern Asia-Pacific Division (NSD), South American Division (SAD), South Pacific Division (SPD), Southern Africa-Indian Ocean Division (SID), Southern Asia Division (SUD), Southern Asia-Pacific Division (SSD), Trans-European Division (TED), and West-Central Africa Division (WAD).

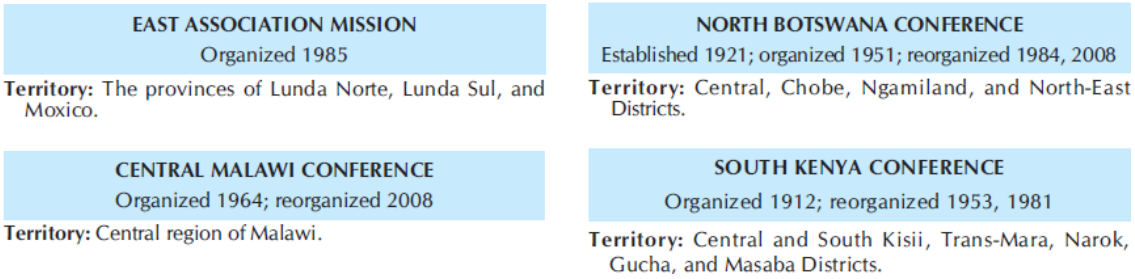
The countries in our sample come from WAD, ECD, SID, as well as the Middle East and North Africa Union Mission.

Administratively speaking, many Missions and Conferences are further subdivided into Fields (Seventh-Day Adventist Church, Monrovia Central, 2018; Adventist Statistics, 2024). As such, the lowest administrative level in each geographical can be a Mission, a Conference, or a Field. Our analyses always take the lowest administrative level available as our unit of analysis, because this is the lowest level at which the data are made available to the public.

A.2. Localities

To construct our unit of analysis, which we refer to as the *locality*, we gathered information from several sources. First, using the ASTR's website structure, we identified all the units at the lowest level of the organizational structure of the Seventh-Day Adventist Church and scraped their membership tables for each one of them. Then, we compared the units available with the ones listed in the SDA Yearbooks, identifying the *geographical territory* of each locality. Figure A2 provides examples of territorial definitions in the 2015 SDA Yearbook.

Figure A2: 2015 SDA Yearbook



Notes: The figure presents the territories of four *localities*, as described in the 2015 SDA Yearbook: the East Association Mission of Angola, the North Botswana Conference, the Central Malawi Conference, and the South Kenya Conference.

Given the expansion of the SDA church, *localities* go through slight changes over the years, adapting to their growing membership by splitting Missions, Conferences, or Fields into smaller units over time. Instead of trying to modify these units to match across the entire sample period, we decided to respect their structure by identifying as a locality a Mission, Conference, or Field that has the exact same boundaries over time, for as many years as the locality's geographical territory remains constant. This yields an unbalanced panel, with a varying number of localities across years (ranging from 93 in 1991 to 195 in 2020).

For most of these *localities*, the sub-national units described in the *territory* description in the corresponding SDA Yearbook are straightforward, as seen in Figure A2, describing the exact districts, states, or regions encompassed by the Mission, Conference, or Field. In a minority of cases, Yearbook territorial definitions were ambiguous, requiring us to make informed judgments about exact locality boundaries.

A.3. GAEZ

GAEZ is a seven-stage model that combines soil and climate data to produce estimates of potential yields under different assumptions. The calculated yield of each crop/land utilization type (LUT) is affected by water sources (e.g., rain-fed vs. irrigated) and by the assumed intensity of inputs and management (e.g., low vs. high).

For this study, we selected the rain-fed, low-level option of inputs for each crop to reduce potential concerns that the choice of (high) agricultural inputs or irrigation reflects endogenous decisions that could be potentially correlated with religious adherence.[21]

A.4. Concordance of GAEZ crops with Crops in FAO Production Data

Appendix Table A1 shows the concordance we use to match crops found in the GAEZ data with crops found in the FAO production database.

[21] According to the GAEZ documentation, under a low level of inputs, the farming system is largely subsistence-based. The production relies on traditional cultivars, labor-intensive techniques, no application of plant nutrients, no use of chemicals for pest and disease control, and minimum conservation measures (FAO and IIASA, 2022).

Table A1: Mapping between GAEZ crops and FAO Production names

Crop Name	**GAEZ Abbreviation**	**FAO Specification List**
banana	bana	Bananas
barley (best type)	barl	Barley
buckwheat	bckw	Buckwheat
phaseolous bean	bean	Beans, dry
cabbage	cabb	Cabbages
carrot	carr	Carrots and turnips
cassava	casv	Cassava, dry
chickpea	chck	Chick peas, dry
coconut	cocn	Coconuts, in shell
cacao (best type)	coco	Cocoa beans
coffee (best type)	coff	Coffee, green
cotton	cott	Cotton linters
cowpea	cowp	Cow peas, dry
dry peas	dpea	Peas, dry
flax fibre	flax	Flax, raw or retted
gram	gram	Chick peas, dry
groundnut	grnd	Groundnuts, excluding shelled
maize (best type)	maiz	Maize (corn)
millet (best type)	mllt	Millet
oat	oats	Oats
oil palm	oilp	Palm oil
olive	oliv	Olive oil
onion	onio	Onions and shallots, dry (excluding dehydrated)
pigeonpea	pigp	Pigeon peas, dry
rapeseed	rape	Rape or colza seed
dryland rice	ricd	Rice
rye (best type)	ryes	Rye
sorghum (best type)	sorg	Sorghum
soybean	soyb	Soya beans
sweet potato	spot	Sweet potatoes
sugar beet	sugb	Sugar beet
sugar cane	sugc	Sugar cane
sunflower	sunf	Sunflower seed
tea	teas	Tea leaves
tobacco	toba	Unmanufactured tobacco
tomato	toma	Tomatoes
wheat (best type)	whea	Wheat
yam (best type)	yams	Yams

