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From Worship to Worldly Pleasures: Secularization and Long-Run Economic Growth

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No. 116

**From Worship to Worldly Pleasures:
Secularization and Long-Run Economic Growth**

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May 2012

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From Worship to Worldly Pleasures: Secularization and Long-Run Economic Growth

Holger Strulik*

This Version: May 2012.

Abstract. In medieval times, most people identified with religious values and aggregate income and productivity grew at glacier speed. In the 20th century, religion played a much lesser role in daily life and income and productivity grew at high and unprecedented rates. The present paper develops a simple economic theory of identity choice that explains both stylized facts as well as a period of secularization during which an increasing share of the population abandons religious identity for worldly pleasures and aggregate productivity takes off. An extension of the basic model investigates the Protestant reformation as an intermediate stage. Another extension introduces socially-dependent religious preferences, establishes the endogenous emergence of multiple, self-fulfilling equilibria, and demonstrates how a social multiplier amplifies the speed of transition.

Keywords: religion, identity, economic growth, productivity, secularization, comparative development.

JEL: N30, O10, O40, Z12, Z13.

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Do not love the world or the things in the world. If anyone loves the world, the love of the Father is not in him. For all that is in the world – the desires of the flesh and the desires of the eyes and pride in possessions – is not from the Father but is from the world.
(1 John 2: 15-16)

1. INTRODUCTION

This paper proposes a novel theory of identity choice and endogenous economic growth in which secularization is both cause and consequence of successful economic development. Secularization is understood as the endogenous transformation of a society from close identification with religious values towards one that identifies predominantly with nonreligious (secular) values. As indicated by the opening quote, a special focus will be on one particular element of the – certainly multi-dimensional – vector of religious (vs. secular) values: the value of consumption. Most religious denominations emphasize the strife for immaterial, eternal values and devalue the strive for material possessions and the enjoyment and excitement derived from “worldly” consumption activities. This means that an identification with religion requires to focus on immaterial values and to depreciate utility from consumption. In order to experience the full pleasure from consumption activities it is thus helpful to abandon the identification with religious values.

Religious identity is defined as the adherence to a religion and the importance of this religion for one’s self-concept. Abandoning religious identity and identifying with “secular” or “consumerist” values is thus *not* the same as ceasing to believe in basic religious principles (this would be an “atheist” identity). A person identifying with secular values, in terms of the World Value Surveys, may well state that she believes in God. But we would expect such a person to admit that God is not very important in her life and that she attends church less frequently than a person identifying with religious, immaterial values. Less attendance at church is a revealed preference of a secular identity not only because attendance interferes with consumer activities (the Sunday football match) but also because the sermon may try to refocus the congregation on immaterial values and to depreciate the pleasure derived from material consumption.

Secularization is one characteristic feature of the broader process of modernization, i.e. the general change of values associated with economic development. Inglehart and Baker (2000) investigate modernization across countries quantitatively by, among other things, computing a

secular value index from the World Value Surveys. Two out of five item of the secular value index measure directly religious values (God is not very important in respondents life; it is not important to instil religious faith in children). Inglehart and Baker find a significant and quantitatively important association with income per capita and the secular value index. In fact, 70 percent of the cross-country variation of secular values can be explained by income, the employment share in the industrial sector, and three history dummies (Communist, Catholic, and Confucian). The present paper focusses on the income channel but the finding that cultural history matters is interesting as well. It shows that we cannot expect to discover a unique “secularization trajectory”. The timing of secularization and the take off of modern economic growth will be culture- and country-specific.

Recently, a couple of studies investigated the association between income and religiosity in more detail. Barro and McCleary (2006) identify across countries a causal negative effect of income on religious participation and beliefs, which is also quantitatively important. A one standard deviation increase in log GDP per capita decreases church attendance by 17 percent. In a second exercise they take growth of income per capita as the independent variable and find that monthly attendance at church has a significantly negative impact on growth.¹ Paldam and Gundlach (2012) use the World Value survey to compile a country-specific religiosity index (14 items from “God is very important in life” to “Churches answer spiritual needs”) and find a causal negative impact of income on religiosity. On average, religiosity falls by 50 percent when countries pass through the transition from being underdeveloped to becoming a developed country. Lipford and Tollison (2003) document a strong bi-causal negative association of income and religious participation across US states. Rupasingha and Chilton (2009) use US county level data on religious adherence and find a causal negative effect of adherence on economic growth. An increase of religious adherence by one standard deviation would reduce growth by 0.4 percent per year.

The available empirical literature thus provides some supporting evidence that vanishing religiosity (secularization) plays a role for comparative economic development. The negative association between religiosity and income may appear surprising at first sight, since there is also evidence across countries that actively religious persons display several “good” attitudes which are thought to be conducive to growth, in particular trust and trustworthiness (Guiso et al.,

¹Barro and McCleary (2006) furthermore find that belief in hell has a significantly positive effect on growth. Later robustness checks, however, could not confirm this conjecture (Durlauf et al., 2011).

2003). The explanation offered by the present paper is that persons identifying with religion put more emphasis on immaterial values and strive less for worldly pleasures and possessions. A person identifying with secular or consumerist values can be expected, *ceteris paribus*, to work harder and to save more in order to enjoy more worldly possessions and engage in more worldly leisure activities now and in the next period. This view is supported by Hirschle (2011) who investigates church attendance rates across 82 European regions. To begin with, Hirschle confirms the negative association between attendance and income found by other studies. He then compiles an index of “consumption-related cultural activities” (number of visits to cinema, concert, sports event etc.) and shows that consumption beats income. When both are taken into account in the regression, income turns insignificant and a significantly negative correlation between church attendance and consumption activities emerges.²

The theory of secularization offered by the present paper is inspired by Akerlof and Kranton’s (2000, 2010) economic theory of identity. Akerlof and Kranton argue that preferences and individual utility are identity-specific and that identities are chosen, given certain constraints. In order to facilitate access to the new field of identity economics they carefully explain that people are not necessarily aware that they are actively choosing the utility-maximizing identity. Referring to Friedman’s (1953) general methodology of positive economics it is important that people behave as if they maximize their utility but not whether they are aware of their maximizing behavior. A religious or secular identity is certainly less ascriptive than several other dimension of identity and can be relatively easily adopted or abandoned (see Caselli and Coleman, 2011, for a paper on ethnic identity choice, which seems to be much harder to accomplish). Moreover, identifying with secular, consumerist values does not necessarily imply apostasy. It is not required that the consumerist entirely “loses his religion”. It is only required that he abandons the immaterial and ascetic values propagated by religion in favor of a secular identity which allows to experience – without feeling of guilt – the full pleasure provided by consumption activities and worldly possessions.

The present study is related to a few papers investigating the role of “the spirit of capitalism” in the theory of economic growth, notably Zuo (1994, 1995), Cavalcanti et al. (2007), and Doepke and Zilibotti (2008). The papers by Zuo and Calvacanti et al. investigate the impact of

²Hirschle (2010) presents corroborating evidence from Ireland’s recent growth and secularization experience. A related study by Gruber and Hungerman (2008) investigates how religious participation across US states depends on laws prohibiting retail activity on Sunday. It finds a strong reduction in religious attendance when these laws are repealed.

alternative given preferences and character traits on economic growth. The paper by Doepke and Zilibotti is more closely related to the present one in that it proposes as well a theory of preference formation. Parents shape their children's preferences for leisure and patience depending on occupational possibilities. The theory is useful in explaining the demise of the aristocracy and the rise of a capitalist middle class during industrialization. Doepke and Zilibotti put less emphasis on explaining the economic take off of aggregate income per capita and productivity and do not consider the secularization of a society. In Section 3 the present paper provides a complementing view on the Protestant reformation by extending the basic model towards the choice between two religious identities.³

In a certain sense the present paper provides a unified growth theory (Galor, 2011). It explains a long epoch of quasi stagnation as well as a terminal epoch of balanced growth and the endogenous emergence of a take-off period connecting the initial and terminal stage. The mechanism that generates unified growth, however, is new and non-standard. It is based on the interaction between income and identity choice. In the period of (quasi) stagnation income and consumption opportunities are low and people identify predominantly with religious, immaterial values. Consequently they supply relatively little labor and save little for future consumption. The economy, nevertheless, grows (at glacier speed) because of productivity increases realized through learning-by-doing. As income rises people increasingly identify with secular, material values and start to work more and save more for future consumption. Eventually the economy takes off, accompanied by a consumer revolution (McKendrick et al., 1982) and an industrious revolution (de Vries, 1994). With increasing secularization and increasing savings rates and productivity growth the economy finally converges toward a terminal stage of high and constant growth.⁴

The paper is organized as follows. The next section introduces the basic model, derives the main propositions, and calibrates the model to reproduce the long-run economic and religious

³See also Strulik (2012) who investigates the role of patience for explaining the gradual take off to growth in a representative agent framework. Galor and Moav (2002) and Galor and Michalopoulos (2012) investigate the role of genetics for preference formation in the context of economic growth.

