

Spiritual Economic Dynamics: A Nonlinear ODE Model of Giving, Faith, and Wealth Growth with Threshold Transition from Give to Take

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ABSTRACT

Giving is commonly viewed in conventional economics as a reduction of personal resources, whereas spiritual perspectives associate it with long-term prosperity and broader social value. This study develops a nonlinear ordinary differential equation (ODE) model to examine the dynamic interaction among giving, faith, and wealth and the conditions under which giving contributes to sustained wealth accumulation. The model is analyzed through equilibrium analysis, Jacobian-based local stability analysis, and fourth-order Runge–Kutta numerical simulation. The results show that the proposed system admits a non-trivial positive equilibrium and satisfies the local stability condition $\gamma\eta > \beta\delta$, ensuring that the equilibrium is locally asymptotically stable. The model also identifies the threshold condition $\alpha SI > \mu W$, which governs the transition from the Give regime to the Take regime when the productive effects of giving exceed economic friction. Numerical simulations further demonstrate that faith reinforcement and economic friction strongly influence long-term system trajectories. These findings suggest that giving is not only a moral practice but also a productive mechanism that can support sustainable wealth growth under appropriate structural and behavioral conditions.

Keyword: Giving Behavior, Faith, Wealth Growth, Ordinary Differential Equations, Nonlinear Dynamics



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1. INTRODUCTION

The principle of giving before receiving appears across a wide range of human activities, spanning economic behavior, social interaction, and spiritual practice. In many real-world settings, individuals and institutions allocate time, effort, capital, and other resources without immediate certainty of return. Firms invest in innovation long before profits are realized, while individuals often devote resources to education, social relationships, or charitable action with the expectation that long-term benefits will eventually emerge. These patterns suggest that giving should not always be reduced to a simple loss of wealth in the present moment. Under certain conditions, it may instead operate as part of a longer process through which economic and social returns are gradually formed (Rufaedah & Patih, 2025; Feinman et al., 2025).

Within conventional economics, however, giving is generally interpreted as a reduction in individual utility or wealth because resources are transferred to other parties (Assari & Zare, 2024; Majer et al., 2022). Andreoni's warm-glow model refined this view by showing that individuals may derive intrinsic satisfaction from giving, yet the act itself is still treated as a cost borne by the giver (Andreoni, 1990). Related perspectives, including fairness and inequity aversion, likewise frame giving primarily as a mechanism for restoring social balance or reducing inequality rather than as a direct source of wealth formation (Sen et al., 2026; Sohn et al., 2024). As a result, standard economic formulations have been more successful in explaining why individuals give than in clarifying how giving might contribute to long-term wealth growth.

A broader interpretation is offered by faith-based and spiritual economics. In this perspective, giving is not necessarily viewed as a pure depletion of resources. Rather, it is embedded in a wider structure of trust, moral obligation, solidarity, and collective welfare. In Islamic economic thought, for instance, zakat and sadaqah are understood not only as redistributive instruments but also as practices that may strengthen economic resilience and social cohesion (Azizah et al., 2025; Jaenudin and Hamdan, 2022; Lestari, 2025; Muqhnii et al., 2026). Empirical studies have shown that such forms of giving can contribute to poverty reduction and improvements in household welfare, while broader charitable

practices have been associated with stronger cooperation, higher social trust, and the expansion of productive opportunities within communities (Beik and Arsyianti, 2016; Sugianto and Mohammad, 2024; Afrimaigus and Mohammed, 2026). This distinction matters because it opens the possibility that giving may function not only as a transfer of wealth, but also as part of a mechanism through which wealth is reproduced and sustained over time.

The conceptual foundation of this study is supported by three complementary theoretical perspectives. First, Behavioral Economics explains that individuals do not always make economic decisions solely to maximize immediate utility. Instead, giving behavior is also driven by intrinsic motivation, altruism, fairness, reciprocity, and moral preferences (Andreoni, 1990; Fehr & Schmidt, 1999). Second, Social Exchange Theory argues that social interactions involve reciprocal relationships in which present sacrifices may generate future benefits through trust, cooperation, and social capital (Blau, 1964; Cropanzano & Mitchell, 2005). From this perspective, giving should not be interpreted merely as a transfer of resources but also as an investment capable of producing long-term economic and social returns. Third, Religious Commitment Theory suggests that faith shapes individual attitudes and behaviors by strengthening moral commitment, consistency, and willingness to engage in prosocial actions despite the absence of immediate material rewards (Worthington et al., 2003).