A.5. FAO Export Prices

The Food and Agricultural Trade Dataset is collected, processed, and disseminated by FAO according to the standard International Merchandise Trade Statistics (IMTS) Methodology. The data is mainly provided by the United Nations Statistics Division, Eurostat, and other national authorities as needed. This source data is checked for outliers, trade partner data is used for non-reporting countries or missing cells, and data on food aid is added to take into account total cross-border trade flows (Food and Agriculture Organization of the United Nations (FAO), 2024). The data contains information on import and export quantities and values at a country-year level starting in 1961. Quantities are reported in thousands of animals or tonnes, (only the latter being relevant for our analyses). Values are adjusted using US prices and reported in thousands of real 2010 US dollars. With this information, we construct a panel of time-varying trade prices at the country level, focusing on Sub-Saharan Africa (SSA). The dataset is first filtered to retain only observations corresponding to crops matching the FAO GAEZ crops as listed in Annex A.4, for which land suitability is measured. Export prices are calculated by dividing export value by export quantity, when both values are different from zero, and assigning a missing value otherwise. Thus, prices correspond to thousands of US dollars per ton. To adjust for inflation – since the export values are reported in US dollars – prices are further deflated using the U.S. Consumer Price Index (CPI) from the The World Bank (2024). The data is filtered to include only SSA countries. Finally, missing country-crop-year combinations are filled in with the average of available prices for countries in the region for each crop-year combination, weighted by the export volume of each country.

A.6. Seventh-Day Adventist Global Church Member Survey (GCMS)

The General Conference of the SDA church commissioned the Global Church Member Survey (GCMS) over three rounds: 2013, 2017, and 2022. The GCMS was fielded in each of these years in the church's global membership, at the individual level. The Meta-Analysis Research Team at Andrews University worked with the ASTR and the research teams from each Division during the development of the surveys. Each research team chooses the data collection format that fits their needs. The vast majority of them are collected in-person, with mail, electronic surveys in asynchronous mode, and synchronous group settings being the second, third, and fourth most common (66%, 12%, 11%, and 11% respectively for the third GCMS round).[22] Participation is voluntary. The survey is administered at the individual level. There is no intentional individual-level

[22]For a small portion of the data, they do not have registries of the collection method.

panel dimension; while some individuals may be present in the panel for multiple years, no individually-identifying data is collected to connect these individuals over time. We use the country-level geographic identifiers in the dataset to create a panel of cross-sections over time.

The survey first asks for demographic characteristics such as gender, age, marital status, and education. Of greatest interest to us are questions on religious behavior and beliefs. To maintain comparable questions for our analysis, and due to lower sample sizes, we exclude the first round for our estimations. In both the 2017 and 2022 rounds, members are asked whether they agree or disagree with statements aiming at measuring their *spiritual struggle*:

- In some ways I think I am spiritually lost.
- My faith has been shaken and I am not sure what I believe.
- I feel I have lost some important spiritual meaning that I had before.

All responses to these questions are on a five-point scale that ranges from one (strongly disagree) to five (strongly agree). We define a "spiritual struggle" index as the average of these three questions (on feeling "spiritually lost", that their "faith has been shaken", and that they have "lost some important spiritual meaning").

Additionally, the GCMS includes questions regarding the consumption of alcohol and tobacco. (There are no questions on the consumption of coffee or tea, and no questions on the production of any of these goods.) The 2017 round asks a yes or no question on whether the members have consumed tobacco or alcohol in the past 12 months. The 2022 round asks how often members have consumed alcohol or tobacco in the past 12 months, with the options being: never, once or twice, 3-10 times, or more than 10 times. To make the questions comparable, for the 2022 round we group all answers for which the members have consumed any amount of alcohol or tobacco as a yes. We then construct indicator variables for the 2017 and 2022 rounds indicating whether the individual has consumed these prohibited goods in the last 12 months (separately for alcohol and tobacco).

See Table B4 for summary statistics of the GCMS data. The final sample once we restrict to the countries included in our sample is around 35,000 across the two GCMS rounds. The average alcohol usage across the two survey rounds is 7%, and the average tobacco usage is 3%. The mean of "Spiritual Struggle" is 2.88 and its standard deviation is 1.07.

A.7. Nighttime Lights

The harmonized global nighttime light dataset from Li et al. (2020) consistently integrates records of nightscape from the Defense Meteorological Satellite Program (DMSP) and the Visible Infrared Imaging Radiometer Suite (VIIRS). From their dataset, we use the DMSP data, which reports nighttime light information at a 30 arc-seconds resolution (approximately one kilometer) in digital numbers (DN). DN values range from 0 to 63, where higher values indicate more intense light emissions (Li et al., 2020). To use a consistent measurement for a proxy of economic development previous to our sample, we use the 1992 data, taking the population-weighted average across each locality to build our nighttime lights (NL) variable.