⁴The standard mechanism of unified growth theory is built upon the evolution of demographic variables in interaction with education and aggregate productivity growth. See, Galor and Weil (2000), Kögel and Prskawetz (2001), Jones, 2001, Lucas (2002), Boucekine et al. (2002), Doepke (2004), Galor and Mountford (2008), Strulik and Weisdorf (2008) and many others. Of course, the present paper does not deny the importance of demographic change for long-run economic development. Abstracting from demographics helps to keep the model simple, to disentangle effects, and to establish, in theory, identity choice and its impact on economic behavior as a stand-alone mechanism, which, of course, in practice interacts with demographic forces.

development of England. Section 3 extends the model by allowing identification with two distinct religions. One of these, Protestantism, promotes to derive utility from wealth accumulation at the expense of a less impressive religious experience. The extended model explains the endogenous rise and fall of Protestantism and overshooting behavior of capital accumulation and productivity growth (a decline of the capitalist spirit). Section 4 introduces social interaction at church, which, for simplicity, has been neglected in the basic model. The fact that the value of religious identity depends on how many other people identify with religion creates a social multiplier and multiple equilibria. The social multiplier generally accelerates the speed of secularization. If people furthermore coordinate on an equilibrium at which most identify with secular values, secularization can be very quick. Section 5 concludes by mentioning limitations of the present study and an outlook for future research.

2. THE BASIC MODEL

2.1. Preferences. Consider an economy populated by two overlapping generations, each consisting of a measure $[0, 1]$ of individuals. As usual individuals experience utility from consumption and leisure. Furthermore they experience a utility from identifying themselves with a social group. A social group shares a common perspective from which to view the world and a set of basic principles to live out. For simplicity there are only two identities available, a religious identity and a secular identity. In line with psychological evidence and recent modeling in economics we understand identity as an individual control variable (Akerlof and Kranton, 2000). Formally, identity is a bivariate indicator variable, $\omega \in [0, 1]$, with $\omega = 1$ if individuals identify with secular, “consumerist” values and $\omega = 0$ if they identify with religious, immaterial values.

Individuals are assumed to be heterogenous in the value that they attach to religiosity but are otherwise, as usually in growth theory, assumed to be homogenous. Specifically, let ρ be a measure of the general value of religion in society and let $\rho R(i)$ denote the *unconditional* utility that individual i experiences from being religious. The general value of religion ρ is taken as given by individuals but it may be subject to parametrical shifts (the Enlightenment) or depend on the stock of available knowledge. Later on, in an extension of the basic model, we allow the value attached to religion to depend on the number of religious persons in society. For the basic model we abstract from social interaction and treat it parametrically. In order to get analytical

results we assume that the individual value of religion is uniformly distributed in the society such that $R(i) \in [0, 1]$.

Individuals identifying with religious values attach a lower weight on utility experienced from consumption than individuals identifying with secular values. Putting less weight on “worldly” consumption is required or recommended by most religions including Christianity. In economic terms, less utility gained from consumption is the “opportunity cost” of an religious identity. Only persons who abandon their religious identity are capable to enjoy the full pleasure from consumption. This is the minimum setup of an identity-driven growth model. Extensions are conceivable. For example, identifying with religion could also involve a time cost (for prayer and churchgoing; Azzi and Ehrenberg, 1975) and/or a monetary cost (the tithe). For the sake of notational simplicity we refrain from these extensions, which could be integrated without loss of generality.

Summarizing and assuming log functional forms an individual born at time t experiences utility

$$u_t = (\alpha + \omega) \log c_t + \beta (\alpha + \omega) \log c_{t+1} + \gamma \log (1 - \ell_t) + (1 - \omega) \rho R, \quad (1)$$

in which c_t and c_{t+1} denotes consumption when young and when old, respectively, and ℓ_t denotes labor supply when young. Old age is defined as the period of retirement. If an individual identifies with secular values $\omega = 1$ and the utility function reduces to the one of a standard OLG model with endogenous labor supply. If an individual identifies with religious values $\omega = 0$, and the individual experiences utility from being religious at the expense of reduced utility from consumption. The parameter α is potentially dependent on the specific religion. Some denominations recommend or require an ascetic life style (small α) while others require less sacrifice (high α).

We assume that a chosen identity is kept in both periods of life which allows a simple representation of the value of religion in the utility function. For a given general value of religion ρ a change of identity would indeed be suboptimal. Persons who identified with religious values in the first period and thus saved relatively little for the second period would not like to change their identity when old and put a lot of weight on consumption activities. Similarly a secular identity choice in the first period induces higher savings for consumption in the second period and secular individuals would not like to depreciate their utility from consumption by an identity change.

Young individuals take wages as given and earn a labor income $w_t \ell_t$. Furthermore they operate a home production technology which generates b units of goods. With s_t denoting savings, the budget constraint is given by

$$w_t \ell_t + b - c_t - s_t = 0. \quad (2)$$

Assuming a (small) contribution of home production to total income is sufficient to ensure that an equilibrium of stagnation, if it exists, is associated with a positive capital stock and positive aggregate output.

2.2. Identity-Specific Labor Supply and Saving. Maximizing the utility function (1) with respect to the budget constraint (2) and the savings constraint $c_{t+1} = (1 + r_t)s_t$, in which r_t is the interest rate, provides the following solution.

$$c_t = \frac{(\alpha + \omega)(w_t + b)}{(\alpha + \omega)(1 + \beta) + \gamma} \quad (3)$$

$$s_t = \frac{\beta(\alpha + \omega)(w_t + b)}{(\alpha + \omega)(1 + \beta) + \gamma} \quad (4)$$

$$\ell_t = \frac{(\alpha + \omega)(1 + \beta)w_t - \gamma b}{[(\alpha + \omega)(1 + \beta) + \gamma]w_t}. \quad (5)$$

In order to avoid distracting case differentiation we assume that the return from home production b is low enough to allow for an interior solution of labor supply ℓ_t . Religious persons, that is persons who set $\omega = 0$, derive less pleasure from consumption and consequently supply less labor and save less for future consumption. Taking the derivative of (3)-(5) with respect to ω verifies this claim.

PROPOSITION 1. *For given labor income, persons identifying with secular values supply more labor and save more; $\partial \ell_t / \partial \omega > 0$, $\partial s_t / \partial \omega > 0$.*

A religious transition during which a majority of the population changes identity will thus be characterized by increasing labor supply (an industrious revolution) as well increasing savings (capital accumulation) and increasing consumption (consumer revolution). It can also be seen from (4)-(5) that labor supply and the savings rate s/w approach constants when income grows perpetually.

2.3. Identity Choice. Inserting (3)-(5) into (1) we obtain identity-dependent maximized utility.

$$u_t(\omega) = [(\alpha + \omega) + \gamma] \log(w + b) + (1 - \omega)\rho R - [(\alpha + \omega) + \gamma] \log [(\alpha + \omega) + \gamma] + (\alpha + \omega) \log(\alpha + \omega) + \beta \log \beta + \gamma \log \gamma + \beta(\alpha + \omega) \log(1 + r_t). \quad (6)$$

Following the economic theory of identity choice, a person identifies with religion if this provides more utility than identifying with secular values. This means that person i , who attaches the value $R(i)$ to religion, identifies with religion if $u_t(0) > u_t(1)$. Calculating the utility difference we obtain that person i identifies with religion if

$$R(i) > \frac{1}{\rho} [(1 + \beta) \log(w_t + b) + \phi] \equiv C(w_t), \quad (7)$$

with $\phi \equiv [\alpha(1 + \beta) + \gamma] \log [\alpha(1 + \beta) + \gamma] - [(\alpha + 1)(1 + \beta) + \gamma] \log [(\alpha + 1)(1 + \beta) + \gamma] + (\alpha + 1)(1 + \beta) \log(\alpha + 1) - \alpha(1 + \beta) \log \alpha$.

FIGURE 1. The Secularization Threshold

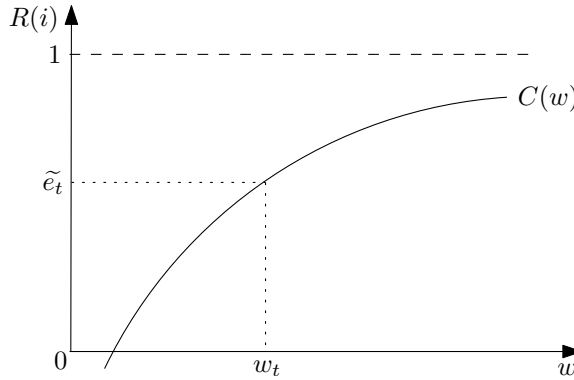


Figure 1 illustrates the result. Person i chooses religion iff $R(i)$ lies above the concave secularization threshold $C(w)$. If $R(i)$ lies below the curve, he or she chooses worldly pleasures. Since $R(i) \in [0, 1]$, we read off that there are \tilde{e}_t persons in society not identifying with religion when the wage per unit of labor is w_t . Generally, however, $C(w_t)$ may be smaller than zero or larger than unity, in which case nobody or everybody identifies with religion. Taking the corner solutions into account the number of persons in society not identifying with religion, denoted by e_t is given by

$$e_t = \max \{0, \min \{\tilde{e}_t, 1\}\}, \quad \tilde{e}_t \equiv \frac{1}{\rho} [(1 + \beta) \log(w_t + b) + \phi]. \quad (8)$$

As wages grow and the society gets richer less persons are induced to identify with religion, a result that reflects the phenomenon usually called *secularization*. Note also that a general devaluation of religion, captured by declining ρ , shifts the $C(w)$ -curve upwards and leads to fewer religious identities in society.