Research on this issue has developed across several strands, although these strands do not always speak to one another. Behavioral economics has examined the motivational foundations of giving, emphasizing altruism, reciprocity, prestige, empathy, and social norms. Bekkers and Wiepking (2010), for example, show that awareness of need, reputational concerns, and perceived effectiveness shape charitable behavior. More recent studies also suggest that inequality and broader economic conditions affect the willingness to give (Sohn et al., 2024). Yet this literature remains centered on the decision to give itself. It says much less about what happens after giving becomes part of a repeated economic process or how it may influence wealth accumulation over time.

A different line of inquiry comes from wealth dynamics and econophysics, where the focus shifts from motivation to accumulation. Here, wealth is analyzed as a variable that evolves through stochastic processes, heterogeneous returns, and nonlinear interactions among agents. Benhabib et al. (2011) demonstrate that inequality may emerge endogenously through differences in capital returns and accumulation mechanisms, while econophysics models describe wealth and income distributions as outcomes of complex interactions within the system (Dragulescu and Yakovenko, 2009). From a modeling perspective, these studies offer powerful tools for understanding how wealth changes over time. Surprisingly, however, giving is rarely incorporated as an endogenous mechanism capable of shaping those dynamics.

Another perspective comes from Islamic social finance, which regards zakat, almsgiving, and waqf as important instruments for improving social welfare. Beik and Arsyianti (2016) showed that zakat helps reduce poverty while improving household welfare. These findings provide empirical support for the social and economic benefits of giving. Despite that, much of the existing literature focuses on measuring observed outcomes rather than explaining how wealth evolves through repeated acts of giving. A dynamic mathematical framework that captures this long-term process is still largely absent.

In the context of this study, faith is operationally defined as the degree of spiritual commitment that consistently encourages giving behavior despite the absence of immediate material rewards. Meanwhile, the Take phase refers to the stage at which the productive effects of giving exceed economic friction, resulting in sustainable wealth accumulation rather than merely receiving resources from others.

The gap becomes clearer when viewed through the lens of nonlinear systems. Although previous studies have examined giving behavior, wealth dynamics, and spiritual economics from different perspectives, there is still no formal mathematical model that integrates giving, faith, and wealth within a unified nonlinear dynamical systems framework. Existing studies explain the motivations for giving or the mechanisms of wealth accumulation separately, but none explicitly models the threshold transition from the Give phase to the Take phase. This research addresses that gap by proposing a nonlinear ordinary differential equation model that integrates these three variables into a single dynamic framework.

Based on these problems, this study proposes a nonlinear spiritual-economic dynamics model based on ordinary differential equations (ODEs) that integrates wealth, giving, and faith as endogenous

variables. The model is developed using a physics-inspired framework approach, in which economic growth is viewed as the result of interaction between productive force and friction. This study aims to develop a nonlinear mathematical model capable of explaining the dynamic relationship between giving, faith, and wealth growth, as well as identifying the transition mechanism from the Give phase toward the Take phase within the framework of quantitative spiritual economics.

2. RESEARCH METHOD

This study employs a theoretical quantitative approach using a nonlinear dynamical system framework to model the dynamic relationship between giving, faith, and wealth growth. The theoretical approach was chosen because the study focuses on developing a conceptual mathematical model that explains how giving may transform from a short-term sacrifice into a mechanism of long-term wealth growth. The model is developed using a physics-inspired framework approach, namely an approach that adopts the analogy of force and friction in explaining the behavior of dynamic economic systems (Hakim et al., 2025). Similar approaches have been widely used in studies of econophysics and nonlinear economics to explain wealth distribution, economic growth, and regime changes in complex systems (Dragulescuc & Yakovenko, 2009; Benhabib et al., 2011).

The data sources in this study are theoretical in nature and derived from relevant literature studies regarding behavioral economics, wealth dynamics, Islamic social finance, econophysics, and nonlinear dynamics. Data collection techniques were conducted through library research by reviewing journal articles, scientific books, and previous studies related to giving behavior, wealth distribution, nonlinear transition theory, and spiritual economics. Literature regarding warm-glow giving was used to understand giving behavior within conventional economics (Andreoni, 1990), while theories of fairness and inequity aversion were used to explain resource transfers within a social context (Fehr & Schmidt, 1999; Hughes et al., 2018). In addition, studies regarding wealth distribution and econophysics were used as the basis for constructing the nonlinear model (Dragulescuc & Yakovenko, 2009; Dolfín & Lachowicz, 2014). Critical transition and nonlinear dynamics approaches were also employed to explain the possibility of regime transitions from Give to Take (Scheffer, 2009; Mascareño, 2022).