A.8. Droughts

The Global SPEI Database offers comprehensive information on drought severity and duration worldwide, drawing from monthly precipitation and evapotranspiration data from the Climatic Research Unit of the University of East Anglia, to build a global gridded dataset of a multi-scalar drought index – the standardized precipitation evapotranspiration index (SPEI).[23] This measure considers the joint effects of temperature and precipitation on droughts. Version 2.9 of the database covers the period from January 1901 to December 2022, providing a detailed record of meteorological conditions over more than a century. Following Vicente-Serrano et al. (2010), we use the 12-month Standardized Precipitation-Evapotranspiration Index (SPEI-12), to identify droughts from water deficits in a rolling 12-month period, allowing for the precise characterization of drought events and their temporal variability across the countries in the sample. The SPEI standardized scale defines the following categories of drought: Slight $(0, -0.9)$, Moderate $[-0.9, -1.5)$, Severe $[-1.5, -2)$, and Extreme $[-2, -\infty)$.

We combine the shapefiles for the SDA localities with the drought data to build yearly measurements of droughts for each locality. We take the highest level of drought in the 12-month period for each pixel in the SPEI data, and then take averages across pixels within each SDA locality. We do this separately in each year of analysis. This yields a measure of droughts at the locality-year level: the within-locality average of the pixel-level max drought across months (in a particular year). Lastly, we flip the sign of the variable to obtain a more intuitive interpretation, with higher values representing higher levels of drought.

[23] Based on the Palmer drought severity index (UCAR-PDSI, 2.5°).

Appendix B. Additional Tables & Figures

B.1. Summary Statistics

Table B2: Summary Statistics: SDA Membership Data

	Mean	SD	p10	p25	p75	p90	Min	Max	N
Costs:									
SDA Cost$_t$	15.41	58.06	0.00	0.00	0.80	30.03	0.00	652.93	3,944
SDA Cost$_{t-1}$	15.03	57.89	0.00	0.00	0.41	26.41	0.00	677.20	3,944
SDA Cost$_{t-2}$	15.84	60.58	0.00	0.00	0.39	29.50	0.00	677.20	3,944
SDA Cost$_{t-3}$	15.89	61.11	0.00	0.00	0.26	28.11	0.00	677.20	3,944
Average Costs:									
SDA Cost$_{t,t-1}$	15.22	46.62	0.00	0.00	5.62	41.63	0.00	645.51	3,944
SDA Cost$_{t,t-2}$	15.43	43.03	0.00	0.00	9.17	45.63	0.00	593.24	3,944
SDA Cost$_{t,t-3}$	15.54	40.97	0.00	0.00	11.40	47.89	0.00	457.48	3,944
Dependent Variables:									
Gains	3092.61	4334.19	110.00	389.00	4227.50	8259.00	0.00	47397.00	3,944
Losses	632.30	2878.21	0.00	6.00	499.00	1514.00	0.00	1.3e+05	3,944
Supply-Side Variables:									
Churches	336.04	373.52	26.00	75.00	470.00	803.00	0.00	2735.00	3,944
Ministers	21.26	26.41	0.00	0.00	34.00	57.00	0.00	549.00	3,944
Education Institutions	0.46	0.94	0.00	0.00	1.00	2.00	0.00	7.00	3,944
Healthcare Institutions	1.92	2.78	0.00	0.00	3.00	7.00	0.00	16.00	3,944

Table B3: Summary Statistics: SDA Membership Data
Sample for Results with Country-Year Fixed Effects

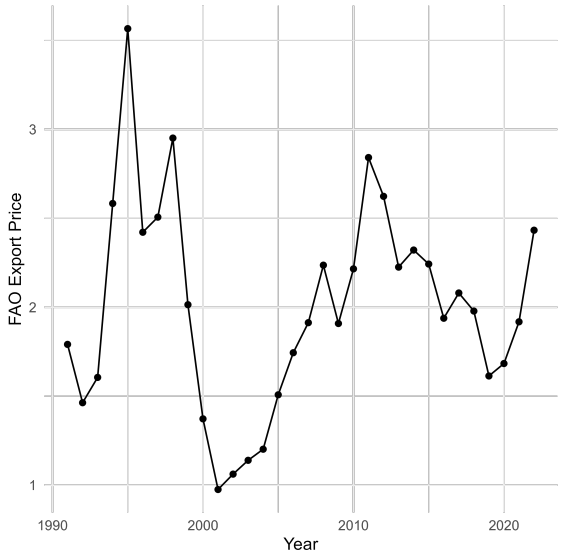
	Mean	SD	p10	p25	p75	p90	Min	Max	N
Costs:									
SDA Cost$_t$	15.22	58.67	0.00	0.00	0.43	27.95	0.00	652.93	3,260
SDA Cost$_{t-1}$	14.84	58.49	0.00	0.00	0.14	24.96	0.00	677.20	3,260
SDA Cost$_{t-2}$	15.95	62.02	0.00	0.00	0.13	27.81	0.00	677.20	3,260
SDA Cost$_{t-3}$	16.23	63.11	0.00	0.00	0.05	27.81	0.00	677.20	3,260
Average Costs:									
SDA Cost$_{t,t-1}$	15.03	47.14	0.00	0.00	5.02	41.03	0.00	645.51	3,260
SDA Cost$_{t,t-2}$	15.34	43.76	0.00	0.00	8.38	45.47	0.00	593.24	3,260
SDA Cost$_{t,t-3}$	15.56	41.93	0.00	0.00	10.44	47.79	0.00	457.48	3,260
Dependent Variables:									
Gains	3673.61	4548.22	260.50	702.00	5077.00	9132.00	0.00	47397.00	3,260
Losses	745.88	3145.81	0.00	21.00	653.50	1720.50	0.00	1.3e+05	3,260
Supply-Side Variables:									
Churches	395.71	384.42	58.00	120.00	528.00	862.00	1.00	2735.00	3,260
Ministers	24.45	27.83	0.00	0.00	39.00	61.00	0.00	549.00	3,260
Education Institutions	0.51	0.99	0.00	0.00	1.00	2.00	0.00	7.00	3,260
Healthcare Institutions	2.18	2.93	0.00	0.00	3.00	7.00	0.00	16.00	3,260