2.4. Aggregate Savings and Capital Accumulation. As usual in OLG modeling we assume that savings of the currently young generation constitutes the capital stock with which the next young generation works. For simplicity we assume that capital depreciates completely within one generation such that $k_{t+1} = \tilde{s}_t$, in which k_{t+1} is aggregate capital of the next generation and $\tilde{s}_t = \int_0^1 s_t(i) di = s_t(\omega = 1) \cdot e_t + s_t(\omega = 0) \cdot (1 - e_t)$ is aggregate savings of the currently young generation. Inserting identity-dependent savings from (4) we obtain

$$k_{t+1} = \frac{(\alpha + 1)\beta(w_t + b)}{(\alpha + 1)(1 + \beta) + \gamma} \cdot e_t + \frac{\alpha\beta(w_t + b)}{\alpha(1 + \beta) + \gamma} \cdot (1 - e_t). \quad (9)$$

Taking the derivative of (8) with respect to e_t (at the interior solution) verifies the following result.

PROPOSITION 2. *The larger the population share identifying with secular values e_t , the larger aggregate savings and thus next period's capital stock k_{t+1} .*

2.5. Production. There exists a continuum of size one of competitive firms producing a homogenous output using a Cobb-Douglas production function and employing capital and labor. In period t a firm j employs capital $k_t(j)$ and labor $L_t(j)$ and produces output $y_t(j) = A_t(j)k_t(j)^\theta L_t(j)^{1-\theta}$ where total factor productivity $A_t(i)$ is exogenous to the single firm and $0 < \theta < 1$. Production factors are demanded such that factor prices equal the (private) marginal product, $w_t = (1 - \theta)A_t(j)k_t(j)^\theta L_t(j)^{-\theta}$, $r_t = \theta A_t(j)k_t(j)^{\theta-1} L_t(j)^{1-\theta}$. Aggregate employment is denoted by k_t and $L_t = \int_0^1 \ell_t(i) di$.

In the basic model long-run growth is driven by learning by doing. As proposed by Arrow (1962) and Romer (1986) we think of knowledge embodied in capital goods such that the aggregate capital stock approximates the existing knowledge. In order to generate long-run growth knowledge is assumed to be given by $A_t(j) = \bar{A}k_t^{1-\theta}L_t^\theta$ such that, on the aggregate level, output per hour becomes a linear function of capital per worker. This implies $w_t = (1 - \theta)\bar{A}k_t$. The parameter \bar{A} controls the diffusion of knowledge independently from the current state of

the economy. It can be thought of capturing the effect of persistent determinants of access to knowledge as, for example, institutional barriers to travel and trade.

2.6. Dynamics. A linear aggregate production technology is necessary but not sufficient for long-run growth. In order to see this explicitly, insert wages into (8) to obtain the equation of motion for aggregate capital:

$$k_{t+1} = \frac{(\alpha + 1)\beta [(1 - \theta)\bar{A}k_t + b]}{(\alpha + 1)(1 + \beta) + \gamma} \cdot e_t + \frac{\alpha\beta [(1 - \theta)\bar{A}k_t + b]}{\alpha(1 + \beta) + \gamma} \cdot (1 - e_t). \quad (10)$$

For long growth to be sustainable, the gross rate of growth $k_{t+1}/k_t > 1$ for $k_t \rightarrow \infty$. For high k_t the subsistence term becomes negligible and the feasibility of long-run growth depends solely on the slope, i.e. on whether $\partial k_{t+1}/\partial k_t > 1$.

In order to make the problem interesting we make the following assumption.

ASSUMPTION 1.

$$s_W(k)' \equiv \frac{(\alpha + 1)\beta(1 - \theta)\bar{A}}{(\alpha + 1)(1 + \beta) + \gamma} > 1 > \frac{\alpha\beta(1 - \theta)\bar{A}}{\alpha(1 + \beta) + \gamma} \equiv s_R(k)' .$$

This means that long-run growth is feasible if all members of society choose a secular identity, that is for $e_t = 1$, because $s_W(k_t)' > 1$. On the other hand, there is no long-run growth if everybody chooses a religious identity, that is for $e_t = 0$, because $s_R(k_t)' < 1$. In the context of the present paper Assumption 1 provides the only interesting case. Otherwise there would be always or never long-run growth irrespective of identity choice and the secularization of society.

FIGURE 2. Phase Diagram: Religious Identity (Left) – Secular Identity (Right)

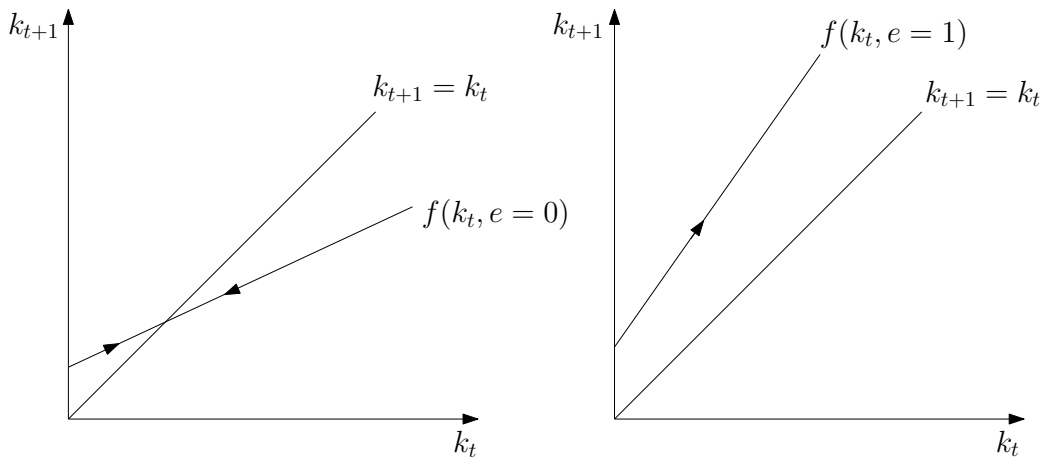
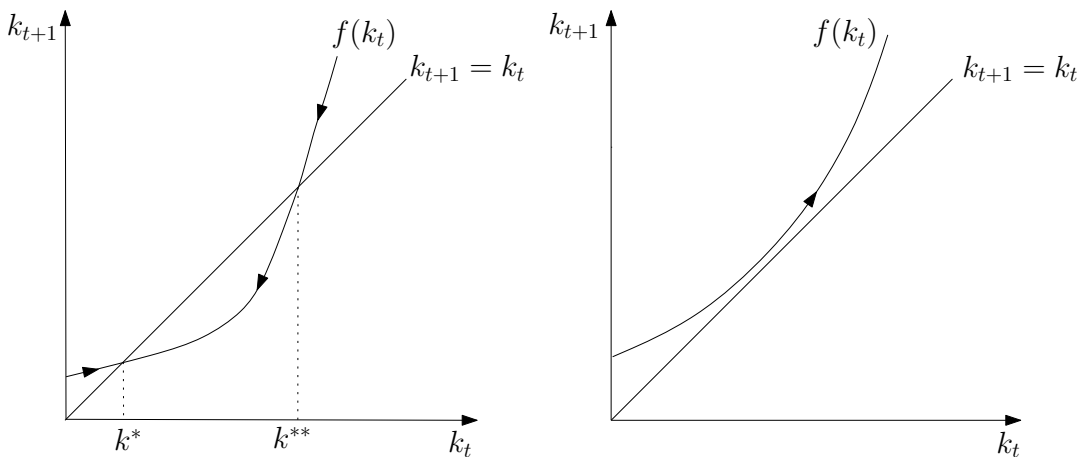


Figure 2 illustrates Assumption 1. On the left hand side we see the case when everybody chooses a religious identity. Since $s'_R < 1$ there exists a unique intersection with the identity line, which determines a globally stable equilibrium of stagnation. The right hand side shows the case when everybody identifies with secular values. There is no intersection with the identity line and $s'_W > 1$ such that there is always economic growth. In the long-run the growth rate converges from below towards $g \equiv (1 + \alpha)\beta(1 - \theta)\bar{A}/[(1 + \alpha)(1 + \beta) + \gamma] - 1$.

But Figure 2 illustrates only the two limiting cases. The actual curvature of $f(k)$, as shown in (10), is a linear combination of the limiting cases. When society predominantly identifies with religion, the left hand side of Figure 2 dominates the aggregate picture and the slope of $f(k)$ is relatively flat. When society predominantly identifies with secular values, the right hand side dominates, and $f(k)$ is steep. Because identity choice is itself a function of wages (8), and wages are a linear function of capital, we can insert the resulting $e(k)$ in (10) and get the reduced form of the economy as one equation of motion for capital per capita. When there is little capital, wages are low, most people identify with religion, and labor supply and savings are low. Consequently, $f(k)$ is relatively flat. With rising capital stock, wages increase, more people identify with secular values and $f(k)$ becomes steeper. In short, the $f(k)$ curve is convex, converging asymptotically against a straight line as k goes to infinity.