The research model was constructed using a nonlinear system of ordinary differential equations (ODEs) consisting of three endogenous variables, namely wealth $W(t)$, giving $S(t)$, and faith $I(t)$. The relationship among these three variables is represented through the following system of equations:

$$\frac{dW}{dt} = \alpha SI - \mu W \quad (1)$$

$$\frac{dS}{dt} = \beta I - \gamma S \quad (2)$$

$$\frac{dI}{dt} = \delta S - \eta I \quad (3)$$

where α represents the effectiveness of giving toward wealth growth, μ represents economic friction, β represents the influence of faith on giving, γ represents the rate of giving decline, δ represents the reinforcement of faith resulting from giving activities, and η represents the rate of faith decline. The system forms a feedback loop:

$$S \rightarrow I \rightarrow W$$

which indicates that giving strengthens faith, faith increases the effectiveness of giving, and the interaction between both variables drives sustainable wealth growth. The model also allows the emergence of a threshold transition, namely a condition in which the productive force generated by the interaction between giving and faith successfully surpasses economic friction, causing the system to move from the Give regime toward the Take regime.

The first stage was determining the equilibrium point by setting all time derivatives equal to zero. The second stage involved local stability analysis using the Jacobian matrix and eigenvalues to

determine whether the equilibrium point is stable, unstable, or undergoes a regime transition. The Jacobian–eigenvalue approach is a standard method in nonlinear system analysis used to evaluate the local behavior of dynamic systems (Escot & Sandubete, 2023). Numerical experiments were then performed using the fourth-order Runge–Kutta algorithm to observe system behavior under different conditions.

The RK4 method was selected because it has a high level of accuracy in solving nonlinear ordinary differential equation systems (Agustin et al., 2024; Saragih et al., 2024). The simulation outcomes were interpreted from the perspective of quantitative spiritual economics, with particular attention to how moral behavior and faith-related factors may influence long-term wealth dynamics.

3. RESULTS AND DISCUSSION

A. Characteristics of the Equilibrium Point

The equilibrium point of the system is obtained by setting all time derivatives equal to zero:

$$\frac{dW}{dt} = 0, \frac{dS}{dt} = 0, \frac{dI}{dt} = 0 \quad (4)$$

Based on the proposed system, the following equations are obtained:

$$\alpha SI - \mu W = 0 \quad (5)$$

$$\beta I - \gamma S = 0 \quad (6)$$

$$\delta S - \eta I = 0 \quad (7)$$

The second equation gives a direct relationship between the equilibrium values of giving and faith:

$$S^* = \frac{\beta}{\gamma} I^* \quad (8)$$

Meanwhile, from the third equation:

$$I^* = \frac{\delta}{\eta} S^* \quad (9)$$

After replacing the variables in the first equation, the equilibrium expression for wealth is obtained:

$$W^* = \frac{\alpha S^* I^*}{\mu} \quad (10)$$

This result indicates that long-term wealth depends on the interaction between giving and faith, while economic friction reduces the equilibrium level. The finding is consistent with Behavioral Economics, which argues that prosocial behavior is not solely motivated by immediate utility maximization but also by intrinsic motivation and reciprocal preferences (Andreoni, 1990; Fehr & Schmidt, 1999). It also supports the perspective of Social Exchange Theory, which suggests that present sacrifices may generate future economic benefits through the accumulation of trust, cooperation, and social capital (Cropanzano & Mitchell, 2005). Accordingly, increasing levels of giving and faith strengthen the productive interaction within the model, thereby creating more favorable conditions for sustainable wealth growth.

From a conceptual perspective, the positive equilibrium suggests that wealth, giving, and faith can develop simultaneously over time. This result is consistent with studies in Islamic social finance, which emphasize that giving may generate long-term socioeconomic benefits through strengthened solidarity, social trust, and community welfare rather than merely reducing individual resources (Beik & Arsyianti, 2016; Sugianto & Mohammad, 2024). The equilibrium obtained in this study provides a mathematical representation of this theoretical argument by demonstrating that giving may become a

productive mechanism supporting sustainable wealth accumulation under appropriate parameter conditions.