Table B4: Summary Statistics: SDA Member Surveys

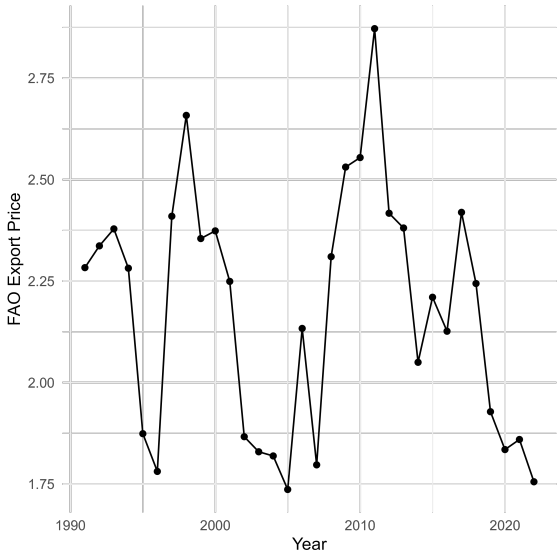
	Mean	SD	p10	p25	p75	p90	Min	Max	N
Prices:									
SDA Cost$_t$	3.14	5.84	0.00	0.00	1.46	10.28	0.00	80.85	35,127
SDA Cost$_{t-1}$	19.62	53.49	0.00	0.00	4.59	51.27	0.00	320.70	35,127
SDA Cost$_{t-2}$	4.24	13.67	0.00	0.00	3.42	3.43	0.00	168.50	35,127
SDA Cost$_{t-3}$	22.03	56.13	0.00	0.00	14.33	39.94	0.00	353.45	35,127
Dependent Variables:									
Alcohol Usage	0.07	0.26	0.00	0.00	0.00	0.00	0.00	1.00	32,513
Tobacco Usage	0.03	0.16	0.00	0.00	0.00	0.00	0.00	1.00	32,286
Should Abstain	0.94	0.24	1.00	1.00	1.00	1.00	0.00	1.00	32,070
God Wants me to Abstain	0.96	0.19	1.00	1.00	1.00	1.00	0.00	1.00	32,900
Spiritual Growth (Mean)	4.08	0.67	3.25	3.75	4.50	5.00	1.00	5.00	33,184
Spiritual Struggle (Mean)	2.88	1.07	1.00	2.33	3.67	4.00	1.00	5.00	32,914
Spiritual Growth	0.78	0.21	0.50	0.75	1.00	1.00	0.00	1.00	33,184
Spiritual Struggle	0.41	0.30	0.00	0.33	0.67	1.00	0.00	1.00	32,914
Alcohol is Safe to Use	0.23	0.42	0.00	0.00	0.00	1.00	0.00	1.00	30,749
Healthy Diet	0.96	0.20	1.00	1.00	1.00	1.00	0.00	1.00	32,235
Health Adherence	0.95	0.16	1.00	1.00	1.00	1.00	0.00	1.00	33,530

B.2. Price Time Series

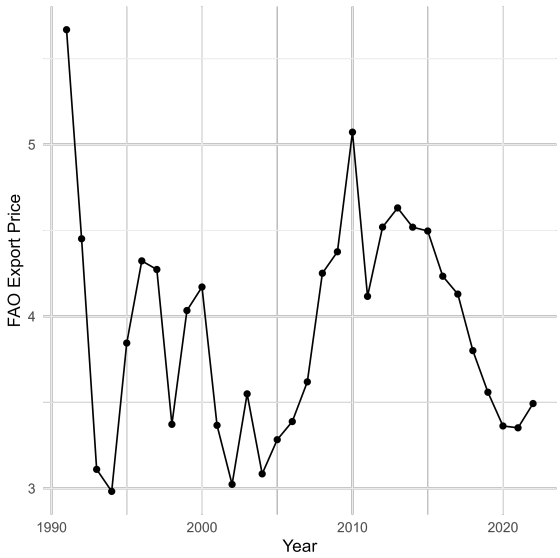
Figure B3: Average FAO Export Prices: Prohibited Crops