FIGURE 3. Poverty Trap (Left) – Transition to Long-Run Growth (Right)



On the aggregate there are thus two different cases conceivable, as illustrated in Figure 3. The panel on the left hand side shows a case in which the $f(k)$ -curve intersects the identity line twice. We observe two equilibria, a locally stable one at k^* and an unstable one at k^{**} . This means that

social identity is simultaneously cause and consequence of successful economic development. If a medieval socio-economic history is conceived as stagnating at an equilibrium k^* , at which most identify with religious values and aggregate savings and thus capital and productivity are too low for long-run growth, then an exogenous event is needed to release society from the poverty trap. This would be a parametric change that shifts the $f(k)$ -curve upwards such that the equilibrium of stagnation ceases to exist and the picture looks like the one on the right hand side of Figure 3.

Note that the equilibrium of stagnation differs conceptually from the poverty trap generated by the conventional Malthusian model: it is not necessarily where income corresponds with subsistence needs. In particular, income could be above subsistence needs yet still low enough such that identification with religious values and low labor supply and savings is the preferred choice of a majority in society. The theory thus provides an alternative mechanism that rationalizes why in some middle age societies, such as England, average income per capita – although not visibly growing – exceeded by far the subsistence minimum (Clark, 2007; see also Voigtländer and Voth (2010), and Sharp et al., 2012).

An upward shift of the $f(k)$ -curve could be realized by an exogenous shift of \bar{A} , allowing for an easier diffusion of knowledge, as discussed in Strulik (2009). Alternatively it could be an event that diminishes the general value of religion ρ . This would shift the secularization threshold $C(w)$ upwards in Figure 1. Ceteris paribus less people identify with religion and as a consequence the *aggregate* savings rate rises and the $f(k)$ -curve shifts upwards. It is easy to imagine the demystification of the world by Enlightenment as such an event. Alternatively one might think of misbehavior of the church (e.g. witch hunting during counter-reformation) which made it harder for some people to identify with religion. In the case of Enlightenment the curve shift could also be conceptualized as brought forward endogenously. In the simplest case it could be a function of time. After people have contemplated metaphysical issues for a sufficiently long period of time, Enlightenment emerges.

Economic take off and secularization must not necessarily be initiated by an exogenous value loss of religion. Alternatively, both medieval times and the modern era could be captured by the picture on the right hand side of Figure 3. To see this, note that the distance between the $f(k)$ -curve and the identity line provides the gross growth rate of capital Δk . The middle ages are then identified as a period in which the $f(k)$ -curve comes close to the identity line. In

fact, as demonstrated below, the distance between the two curves can be so small that growth becomes unobservable over centuries for the naked eye. Actually, however, since stagnation does not exist, there is always growth of knowledge and productivity but during some “dark period” it is growth at glacier speed. As the funnel between the two curves widens, the economy takes off and the society secularizes endogenously. These insights are summarized by the following proposition.

PROPOSITION 3. *(a) If the value of religion ρ is sufficiently high or autonomous factor productivity \bar{A} is sufficiently low then there exist two equilibria of stagnation, one locally stable (k^*), one unstable (k^{**}). An economy starting at $k_0 < k^*$ converges to stagnation at k^* . Take off to growth and secularization need an exogenous event (Enlightenment).*

(b) If the value of religion ρ is sufficiently low or productivity \bar{A} is sufficiently high, there exists no equilibrium of stagnation and take off to growth and secularization are initiated endogenously.

The case of endogenous secularization, without value loss of religion, helps to rationalize the frequently observed phenomenon that in a secularized society many people still believe in God, heaven, an afterlife etc. These beliefs, however, do no longer dominate their daily life. Notwithstanding their beliefs they identify with secular, material values because rising income has provided access to worldly pleasures and the desire for worldly possessions. Consuming a football game, shopping at IKEA, or enjoying a day trip on a Sunday provides higher utility than attending church. Moreover Sunday service reminds the congregation that true believers would not seek worldly pleasures. Only abandoning religious identity provides the full enjoyment of consumption.

A recent study by Opfinger (2012) corroborates this view. Opfinger investigates how the answer to questions about religion in the World Value Surveys correlate with income per capita in the respondent’s country. He finds that income per capita is strongly negatively correlated with church attendance but not significantly correlated with beliefs (belief in God, self assessment as religious). The *importance* of beliefs, however, is found to be strongly negatively correlated with income (affirmative answer whether religion is very important in respondent’s life, whether God is very important, whether it is important for children to learn religious faith). This finding corresponds well with Hirschle’s (2011) study mentioned in the Introduction. Hirschle finds that a previously strongly negative correlation between income and church attendance turns insignificant once consumption related activities (visits to cinema, theater, concert etc.) enter

the regression equation. Instead consumption becomes significantly negatively correlated with church attendance. It thus seems that during secularization religious beliefs are kept or changed very slowly while the importance of beliefs vanishes as younger generations increasingly identify with secular values because this allows them to experience more pleasure from consumption activities.

2.7. A Calibration Exercise. In this section I calibrate the model and investigate how well it can explain economic take off and secularization in England. England is a natural choice because it is best covered with historical data, because it is the pioneer country of the Industrial Revolution, and because it has been already investigated by several other calibration studies of growth over the very long run. However, even for England, historical data on religiosity and religious behavior is scarce. While there exists no hard data for the Middle Ages and the early modern period, we know that “most British social scientists, historians, and church leaders think that Britain is now not very religious and was once markedly so.” (Bruce, 1995, see also Bruce, 2001; 2010). There exists data from a census in 1851 and then again from after WWII (Brierley, 1999). Another source is a retrospective calculation from recent surveys using the respondents recollection of church attendance during their childhood. This data has been compiled by Iannaccone (2003) on a quinquennial basis for the years 1925 to 1990. One could, of course, question whether church attendance is a reasonable proxy for religious identity. Some people may go to church for worldly secular as well (networking). But attendance is the most widely available religiosity variable, which is also mostly used by other studies. Moreover, attending church (instead of shopping or attending a football game) is a clear signal that religion is indeed an important determinant in a person’s life. It is also in church where people expose themselves to sermons preaching not to value possessions too much, an exhortation that secular identities presumably do not want to hear but which religious identities would like to be reminded of.

For GDP and TFP I took the data compiled by Madsen et al. (2010) for the years 1620-2000. From the data for GDP and employment I compute GDP per worker. TFP is computed by Madsen et al. as the Solow-residual, implying huge fluctuation in annual growth of TFP. In order to identify a TFP trend I have computed 50-year moving averages from the Madsen et al. data, as in Strulik (2009).

After calculating adjustment dynamics for the overlapping generations economy the generational data is converted into annual one by assuming that a generation takes 20 years. As usual

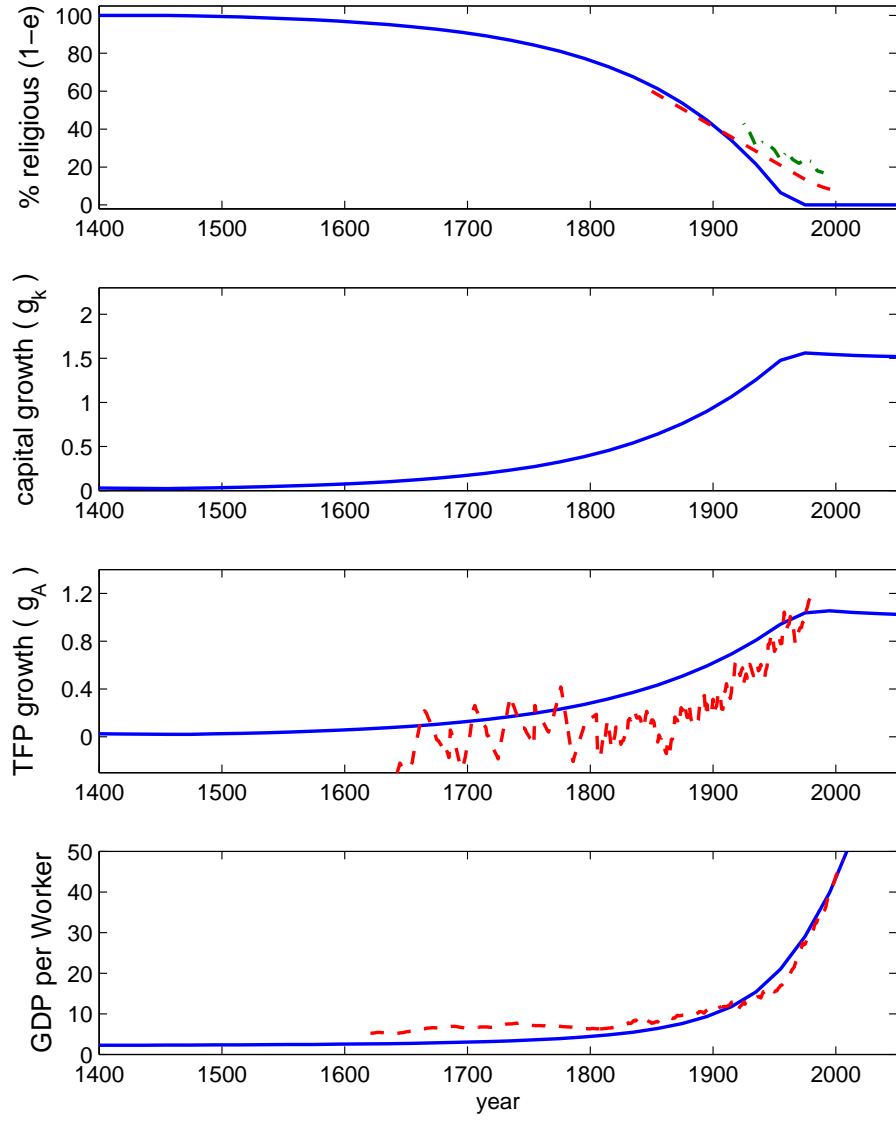
in these exercises I have set the capital share θ to $1/3$. I have set \bar{A} , β , and γ such that the steady-state growth rate is 1.5 percent annually, the savings rate is 15 percent, and such that people work $1/3$ of their time, as it is usually assumed in the RBC literature. These values try to capture England (the UK) at the end of the 20th century. We are thus left with three parameters to calibrate adjustment dynamics from the high middle ages (year 1000) to today and beyond (year 2050): home production b , the value of religion ρ , and the weight attached to consumption α . It turns out that the best fit of the historical time series is obtained for $b = 0.48$, $\rho = 3$, and $\alpha = 1.5$. For these parameters values there exists no steady-state of stagnation and secularization and the take-off to growth are endogenously initiated.