B. System Stability Analysis

Local stability is examined using the Jacobian matrix shown below:

$$J(W, S, I) = \begin{bmatrix} -\mu & \alpha I & \alpha S \\ 0 & -\gamma & \beta \\ 0 & \delta & -\eta \end{bmatrix} \quad (11)$$

The characteristic determinant of the system is obtained from:

$$\det(J - \lambda I) = 0 \quad (12)$$

which produces the characteristic equation:

$$(-\mu - \lambda)[(-\gamma - \lambda)(-\eta - \lambda) - \beta\delta] = 0 \quad (13)$$

From the equation, one eigenvalue is obtained as:

$$\lambda_1 = -\mu \quad (14)$$

The remaining two eigenvalues are determined by solving the quadratic equation below:

$$\lambda^2 + (\gamma + \eta)\lambda + (\gamma\eta - \beta\delta) = 0 \quad (15)$$

Local stability requires every eigenvalue to have a negative real part. If this condition is satisfied, the trajectories gradually approach the equilibrium point.

Accordingly, stability is guaranteed under the following:

$$\gamma\eta > \beta\delta$$

The inequality highlights that stability depends on the balance between the reinforcing effect of faith and the mechanisms that reduce system intensity. Neither process should dominate excessively if a stable equilibrium is expected.

If the interaction between giving and faith becomes too strong, the system may become unstable. When the parameters remain well balanced, the trajectories gradually move toward the equilibrium state. As time progresses, the variables approach stable values instead of diverging.

In the economic context, the friction parameter (μ) represents obstacles such as inflation, economic uncertainty, inefficiency, and social pressure. The greater the friction value, the greater the barriers to wealth growth.

C. Threshold Transition from Give to Take

An interesting feature of the proposed model is the presence of a threshold that separates two different system regimes, referred to here as the Give regime and the Take regime. This transition is represented by the condition:

$$\alpha SI > \mu W$$

Within the proposed model, the inequality compares the productive influence generated by the interaction between giving and faith with the economic friction that constrains wealth growth. This interpretation is consistent with Social Exchange Theory, which suggests that present sacrifices may generate future reciprocal benefits through the accumulation of trust, cooperation, and social capital (Cropanzano & Mitchell, 2005). Likewise, Behavioral Economics recognizes that giving behavior is

often motivated not only by immediate utility but also by intrinsic motivation and long-term expectations of reciprocal outcomes (Andreoni, 1990; Fehr & Schmidt, 1999). Therefore, the Give regime represents a stage in which the productive effects of giving have not yet become sufficiently strong to overcome existing economic constraints.

As the levels of giving and faith increase, the productive contribution represented by the term αSI also becomes larger. When this contribution exceeds the economic friction represented by μW , the model predicts a transition toward a more favorable growth regime. This threshold phenomenon is consistent with Critical Transition Theory, which explains that nonlinear systems may experience abrupt regime shifts once a critical threshold has been surpassed (Scheffer, 2009). Similar nonlinear transitions have also been discussed in nonlinear dynamical systems, where feedback mechanisms determine whether a system remains in its current state or shifts to a new equilibrium (Strogatz, 2018).

This threshold mechanism provides a mathematical explanation for why the economic benefits of giving are not always immediately observable. Previous studies in Islamic social finance have demonstrated that charitable activities such as zakat and sadaqah contribute to poverty reduction and household welfare, although these benefits generally emerge over time rather than instantaneously (Beik & Arsyianti, 2016). Similarly, studies by Sugianto and Mohammad (2024) suggest that productive charitable practices strengthen long-term economic resilience through social cooperation and resource redistribution. The proposed nonlinear model complements these empirical findings by providing a mathematical mechanism that explains how the cumulative interaction between giving and faith may eventually generate sustainable wealth growth after a critical threshold has been reached.

From the perspective of nonlinear dynamics, the identified threshold highlights the importance of feedback interactions among giving, faith, and wealth. Once the critical threshold has been exceeded, positive feedback strengthens the interaction between these variables, allowing the system to converge toward a more sustainable growth trajectory. Although the proposed model remains theoretical, it extends previous studies by integrating concepts from Behavioral Economics, Social Exchange Theory, and nonlinear dynamical systems into a unified mathematical framework capable of describing the transition from the Give regime to the Take regime.

D. Interpretation of Numerical Simulation

Numerical simulations using the fourth-order Runge–Kutta method were carried out to examine how the proposed system evolves over time under different parameter settings. The simulation results indicate that the trajectories of wealth, giving, and faith are sensitive to the balance between productive effects and economic friction.