(a) Coffee



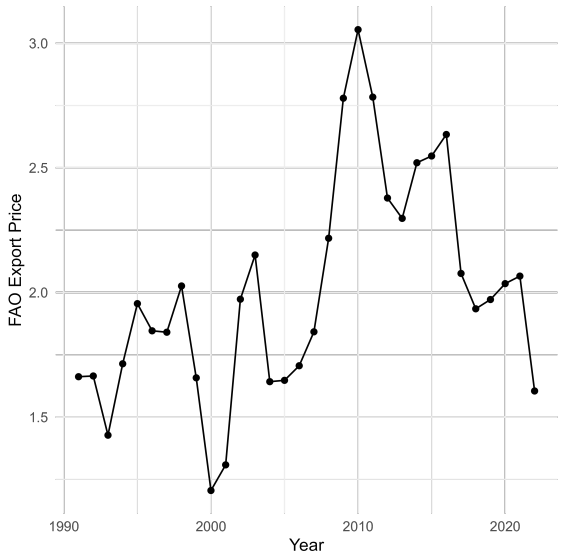
(b) Tea



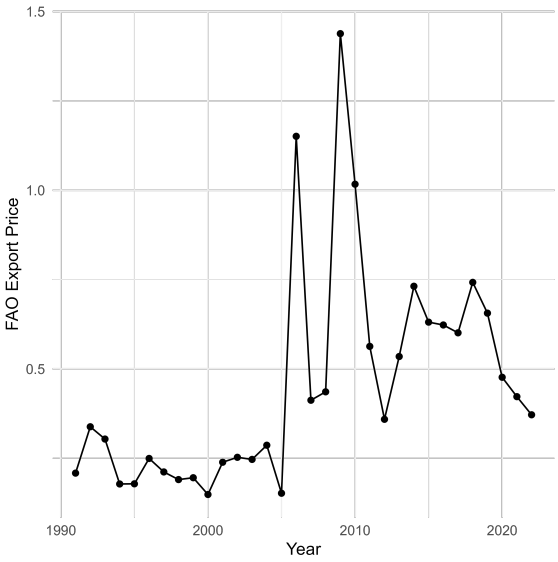
(c) Tobacco

Notes: The figures present the regional (Sub-Saharan Africa) average FAO Export prices over time for crops prohibited or discouraged by the SDA.

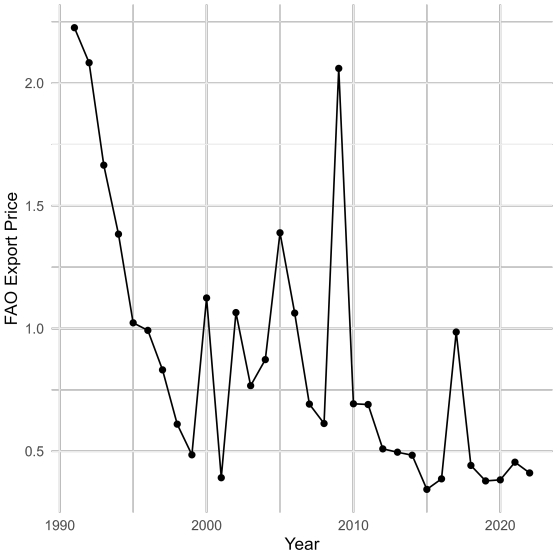
Figure B4: Average FAO Export Prices: Non-Prohibited Crops (Examples)



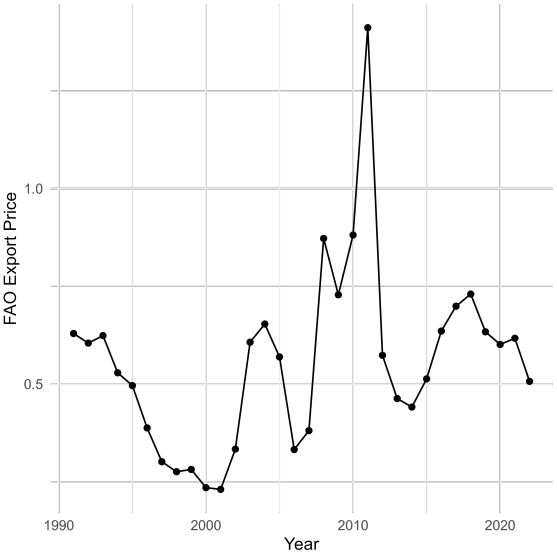
(a) Cacao



(b) Maize



(c) Carrot



(d) Sweet Potato

Notes: The figures present the regional (Sub-Saharan Africa) average FAO Export prices over time for a subset of crops that are neither prohibited nor discouraged by the SDA.

B.3. Production

Table B5: Impact of the Opportunity Cost of Religious Membership on Agricultural Production

	Dependent Variable: Panel A: *Log Area Harvested*							
	Prohibited Crops				*Non-Prohibited Crops*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\ln(\text{SDA Cost}^l_t)$	0.054^{*}				-0.020^{*}			
	(0.028)				(0.011)			
$\ln(\text{SDA Cost}^l_{t,t-1})$		0.080^{**}				-0.031^{**}		
		(0.037)				(0.013)		
$\ln(\text{SDA Cost}^l_{t,t-2})$			0.088^{**}				-0.033^{**}	
			(0.039)				(0.014)	
$\ln(\text{SDA Cost}^l_{t,t-3})$				0.091^{**}				-0.036^{**}
				(0.042)				(0.015)
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Country Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,091	1,091	1,091	1,091	1,091	1,091	1,091	1,091
Num Countries	44	44	44	44	44	44	44	44
Adjusted R^2	0.980	0.981	0.981	0.981	0.984	0.985	0.985	0.985
Outcome Mean	7.522	7.522	7.522	7.522	14.004	14.004	14.004	14.004
Outcome SD	4.517	4.517	4.517	4.517	1.715	1.715	1.715	1.715