Figure 4 shows the resulting adjustment dynamics (solid blue lines) together with the historical time paths (dashed red and green lines). The upper panel shows identity choice, i.e. the share of the population identifying with religion. During the High Middle Ages almost everybody identifies with religion.⁵ From the 17th century on some secular identities become visible, initiating a process of secularization that continues with increasing speed. In 1851 there are still about 60 percent of the population identifying with religion, a figure which corresponds with the historical attendance data. From that on the model predicts a somewhat too fast secularization. For the year 2000 it predicts that nobody is attending church while in fact 7.5 percent are attending. A part of this deviation can be probably explained by the simplifying assumption of a rectangular distribution of the value of religion. A more realistic distribution would perhaps acknowledge that some people put very high value on religion, which would make them resistant against worldly temptations even at high income levels. Another explanation, the emergence of Protestantism, will be discussed in Section 3.

The next panel shows the predicted trajectory for growth of aggregate capital. Since secular identities work and save more, secularization is accompanied by an increase of the average savings rate (Dean and Cole, 1969; Crafts, 1985) and an increase of aggregate labor supply (de Vries, 1994, Voth, 1998). Increasing capital accumulation leads to a higher scale of production and more learning-by-doing. It thus promotes TFP growth, as shown in the third panel. The model gets the gradual take-off of TFP about right but predicts somewhat too high TFP growth in the early modern period and a “too early” increase of TFP for the time before the second Industrial Revolution (before 1860).

⁵The years 1000 to 1400 are not shown in Figure 4 because they pretty much look like 1400. This saves space to show in more detail the years in which there is actually movement in the data.

FIGURE 4. Identity Choice and Economic Growth in the Long-Run



Blue (solid) lines: model prediction. Red (dashed) lines: Data for England from Brierley (1999), Maddison (2003), and Madsen et al. (2010). Green (dash-dotted): attendance data from Iannaccone (2003). Growth rates in percent. GDP per worker in thousands. Parameters and steady-state values: $\theta = 0.33$; $\alpha = 1.5$; $\rho = 3$; $b = 0.48$; $g_y^* = 0.015$; $L^* = 0.33$; $(s/w)^* = 0.15$. Implied: $\beta = 0.83$; $\gamma = 9.3$; $\bar{A} = 13.4$.

The lower panel in Figure 4 shows the predicted evolution of GDP per worker. For better comparison I have normalized income at the 1980 value of the actual data. The model overestimates GDP per worker around the WWII and underestimates it during the early modern period. Overall, however, the theory of secularization and growth explains the actual evolution of income reasonably well.

3. THE PROTESTANT REFORMATION AS AN INTERMEDIATE STAGE

3.1. Setup. This section extends the basic model by allowing individuals to choose between three identities, a secular one and two religious identities. One religious identity, called Catholic, provides the same utility as the unique religious identity in the basic model. The second identity, called Protestant, assigns a lower value to religious experiences but allows to derive utility from wealth accumulation. Specifically utility (1) is rewritten as

$$u_t = (\alpha + \omega) \log c_t + \beta (\alpha + \omega) \log c_{t+1} + (1 - \omega) \pi \eta \log s_t + \gamma \log (1 - \ell_t) + (1 - \omega) [\rho(1 - \pi) + \rho_p \pi] \quad (11)$$

and $\pi \in \{0, 1\}$. This means that for individuals who identify with religion ($\omega = 1$) and choose $\pi = 0$ everything remains as in the basic model. If religious individuals choose $\pi = 1$, however, they assume a Protestant identity, implying less inherent value of religion $\rho_p < \rho$ in exchange for utility derived from wealth accumulation, which enters the utility function with weight $\eta > 0$. Protestants experience a less magical and spectacular divine service in a plain church with less saints to adore and (perhaps) less mystical explanations for the tide of events, thus $\rho_p < \rho$. The Protestant work ethic or “spirit of Capitalism” (Weber, 1905) is captured by $\eta > 0$. As discussed in the Introduction, the modeling of the spirit of capitalism is not new in the literature. The earlier literature, however, did not investigate the role of identity choice and secularization for economic growth.

Maximizing utility with respect to (2) and $c_{t+1} = (1 + r_t)s_t$ provides the solution (12)-(14).

$$c_t = \frac{(\alpha + \omega)(w_t + b)}{(\alpha + \omega)(1 + \beta) + \gamma + (1 - \omega)\pi\eta} \quad (12)$$

$$s_t = \frac{[\beta(\alpha + \omega + (1 - \omega)\pi\eta)](w_t + b)}{(\alpha + \omega)(1 + \beta) + \gamma(1 - \omega)\pi\eta} \quad (13)$$

$$\ell_t = \frac{[(\alpha + \omega)(1 + \beta) + (1 - \omega)\pi\eta] w_t - \gamma b}{[(\alpha + \omega)(1 + \beta) + \gamma(1 - \omega)\pi\eta] w_t}. \quad (14)$$

Comparing the solution for $\omega = 1$ with the one for $\omega = 0$ and $\pi = 1$ or $\pi = 0$, respectively, verifies the following propositions.

PROPOSITION 4. *For given labor income, persons identifying with secular values as well as persons identifying with Protestant values supply more labor and save more than persons identifying with Catholic values; $\partial \ell_t / \partial \omega > 0$, $\partial s_t / \partial \omega > 0$.*

The intuition is similar as for Proposition 1. Protestants experience utility from savings and work harder and save more than Catholics.

PROPOSITION 5. *For given labor income, persons identifying with Protestant values save more than persons identifying with secular values if $\eta > \beta\gamma/(1 + \alpha + \gamma)$. They supply more labor if $\eta > 1 + \beta$.*

If Protestants put sufficient weight on wealth accumulation they supply more labor and save more than secular persons. The condition for savings of Protestants to exceed that of secular persons is relatively easily fulfilled. A sufficient, not necessary condition is, for example, $\eta > \beta$. The condition for more labor supply of Protestants is harder to fulfil because secular types have an incentive to work hard for current worldly pleasures. Protestants lack this incentive. If the condition for savings is fulfilled, the transition from a Catholic religious society to a secular society is accompanied by a non-monotonous behavior of the savings rate and first increasing and then decreasing growth of capital and productivity. Growth is highest at an intermediate state of development. Adjustment to the secular steady-state of balanced growth entails decline when the “spirit of capitalism” recedes (Sombart, 1915, Wiener, 1982).

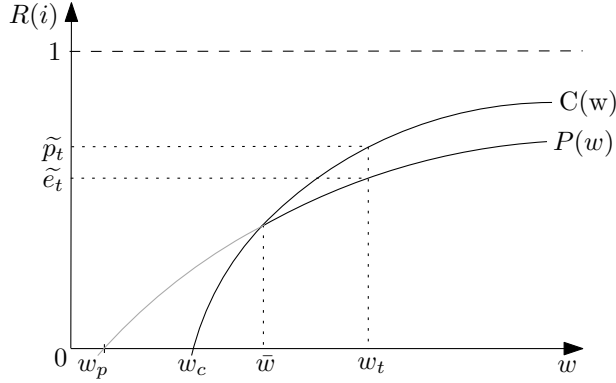
3.2. Identity Choice. Proceeding as in Section 2 and comparing utilities we obtain the same threshold $C(w)$ between (Catholic) religious identities and worldly identities, as shown in equation (7) and displayed in Figure 3. Comparing utilities for $\omega = 1$ and $(\omega = 0, \pi = 1)$ we find that a person prefers a Protestant religious identity over a worldly identity if

$$R(i) > \frac{1}{\rho_p} [(1 + \beta - \eta) \log(w_t + b) + \phi_p] \equiv P(w_t), \quad (15)$$

with $\phi_p \equiv [\alpha(1 + \beta) + \gamma + \eta] \log [\alpha(1 + \beta) + \gamma + \eta] - [(\alpha + 1)(1 + \beta) + \gamma] \log [(\alpha + 1)(1 + \beta) + \gamma] + (\alpha + 1)(1 + \beta) \log(\alpha + 1) - \alpha \log \alpha - (\alpha\beta + \eta) \log(\alpha + \eta)$.