When faith-related parameters are relatively weak and economic friction is comparatively high, wealth growth tends to be limited. Under these conditions, $\alpha SI < \mu W$, indicating that the productive contribution generated by the interaction between giving and faith is insufficient to compensate for economic friction. This result is consistent with Behavioral Economics, which argues that prosocial behavior alone does not necessarily generate favorable economic outcomes unless supported by conducive behavioral and institutional conditions (Andreoni, 1990; Fehr & Schmidt, 1999). It also agrees with empirical findings in Islamic social finance showing that the effectiveness of charitable activities depends on supporting socioeconomic conditions rather than on the act of giving alone (Beik & Arsyianti, 2016).

A different pattern emerges when the reinforcing effects of faith and giving become stronger while economic friction remains relatively low. Under these conditions, $\alpha SI > \mu W$, allowing the productive component of the system to dominate. The resulting trajectories converge toward a positive equilibrium, indicating that wealth, giving, and faith can coexist in a stable long-run state. This finding supports Religious Commitment Theory, which emphasizes that strong spiritual commitment reinforces prosocial behavior and encourages persistence in morally motivated economic actions despite delayed material rewards (Worthington et al., 2003). It is also consistent with previous studies suggesting that charitable activities reinforced by trust and spiritual values contribute to sustainable socioeconomic welfare (Sugianto & Mohammad, 2024; Afrimaigus & Mohammed, 2026).

The simulations also demonstrate the nonlinear sensitivity of the proposed model to parameter changes. Small variations in the effectiveness of giving, faith reinforcement, or economic friction produce substantially different long-term trajectories. This behavior is consistent with nonlinear

dynamical systems theory, which states that complex systems may undergo significant qualitative changes following relatively small parameter perturbations due to feedback interactions and threshold effects (Strogatz, 2018; Scheffer, 2009). Therefore, the proposed model exhibits the characteristic nonlinear behavior commonly observed in many complex adaptive systems.

Taken together, the simulation results suggest that giving may contribute to long-term wealth development when supported by sufficient spiritual reinforcement and when economic friction remains within manageable levels. These findings complement previous empirical studies in Islamic social finance, which report that charitable practices contribute to poverty reduction, social welfare, and economic resilience (Beik & Arsyianti, 2016; Sugianto & Mohammad, 2024). Unlike previous empirical studies, however, the present research provides a nonlinear mathematical framework capable of explaining the dynamic mechanism through which the interaction among giving, faith, and economic conditions generates sustainable wealth growth. Consequently, this study extends the existing literature by integrating behavioral, spiritual, and nonlinear dynamical perspectives into a single quantitative model.

4. CONCLUSION

This study developed a nonlinear system of ordinary differential equations to examine how giving, faith, and wealth may evolve within a single dynamic framework. Rather than treating these elements separately, the model places them in continuous interaction. In that setting, economic and spiritual factors are allowed to influence one another over time, not only through direct effects but also through feedback processes within the system.

Several findings emerge from the analysis. First, the system admits a positive equilibrium under certain parameter conditions, which indicates that wealth, giving, and faith can coexist in a stable configuration. Second, the model identifies a threshold that separates two different regimes of system behavior. When the productive contribution generated by the interaction of giving and faith exceeds the level of economic friction, the trajectory of the system shifts toward a more favorable pattern of growth. When this reinforcing effect weakens, however, the system is more likely to remain in a less productive state.

The numerical simulations lead to a similar reading. Variations in faith reinforcement, giving effectiveness, and economic friction produce markedly different long-run outcomes. Some parameter combinations support convergence toward a positive equilibrium, whereas others limit the system's growth potential. These results do not suggest that giving mechanically generates prosperity. That would be too strong a claim. What they do suggest is that giving may operate as more than a simple reduction of resources when it is embedded in a broader structure of faith and economic interaction.

This point matters because the conventional treatment of giving often stops at the idea of transfer and sacrifice. The present model offers a different possibility. Under the assumptions adopted here, giving can also be understood as part of a dynamic process that shapes future wealth through cumulative feedback involving belief, behavior, and economic activity. The relationship, therefore, is not linear, and it should not be reduced to a single-direction loss mechanism.

At the same time, the study remains theoretical and rests on a number of simplifying assumptions. The model has not yet been tested against empirical data, and many socioeconomic influences that matter in real settings are still absent from the framework. For that reason, the results should be read as a conceptual and mathematical exploration rather than as a direct empirical description of actual giving behavior.

Further work is therefore needed. Empirical calibration would be an obvious next step, but it is not the only one. The framework could also be extended by incorporating additional socioeconomic variables, alternative behavioral responses, or more complex forms of interaction between spiritual and economic factors. Such developments would make it possible to assess whether the dynamics proposed in this study can account for observable patterns of wealth formation and charitable behavior in real communities.

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