	Dependent Variable: Panel B: *Log Amount Produced*							
	Prohibited Crops				*Non-Prohibited Crops*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\ln(\text{SDA Cost}^l_t)$	0.076^{**}				-0.018			
	(0.033)				(0.013)			
$\ln(\text{SDA Cost}^l_{t,t-1})$		0.117^{**}				-0.027^{*}		
		(0.051)				(0.015)		
$\ln(\text{SDA Cost}^l_{t,t-2})$			0.129^{**}				-0.025	
			(0.056)				(0.017)	
$\ln(\text{SDA Cost}^l_{t,t-3})$				0.138^{**}				-0.027
				(0.061)				(0.019)
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Country Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,091	1,091	1,091	1,091	1,091	1,091	1,091	1,091
Num Countries	44	44	44	44	44	44	44	44
Adjusted R^2	0.982	0.982	0.982	0.982	0.981	0.981	0.981	0.981
Outcome Mean	12.701	12.701	12.701	12.701	21.795	21.795	21.795	21.795
Outcome SD	7.078	7.078	7.078	7.078	1.917	1.917	1.917	1.917

Notes: Observations are countries in Sub-Saharan Africa between 1994 and 2022. Standard errors clustered at the country level are presented in parentheses. *Area Harvested* is the total area harvested in each country-year for the given crops, measured in hectares. *Amount Produced* is the total production in each country-year for the given crops, measured in kilograms of dry weight. *Prohibited Crops* are coffee, tobacco, and tea. *Non-Prohibited Crops* are banana, barley, buckwheat, phaseolous bean, cabbage, cacao, carrot, cassava, chickpea, coconut, cotton, cow pea, dry peas, flax fibre, groundnuts, maize, millet, oat, palm oil, olive oil, onion, pigeon pea, rape seed, rice, rye, sorghum, soybean, sweet potato, sugar beet, sugar cane, sunflower, tomato, wheat, yam. $\textit{SDA Cost}_{t,t-k}$ measures the average opportunity cost of abiding by the SDA crop prohibitions–the revenue per hectare agricultural revenue given up per hectare due to abiding by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$. See Data Appendix A for more information. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B.4. Including Country-Year Fixed Effects

Table B6: Impact of the Opportunity Cost of Religious Membership on Religious Demand: SDA Membership, Including Country-Year Fixed Effects

	Dependent Variable: Panel A: *Log Gains*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	-0.035		
	(0.022)		
$\ln(\text{SDA Cost}_{t,t-2})$		-0.044^{*}	
		(0.024)	
$\ln(\text{SDA Cost}_{t,t-3})$			-0.039
			(0.026)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Country-Year Fixed Effects	Y	Y	Y
Observations	3,260	3,260	3,260
Num SDA Localities	369	369	369
Num Countries	22	22	22
Adjusted R^2	0.885	0.885	0.885
Outcome Mean	7.412	7.412	7.412
Outcome SD	1.524	1.524	1.524

	Dependent Variable: Panel B: *Log Losses*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	-0.082^{**}		
	(0.034)		
$\ln(\text{SDA Cost}_{t,t-2})$		-0.062^{*}	
		(0.033)	
$\ln(\text{SDA Cost}_{t,t-3})$			-0.073^{*}
			(0.038)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Country-Year Fixed Effects	Y	Y	Y
Observations	3,260	3,260	3,260
Num SDA Localities	369	369	369
Num Countries	22	22	22
Adjusted R^2	0.753	0.753	0.753
Outcome Mean	4.611	4.611	4.611
Outcome SD	2.461	2.461	2.461

Notes: Observations are SDA localities in Sub-Saharan Africa between 1994 and 2022. Standard errors clustered at the country level are presented in parentheses. *Log Gains* is the log plus one of the number of reported baptisms, professions of faith, and former member baptisms in the SDA locality in a given year. *Log Losses* is the log plus one of the number of dropped and missing members in the SDA locality in a given year. *SDA Cost*$_{t,t-k}$ measures the average opportunity cost of abiding by the SDA crop prohibitions–the agricultural revenue per hectare given up per hectare if *constrained* by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$. See Data Appendix A for more information. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B.5. Accounting for Maximum Unconstrained Revenue

Table B7: Impact of the Opportunity Cost of Religious Membership on Religious Demand: SDA Membership, Controlling for Maximum Potential Revenue

	Dependent Variable: Panel A: *Log Gains*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	-0.040^{**}		
	(0.015)		
$\ln(R^{max,l}_{t,t-1})$	0.081		
	(0.119)		
$\ln(\text{SDA Cost}_{t,t-2})$		-0.045^{**}	
		(0.018)	
$\ln(R^{max,l}_{t,t-2})$		0.381^{**}	
		(0.150)	
$\ln(\text{SDA Cost}_{t,t-3})$			-0.032^{*}
			(0.018)
$\ln(R^{max,l}_{t,t-3})$			0.514^{**}
			(0.196)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.847	0.848	0.848
Outcome Mean	6.964	6.964	6.964
Outcome SD	1.832	1.832	1.832

	Dependent Variable: Panel B: *Log Losses*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	-0.061		
	(0.039)		
$\ln(R^{max,l}_{t,t-1})$	0.525^{**}		
	(0.229)		
$\ln(\text{SDA Cost}_{t,t-2})$		-0.038	
		(0.044)	
$\ln(R^{max,l}_{t,t-2})$		0.730^{**}	
		(0.285)	
$\ln(\text{SDA Cost}_{t,t-3})$			-0.042
			(0.048)
$\ln(R^{max,l}_{t,t-3})$			0.854^{**}
			(0.375)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.726	0.726	0.726
Outcome Mean	4.093	4.093	4.093
Outcome SD	2.648	2.648	2.648