For Protestantism to emerge the $C(w)$ threshold has to intersect the $P(w)$ threshold from below as shown in Figure 5. In this case all religious individuals identify with Catholic values as long as income lies below \tilde{w} . For income larger than \tilde{w} a region emerges between the $P(w)$ -curve and $C(w)$ -curve. In this region individuals prefer a secular identity over Catholicism but also a Protestant identity over a secular one, implying that they identify with Protestantism. For Protestantism to be an option either the weight of wealth in utility η or the value of the

FIGURE 5. Thresholds: Protestant Reformation and Secularization



Protestant religious experience ρ_p has to be sufficiently large. This is stated formally by the following Proposition.

PROPOSITION 6. *The $C(w)$ threshold intersects the $P(w)$ threshold from below if $\phi_p > \phi$ and*

$$\frac{1 + \beta - \eta}{1 + \beta} < \frac{\rho_p}{\rho}. \quad (16)$$

For the proof notice that $P(w)$ is everywhere flatter than $C(w)$ if (16) holds. Then $C(w)$ cuts $P(w)$ from below if the zeroes fulfil $w_c < w_p$, that is if $\phi/\phi_p < (1 + \beta)/(1 + \beta - \eta)$. Since $\eta > 1$ the right hand side is always larger than unity, implying that $\phi_p > \phi$ is a sufficient condition for the inequality to be fulfilled. The condition $\phi_p > \phi$ is hard to interpret because the ϕ 's are large compound parameters. In numerical exercises it turns out that it is always fulfilled for plausible parameters. This means that the easily interpretable condition (16) is crucial. It says that the higher the utility that Protestants experience from wealth accumulation η the lower can be the inherent value of religion ρ_p for Protestantism to emerge. In other words, if the Protestant religion puts little weight on wealth, the religious experience at church must not be too different from Catholicism (Lutheran Protestantism). If the Protestant religion allows to derive much utility from wealth accumulation, on the other hand, the Protestant movement will emerge although it offers a much plainer liturgy and a less spectacular experience at church than the Catholic competitor (Calvinistic Protestantism).

The condition for an intersection at \tilde{w} , however, is only necessary not sufficient for Protestantism to emerge. In addition, parameter values have to be such that the intersection is within the feasible region of the idiosyncratic value of religion, that is $0 < P(\tilde{w}) < 1$. Otherwise there

would never be Catholicism (if $P(\tilde{w}) \leq 0$) or never Protestantism (if $P(\tilde{w}) \geq 1$). If such an intersection exists, the population shares of identities can be again read off the ordinate. Take, for example, the wage w_t in Figure 5. Then, a share \tilde{e}_t of the population identifies with secular values, a share $1 - \tilde{p}_t$ identifies with the Catholic religion and a share $\tilde{p}_t - \tilde{e}_t$ identifies with Protestantism. Taking corner solutions into account as well, the complete description of population shares is given by $1 - p_t$ Catholics, $p_t - e_t$ Protestants, and e_t secular types with $p_t = \max\{0, \min\{C(w_t), 1\}\}$ and $e_t = \max\{0, \min\{P(w_t), 1\}\}$ for $C(w_t) > P(w_t)$ and $e_t = p_t$ otherwise.

3.3. Dynamics. The production side of the economy is taken from the basic model. Computing aggregate savings, i.e. aggregate identity-specific savings over the population shares of identities provides the equation of motion

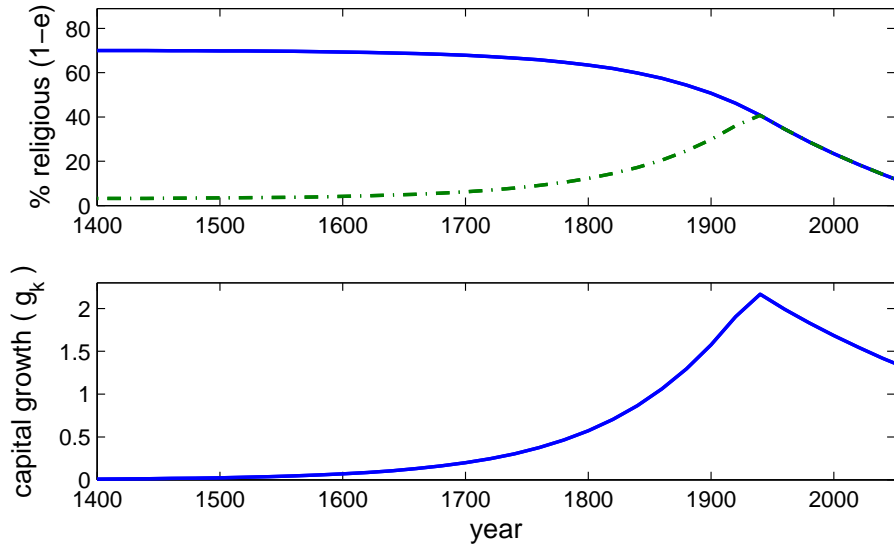
$$\begin{aligned} k_{t+1} = \tilde{f}(k_t) = & \frac{(\alpha + 1)\beta [(1 - \theta)\bar{A}k_t + b]}{(\alpha + 1)(1 + \beta) + \gamma} \cdot e_t + \frac{\alpha\beta [(1 - \theta)\bar{A}k_t + b]}{\alpha(1 + \beta) + \gamma} \cdot (1 - p_t) \\ & + \frac{(\alpha\beta + \eta) [(1 - \theta)\bar{A}k_t + b]}{\alpha(1 + \beta) + \gamma + \eta} (p_t - e_t). \end{aligned} \quad (17)$$

which replaces (10). Because the population shares are a unique function of the wage rate according to (7) and (15) and wages are a unique function of aggregate capital, the reduced form of the model is again a unique, piece-wise defined, and concave difference equation for k . The remainder of the analysis proceeds as described in Section 2. Because Protestantism arises and flourishes, if at all, only when wages are high enough, there exist again two qualitatively different cases: either the $\tilde{f}(k)$ curve intersects the identity line (exogenous initiation of secularization and growth) or not (endogenous initiation). The only difference is that there may be an intermediate phase during which the population share of Protestants first rises and then falls.

3.4. Numerical Experiments: The Rise and Fall of Protestantism. The possibility of Protestantism does not affect the main conclusion that secularization is both cause and consequence of economic development. But it is helpful to explain non-monotonous adjustment behavior of macro-aggregates. If savings rates of Protestants exceed those of secular Consumerists, we observe overshooting behavior of capital stock growth and TFP growth. Growth increases when Protestantism is on the rise (and replaces Catholicism) and growth declines when Protestantism declines (and gets replaced by secular identities).

Figure 6 shows a case of endogenous rise and fall of Protestantism. For that purpose three parameters of the basic model have been reset: $\rho = 5$, $b = 1.27$, and $\alpha = 1$. For the Protestants I set $\eta = 1.5$ and $\rho_p = 4.25$. These values imply that Protestants save more than secular types but that secular types work harder. Moreover, I reduce the steady-state growth rate to 0.1. This adjustment is necessary in order to get a plausible prediction of TFP growth for the 20th century because growth rates are overshooting. If the model is still thought to approximate England, then the spirit of capitalism is perhaps best be represented by the Methodist church, which was inspired by the Pietist movement from the late 17th century and which began to rise to a significant movement in England in the mid 18th century. The parameter values were set in order to capture this timing. The population share of Protestants defined this way is represented by the dashed green line in Figure 6.

FIGURE 6. Protestant Reformation and Overshooting Growth Rates



Upper panel: Blue line: population share of religious identities. Green line: share of Protestant religious identities. Parameters: $\rho = 5$, $b = 1.27$, $\alpha = 1$, $\eta = 1.5$ and $\rho_p = 4.25$; $g_y^* = 0.01$; $L^* = 0.33$; $(s/w)^* = 0.15$.

The lower panel in Figure 6 shows the resulting overshooting behavior of the growth rate of aggregate capital. The rise and fall of Protestantism explains a steeply rising rate of accumulation during the second Industrial Revolution, which reaches a maximum around the “Roaring Twenties” and subsequently declines with ongoing secularization. Another implication visible in Figure 6 is that the presence of Protestants significantly reduces the speed of secularization. For the year 2000 the model now predicts that there are still over 20 percent religious

types in the population. The fact that Protestants appreciate high wages more strongly than Catholics (in order to accumulate wealth) makes them harder to replace by secular types when income is growing. The high share of Protestants and the origin of many denominations from English (Methodist) background could thus be one explanation for the relatively slow speed of secularization in the U.S.