Notes: Observations are SDA localities in Sub-Saharan Africa between 1994 and 2022. Standard errors clustered at the country level are presented in parentheses. *Log Gains* is the log plus one of the number of reported baptisms, professions of faith, and former member baptisms in the SDA locality in a given year. *Log Losses* is the log plus one of the number of dropped and missing members in the SDA locality in a given year. *SDA Cost*$_{t,t-k}$ measures the average opportunity cost of abiding by the SDA crop prohibitions–the agricultural revenue per hectare given up per hectare if *constrained* by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$ (see Appendix A). $R^{max}{}_{t,t-k}$ measures the average maximum potential *unconstrained* agricultural revenue–the agricultural revenue per hectare for producing the maximum potential revenue crop regardless of prohibitions–between years t and $t-k$ in a SDA locality. See Data Appendix A for more information. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B8: Impact of the Opportunity Cost of Religious Membership on Religious Supply: Churches & Religious Personnel, Controlling for Maximum Potential Revenue

	Dependent Variable: Panel A: *Log Churches*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	0.004		
	(0.009)		
$\ln(R^{max,l}_{t,t-1})$	0.036		
	(0.028)		
$\ln(\text{SDA Cost}_{t,t-2})$		0.009	
		(0.010)	
$\ln(R^{max,l}_{t,t-2})$		0.054	
		(0.035)	
$\ln(\text{SDA Cost}_{t,t-3})$			0.011
			(0.011)
$\ln(R^{max,l}_{t,t-3})$			0.061
			(0.044)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.962	0.962	0.962
Outcome Mean	5.156	5.156	5.156
Outcome SD	1.324	1.324	1.324
	Dependent Variable: Panel B: *Log Ministers*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	−0.002		
	(0.011)		
$\ln(R^{max,l}_{t,t-1})$	0.082		
	(0.063)		
$\ln(\text{SDA Cost}_{t,t-2})$		−0.009	
		(0.016)	
$\ln(R^{max,l}_{t,t-2})$		0.059	
		(0.084)	
$\ln(\text{SDA Cost}_{t,t-3})$			−0.014
			(0.017)
$\ln(R^{max,l}_{t,t-3})$			−0.004
			(0.111)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.942	0.942	0.942
Outcome Mean	2.118	2.118	2.118
Outcome SD	1.647	1.647	1.647

Notes: Observations are SDA localities in Sub-Saharan Africa between 1994 and 2022. Standard errors clustered at the country level are presented in parentheses. *Log Churches* is the log plus one of the number of reported churches and companies in the SDA locality in a given year. *Log Ministers* is the log plus one of the total number of ordained and licensed ministers in the SDA locality in a given year. *SDA Cost*$_{t,t-k}$ measures the average opportunity cost of abiding by the SDA crop prohibitions–the agricultural revenue per hectare given up per hectare if *constrained* by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$ (see Appendix A). $R^{max}{}_{t,t-k}$ measures the average maximum potential *unconstrained* agricultural revenue–the agricultural revenue per hectare for producing the maximum potential revenue crop regardless of prohibitions–between years t and $t-k$ in a SDA locality. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B9: Impact of the Opportunity Cost of Religious Membership on Religious Supply: Education, Health & Other Institutions, Controlling for Maximum Potential Revenue

	Dependent Variable:		
	Panel A: *Log Education Institutions*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	0.013**		
	(0.005)		
$\ln(R^{max,l}_{t,t-1})$	−0.107*		
	(0.040)		
$\ln(\text{SDA Cost}_{t,t-2})$		0.013**	
		(0.006)	
$\ln(R^{max,l}_{t,t-2})$		−0.128**	
		(0.049)	
$\ln(\text{SDA Cost}_{t,t-3})$			0.014**
			(0.007)
$\ln(R^{max,l}_{t,t-3})$			−0.088
			(0.064)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.824	0.824	0.823
Outcome Mean	0.253	0.253	0.253
Outcome SD	0.443	0.443	0.443
	Dependent Variable:		
	Panel B: *Log Health Institutions*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	0.005		
	(0.007)		
$\ln(R^{max,l}_{t,t-1})$	−0.055*		
	(0.030)		
$\ln(\text{SDA Cost}_{t,t-2})$		−0.000	
		(0.009)	
$\ln(R^{max,l}_{t,t-2})$		−0.025	
		(0.032)	
$\ln(\text{SDA Cost}_{t,t-3})$			−0.000
			(0.009)
$\ln(R^{max,l}_{t,t-3})$			0.093**
			(0.046)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.891	0.891	0.891
Outcome Mean	0.728	0.728	0.728
Outcome SD	0.783	0.783	0.783

Notes: Observations are SDA localities in Sub-Saharan Africa between 1994 and 2022. Standard errors clustered at the country level are presented in parentheses. *Log Education Institutions* is the log plus one of the number of reported education institutions in the SDA locality in a given year in the SDA annual yearbooks. *Log Health Institutions* is the log plus one of the number of reported health institutions in the SDA locality in a given year in the SDA annual yearbooks. *SDA Cost*$_{t,t-k}$ measures the average opportunity cost of abiding by the SDA crop prohibitions–the agricultural revenue per hectare given up per hectare if *constrained* by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$ (see Appendix A). $R^{max}{}_{t,t-k}$ measures the average maximum potential *unconstrained* agricultural revenue–the agricultural revenue per hectare for producing the maximum potential revenue crop regardless of prohibitions–between years t and $t-k$ in a SDA locality. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B.6. Heterogeneity

Table B10: Impact of the Opportunity Cost of Religious Membership on Religious Demand: Heterogeneity by Share of Population that is an SDA Member in a Locality

	Dependent Variable: Panel A: *Log Gains*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	-0.054*		
	(0.018)		
$\ln(\text{SDA Cost}_{t,t-1}) * SDA_{rSDA}$	0.003*		
	(0.002)		
$\ln(\text{SDA Cost}_{t,t-2})$		-0.070*	
		(0.021)	
$\ln(\text{SDA Cost}_{t,t-2}) * SDA_{rSDA}$		0.005**	
		(0.002)	
$\ln(\text{SDA Cost}_{t,t-3})$			-0.060**
			(0.023)
$\ln(\text{SDA Cost}_{t,t-3}) * SDA_{rSDA}$			0.004*
			(0.002)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.847	0.847	0.847
Outcome Mean	6.964	6.964	6.964
Outcome SD	1.832	1.832	1.832
	Dependent Variable: Panel B: *Log Losses*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	-0.076*		
	(0.044)		
$\ln(\text{SDA Cost}_{t,t-1}) * SDA_{rSDA}$	0.001		
	(0.003)		
$\ln(\text{SDA Cost}_{t,t-2})$		-0.067	
		(0.054)	
$\ln(\text{SDA Cost}_{t,t-2}) * SDA_{rSDA}$		0.003	
		(0.005)	
$\ln(\text{SDA Cost}_{t,t-3})$			-0.065
			(0.061)
$\ln(\text{SDA Cost}_{t,t-3}) * SDA_{rSDA}$			0.000
			(0.004)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.725	0.725	0.725
Outcome Mean	4.093	4.093	4.093
Outcome SD	2.648	2.648	2.648

Notes: Observations are SDA localities in Sub-Saharan Africa between 1994 and 2022. Standard errors clustered at the country level are presented in parentheses.*Log Gains* is the log plus one of the number of reported baptisms, professions of faith, and former member baptisms in the SDA locality in a given year. *Log Losses* is the log plus one of the number of dropped and missing members in the SDA locality in a given year. SDA_{rSDA} is the share of the population that are SDA members in a locality in the first year a locality appears in the SDA records. The denominator is estimated population in 1980 per locality based on Klein Goldewijk et al. (2017). *SDA Cost*$_{t,t-k}$ measures the average opportunity cost of abiding by the SDA crop prohibitions–the agricultural revenue per hectare given up per hectare if *constrained* by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$. See Data Appendix A for more information. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B11: Impact of the Opportunity Cost of Religious Membership on Religious Demand: Heterogeneity by Drought Experience

	Dependent Variable:		
	Panel A: *Log Gains*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	-0.059*		
	(0.021)		
$\ln(\text{SDA Cost}_{t,t-1}) * Drought$	0.022*		
	(0.013)		
$\ln(\text{SDA Cost}_{t,t-2})$		-0.081*	
		(0.026)	
$\ln(\text{SDA Cost}_{t,t-2}) * Drought$		0.030*	
		(0.016)	
$\ln(\text{SDA Cost}_{t,t-3})$			-0.062**
			(0.029)
$\ln(\text{SDA Cost}_{t,t-3}) * Drought$			0.019
			(0.019)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.847	0.847	0.847
Outcome Mean	6.964	6.964	6.964
Outcome SD	1.832	1.832	1.832
	Dependent Variable:		
	Panel B: *Log Losses*		
	(1)	(2)	(3)
$\ln(\text{SDA Cost}_{t,t-1})$	-0.045		
	(0.041)		
$\ln(\text{SDA Cost}_{t,t-1}) * Drought$	-0.034		
	(0.023)		
$\ln(\text{SDA Cost}_{t,t-2})$		-0.036	
		(0.052)	
$\ln(\text{SDA Cost}_{t,t-2}) * Drought$		-0.025	
		(0.026)	
$\ln(\text{SDA Cost}_{t,t-3})$			-0.047
			(0.060)
$\ln(\text{SDA Cost}_{t,t-3}) * Drought$			-0.019
			(0.027)
Locality Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
Observations	3,944	3,944	3,944
Num SDA Localities	397	397	397
Num Countries	44	44	44
Adjusted R^2	0.725	0.725	0.725
Outcome Mean	4.093	4.093	4.093
Outcome SD	2.648	2.648	2.648

Notes: Observations are SDA localities in Sub-Saharan Africa between 1994 and 2022. Standard errors clustered at the country level are presented in parentheses. *Log Gains* is the log plus one of the number of reported baptisms, professions of faith, and former member baptisms in the SDA locality in a given year. *Log Losses* is the log plus one of the number of dropped and missing members in the SDA locality in a given year. *Drought* is the average value for each year of the highest drought point during the year of each pixel for each locality. *SDA Cost*$_{t,t-k}$ measures the average opportunity cost of abiding by the SDA crop prohibitions–the agricultural revenue per hectare given up per hectare if *constrained* by SDA crop restrictions on coffee, tea, and tobacco–between years t and $t-k$. See Data Appendix A for more information. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.