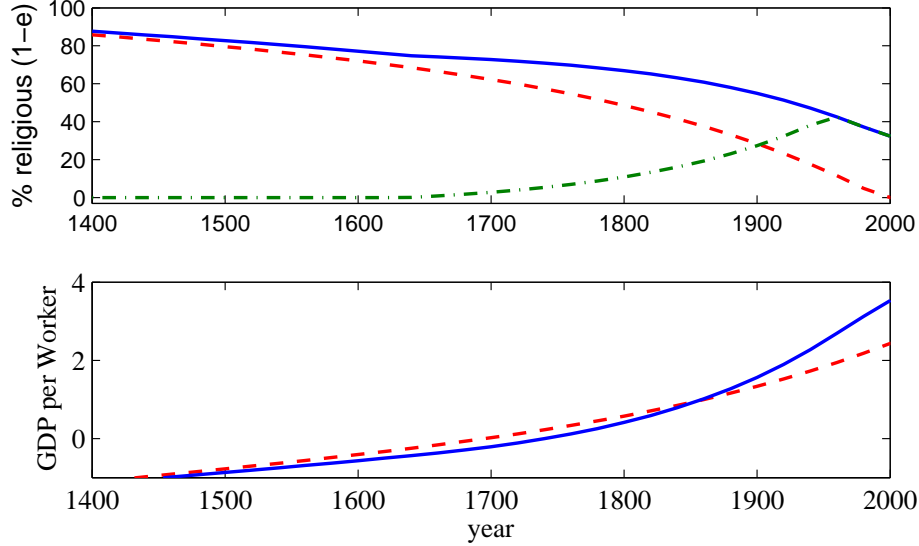
While Weber’s rhetoric of the spirit of capitalism may sound convincing, modern empirical research had some difficulties in providing hard evidence for a positive effect of Protestantism on economic development (see e.g. Cantoni, 2011). The present model offers two explanations. The obvious one is that individuals convert not only to Protestantism but also exchange Protestant and Catholic identities for secular ones. According to Proposition 4 and 5 Protestants outperform Catholics (the Weberian focus) but not necessarily secular types. If secular types save more and people exchange Catholic identities not only for Protestant ones but also for secular ones (perhaps even keeping Catholic church membership and some Catholic beliefs) than a Protestant reformation does no longer imply faster growth.⁶

Another, less obvious explanation is based on the timing of the transition. Figure 7 compares the case from Figure 6 with an alternative scenario without Protestant reformation. The case without reformation keeps all parameters from Figure 6 but sets $\rho_p = 0.1$, which effectively blocks Protestantism, and $\rho = 5.5$ (instead of 6). This means that Protestants are still saving at the highest rate of all types. Their savings rate exceeds that of secular types by factor 1.5. But in the alternative country (or, say, the alternative German land) the general value of religion is somewhat smaller. This means that some individuals prefer relatively early a secular identity over a Catholic religious identity, as shown by the red dashed lines in Figure 7. The relatively good economic performance of the non-reformed country or region is thus explained by a composition effect: it is also inhabited by some secular identities with relatively high savings rates compared to Catholic identities. In fact, as shown in Figure 7, economic performance measured by GDP per worker may be hard to distinguish between the two countries (or lands) until the end of the 19th century (the end of Cantoni’s period of observation). Nevertheless the

⁶Guiso et al. (2003) find from the World Values Surveys that actively religious Protestants across contemporaneous societies consider it less important that thrift is to be taught to children compared to the control group as well as compared to actively religious Catholics. Interestingly, they also find that across all religions, active religiosity has a negative impact on the motivation to instil thrift in children (but significantly so only for Muslims and Protestants).

spirit of capitalists is at work. It is just non-observable. It is represented by the counter-factual evolution of the reformed country or region had there been no Protestant reformation.⁷

FIGURE 7. Economic Advantage of Reformation Could Be Hard to Identify



Blue and green: Protestant reformation ($\rho = 6, \rho_p = 5.1$). Red: no Protestant reformation ($\rho_p = 5.5, \rho_p = 0.1$). Other parameters as for Figure 6. GDP per worker in logs.

4. SOCIAL INTERACTION AND INDETERMINACY

This section returns to the basic model and introduces a so far neglected mechanism, the interdependence of religious preferences. It seems plausible that the individual choice of identity depends on the identity choice of other members in society. For once, as has been vividly illustrated by Iannaccone (1992), religious activities are of a collective nature. The edification derived from Sundays service for example depends on how many others are attending. The same seems to be true for many secular consumer activities, like attending a concert or a sports game. Moreover, the presence of many secular types may rise doubt about the general value of religion.

The simplest way to take these considerations into account is to augment the individual value of religion $R(i)$ with a social multiplier (Glaeser, et al., 2003) such that it becomes $(1 - \delta e_{t-1})R(i)$.

⁷With respect to the German lands in the early modern period it is actually plausible that some individuals prematurely adopted a secular identity. Under the “cuius regio, eius religio” rule (1555-1648) citizens were forced to formally adopt the religion preferred by their local ruler. Those who were no longer allowed to practice their preferred religion may thus experienced higher utility from identifying with secular values instead of identifying with values of the official local denomination. Becker and Woessman (2009) argue in favor of a different channel, knowledge of the Bible and literacy, through which Protestantism had an economic impact in Germany.

The idea here is that the currently young observe the identity choice of their parent generation and attach a lower value to religion if many of the parent generation identified with secular values, i.e. if e_{t-1} is large. The parameter δ measures the strength of social interdependence, $0 < \delta \leq 1$. The assumption that δ is bounded from above by unity seems to be natural. It implies that religion has at least zero value if the whole society consists of secular types.

Introducing the modification into the basic model, we find that individual i prefers a religious identity if

$$R(i) > \frac{(1 + \beta) \log(w_t + b) + \phi}{(1 - \delta e_{t-1})\rho} \equiv g(e_{t-1}, w_t), \quad (18)$$

which replaces (7). Proceeding as in Section 2, we see that there are $e_t = g(e_{t-1}, w_t)$ secular types in society (at an interior equilibrium). A dynamic equilibrium furthermore requires that $e_t = e_{t-1}$. Inserting this condition into (18) we find that the solution $e(w_t)$ – if it exists – reads

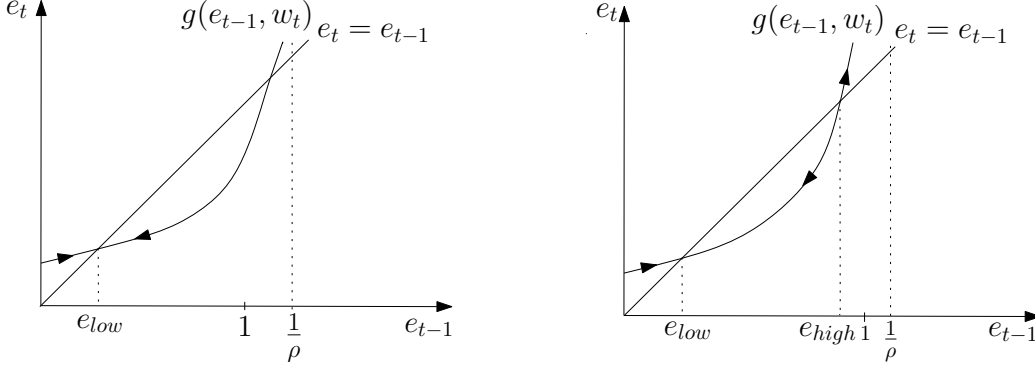
$$\begin{aligned} e_{low} &= \frac{1}{2\delta} - q_t \\ e_{high} &= \frac{1}{2\delta} + q_t \end{aligned} \quad q_t \equiv \sqrt{\frac{1}{4\delta^2} - \frac{(1 + \beta) \log(w_t + b) + \phi}{\delta\rho}}. \quad (19)$$

For a diagrammatic exposition of the solution note that $g(e_{t-1}, w_t)$ is increasing in e_{t-1} and w_t and convex in e_{t-1} with a pole at $1/\delta$. Figure 8 shows the possible solutions with interior equilibria. As before, e_t is bounded from below by zero and from above by unity. From (19) we see that the lower bound (all religious) is assumed when the root exceeds $1/(2\delta)$ and the upper bound (all secular) is assumed when the radicand becomes negative.

Figure 8 shows two situations for a given wage w_t . Actually, however, wages are endogenous and rising with economic development. Economic and religious evolution can then be illustrated as follows. At the beginning there was an epoch during which everybody identified with religion. With wages growing, and $g(e_{t-1}, w_t)$ moving upwards first an interior equilibrium e_{low} emerges. This equilibrium is stable for given w_t , implying that if the associated $f(k)$ -curve intersects the identity line (recall Figure 3) there exists a unique equilibrium of stagnation. This is so because at low e_t the social multiplier is small and almost everybody prefers a religious identity. Diagrammatically the intersection at the upper branch of the $g(e_{t-1}, w_t)$ curve exceeds unity and is thus dominated by the solution e_{low} .

If a unique stable equilibrium does not exist, the $g(e_{t-1}, w_t)$ -curve shifts further upwards as wages continue to rise and a second equilibrium e_{high} emerges. Now there exist two equally valued equilibria and it depends on which equilibrium society coordinates. It seems natural

FIGURE 8. Multiple Social Equilibria



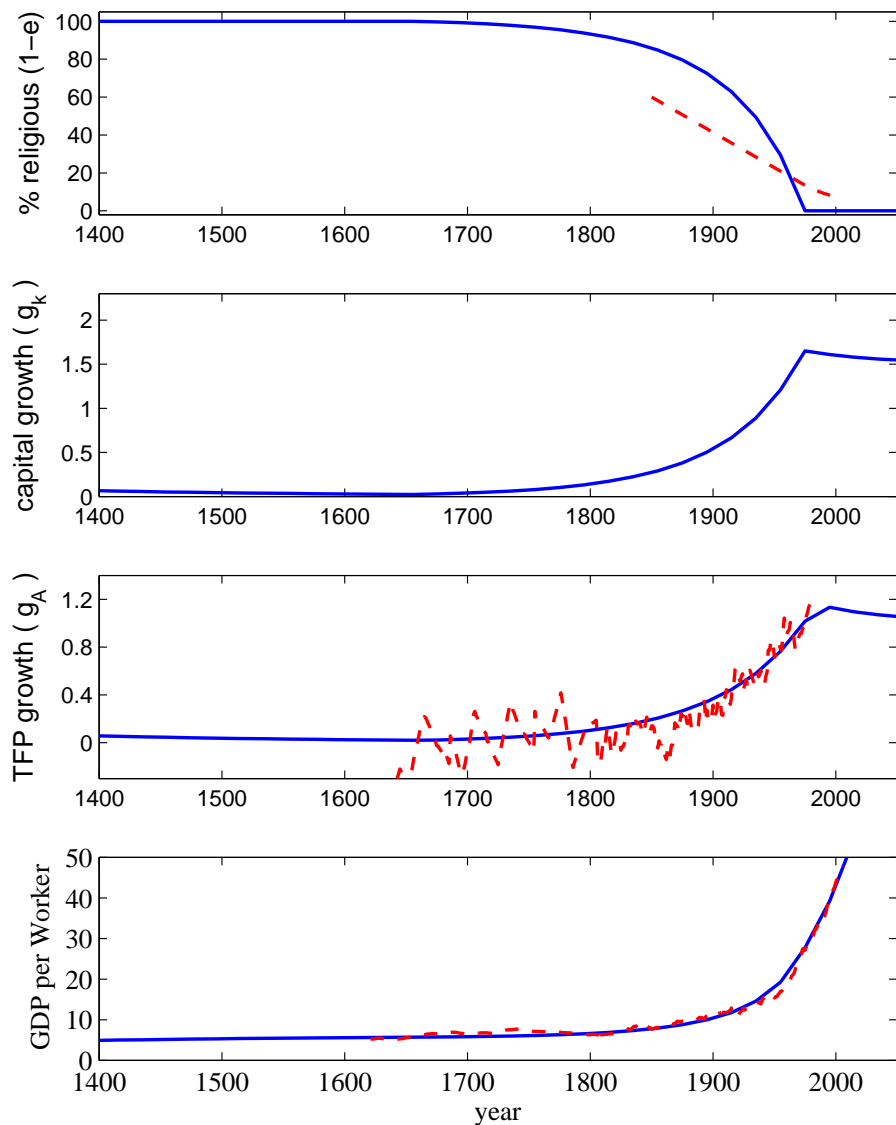
to assume that society coordinates on e_{low} for traditional reasons. Fathers and grandfathers had supported a similar solution. An authoritarian ruler, however, may be capable to solve the coordination problem by verdict. Notice that the equilibrium e_{high} is unstable. This means that as wages continue to rise, dynamics follow the upper branch of the $g(e_{t-1}, w_t)$ -curve and society secularizes very quickly. The equilibrium at e_{low} , in contrast, is locally stable and moves slowly upwards with economic development. It may even be possible that the associated $f(k)$ -curve intersects the identity line and the economy stagnates.

Yet eventually the presence of socially-dependent preferences promotes a fast secularization of society even without coordination on e_{high} . To see this, notice that an interior equilibrium ceases to exist when $q > 1/(2\delta)$. Diagrammatically, the identity line becomes tangent to the $g(e_{t-1}, w_t)$ -curve where $q = 1/(2\delta)$. Any further upward shift initiates a spontaneous complete secularization of society within one generation. People stop going to church because other are no longer going as well. The higher the power of social interaction on preferences, the earlier spontaneous secularization happens. At the extreme, for $\delta = 1$ the critical mass is reached at $1/2$, i.e. when half of society identifies with secular values. On the other hand, if $\delta < 1/2$, spontaneous secularization needs at higher critical mass of secular types. It occurs when $q < 0$.

Figure 9 illustrates the impact of the social multiplier. For that I have set $\delta = 0.3$ and kept everything else from the basic model (Figure 4). The social multiplier now allows for a better match with the historical time series of TFP and GDP. The relatively steep take off in the 20th century requires a quick secularization period. Measured against the church attendance data, however, secularization is too fast, i.e. the share of religious identities is overestimated for the

19th century and underestimated at the end of the 20th century. The speed of secularization, as shown in Section 3, could be reduced by the presence of another religious identity (Methodist Protestantism), which allows to derive utility from wealth. A model combining the features from Section 3 and Section 4 may thus be capable to better approximate both fast economic trade-off and delayed secularization.

FIGURE 9. Secularization and Growth with Social Interaction



Blue (solid) lines: model prediction. Red (dashed) lines: Data for England from Brierley (1999), Maddison (2003), and Madsen et al. (2010). Growth rates in percent. GDP per worker in thousands. Parameters as for Figure 4 and $\delta = 0.3$.

5. CONCLUSION

This paper has proposed a simple theory of identity choice and economic growth that explains a long epoch of (quasi) stagnation in which people predominantly identify with religion and an epoch of high growth in which people predominantly identify with secular, material values, as well as a transition period during which the economy takes off and the society secularizes. The theory offers a rationalization of the observed bi-causal relationship between religious adherence and economic development found across the world as well as across states and counties within countries. An extension of the basic model has investigated Protestantism as third option of identity choice. The extension has been helpful to explain the rise and fall of Protestantism and overshooting behavior of growth and productivity along the way to balanced growth. A second extension has introduced socially-dependent religious preferences and has shown how a social multiplier amplifies the speed of economic development and secularization.

Numerical experiments have compared the predictions of the model with the historical time series for England. The model explained the historical evolution of England reasonably well, an assessment that could presumably be derived from an application of the model to the growth and secularization process of other Western societies as well. An interesting question is how the generally high church attendance in the US can be squared with the model, given that the US is among the richest countries in the world. One possibility has been already noted in Section 3. The option of a Protestant denomination that encourages the accumulation of wealth and the presence of a sizeable share of Protestants in a society delays the secularization process but not necessarily the take off to growth. The take off to growth may actually happen earlier if Protestant religious types display higher savings rates than secular types. Another possibility, applicable since the 1970s, is that income of the US median household increased very slowly compared to GDP. According to the theory, the median citizen had thus little reason to abandon his or her religious identity. A third possibility may be that the large variety of churches and church competition in the US helped to redefine religious values by downplaying the ascetic component of religion such that identification with religion became more compatible with the desire for worldly possessions. According to the theory this would mean an increase of α , i.e. the value of consumption in the utility function of a person that identifies with religion.

Several extensions of the model are conceivable. It would be interesting to consider a society stratified not only by the value attached to religion but also by income. It can be expected that

this would relax the strong implication of income on the individual level without fundamentally changing the aggregate conclusions. In a two-dimensional society we would observe some rich persons identifying with religion and some poor ones identifying with secular values. But on average society would continue to become less religious as average income rises. Secularization would remain both cause and consequence of economic growth.

Another extension could try to implement a more detailed process of value transmission, taking into account that social identification takes place mostly in childhood and youth. The basic story of the model would remain unchanged if with rising income parents are less motivated to instill religious values in their offspring or if children with rising income are more resistant against parental religious education and more interested in getting the full pleasure from worldly consumption activities.

It would also be interesting to integrate other important factors of long-run growth like, for example, fertility and education. One such extension does already exist but has not been included in the present paper for the sake of brevity. In the present paper productivity growth was generated solely by learning-by-doing. This notion seems to be justified for most of human history because technological advances were not much brought forward by formally trained scientists before the mid 19th century (Mokyr, 2005). Since then, however, knowledge production has increasingly become a market activity, rendering the learning-by-doing approach less appropriate. In an extension I have thus integrated market R&D as in Romer (1990). In this framework it can be shown that market R&D is not profitable at low stages of development when society predominantly identifies with religion. But eventually, secularization and the entailed increase of savings and labor supply renders market R&D profitable. The learning-by-doing economy thus converges towards one that is driven by scientific research. According to the extended version, secularization can thus be conceptualized as cause and consequence not only of economic development but also of the scientific exploration of the world.

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