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RESEARCH PAPER

From Polytheism to Monotheism: Zoroaster and Some Economic Theory

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Abstract
The prophet Zoroaster founded the first monotheistic religion in history, which once rose to great imperial status and still survives unchanged today despite centuries of Muslim pressure. Unlike the founders of other monotheistic religions after him, he achieved this not through the overthrow of the original Iranian polytheism but through its deep reform—a strategy that made acceptance easier and ensured a continuing role for the priests. Monotheistic reform is thus a third way out of ancient Indo-European polytheism, besides extinction in the Greco-Roman case and mutation into sectarian theism in the Indian case. This paper surveys the Iranian story and offers two economic models to account for the two key factors that made the transition to monotheism possible: the theological structure and the role of the priesthood.

Keywords Iranian religion · Zoroaster · Polytheism · Monotheism · Priests · Economics of religion

JEL Classification Z12 · D71

1 Introduction

The prophet Zoroaster is credited with the founding of the first monotheistic religion in history sometime around the middle of the second millennium BCE, antedating the Israelites and leaving a lasting imprint on Second Temple Judaism and, through it, on later monotheistic religions.

While founders and missionaries of other religions set out to overthrow the pre-existing polytheism and replace it with an entirely different product, Zoroaster carried out a "reform" of Iranian polytheism, asking his followers to change their ways and beliefs but not to throw away all they had. Consequently, lesser divine beings or "gods" and many old rituals remained, to the dismay of modern European Christian

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scholars who were looking for a "pure" monotheism. This selective continuity was arguably facilitated by the fact that, alone among the known historical founders of great religions, Zoroaster was a trained, working priest of the traditional religion.

Zoroastrianism spread through the Iranian plateau by grassroots conversion for centuries before it rose to state religion in the Achaemenian Empire in the 6th century BCE; and despite the unrelenting pressure from Islam since the Muslim conquest of Iran in the mid-seventh century CE, it still survives today in tiny communities in Iran and India (there called the Parsis) who have remained unswervingly loyal to the traditional beliefs and practices of the faith, remote as they are. This extraordinary endurance calls for explanation. Furthermore, unlike Jesus of Nazareth and many early Christians, Zoroaster was not martyred and martyrdom has no place in the religion's tradition; and unlike Moses, other Jewish prophets, Jesus, many Christian saints and martyrs, and the prophet Muhammad, neither he nor his followers are reported as performing miracles (Woodward, 2000). Hence, two of the most powerful engines of historical conversion to monotheism (as modeled in Ferrero, 2014a, 2016) are missing in Zoroastrianism, which makes its success and persistence all the more remarkable.

One might think that the big question of the transition from polytheism to monotheism could be more fruitfully studied focusing on the big success stories—the great monotheisms that dominate today. However, as will be discussed below, the later entrants are in some ways all derivative of one another and ultimately of Zoroastrianism itself—the original ancestor. That is why this admittedly exotic and remote exemplar may hold some important lesson for the political economy of religion.

This paper is a first attempt to understand the Zoroastrian story in terms of rational choice, using the tools of economic analysis. It will argue that two intertwined factors are key to this understanding: the theological structure and the role of the priests. In this, the paper follows in a line of research on the political economy of polytheism that began with Ferrero and Tridimas (2018) on ancient Greco-Roman religion, and Basuchoudhary et al. (2020) on Hinduism. Comparisons with these two polytheistic systems will help to put Zoroastrianism into analytical perspective. On the other hand, the paper contributes to the meager economic literature on the birth of monotheism, which includes Raskovich's (1996) pioneering work on Judaism as well as Ferrero's (2014a, 2014b, 2016) on Christianity.

Iranian polytheism was a close cousin of Indian polytheism as they both took shape in very ancient times when the Indo-Iranians were still semi-nomadic cattle herders on the Central Asian steppes; subsequently the two peoples parted ways and their religions evolved in different directions. In turn, Indo-Iranian religion was a member of the Indo-European family, and some important family features can be discerned in the Iranian member, including a few deities and a number of important beliefs and rituals.

The Avesta—the corpus of Zoroastrian holy scriptures—was transmitted orally by rote memorization in the priesthood for millennia before it was committed to writing in the Sasanian period (probably as late as the 6th century CE). Its oldest part, the *Gathas*, is a collection of 17 hymns attributed to Zoroaster himself and composed in an archaic form of the language which is close to that of the *Rig Veda*—the earliest

text of Indian religion. Presumably because of its special holiness, this part seems to have been memorized exactly and handed down in a fixed form down the centuries. The rest, written in a later form of the language known as Younger Avestan, appears to have been handed down in a more fluid oral tradition, with each successive generation of priests updating the language, making changes, and adding new material. Nevertheless, it contains some very ancient material. Precisely because some substantial part of the pagan beliefs, rituals and observances survived into Zoroastrianism, scholars can use parts of the Avesta to reconstruct ancient Iranian polytheism, with the help of comparisons with the earliest strata of the Vedic texts.

The paper is organized as follows. Section 2 gives an outline of traditional Iranian polytheism and Sect. 3 describes Zoroaster's innovations and the subsequent development of the faith. Section 4 models two aspects of Zoroastrianism, one focusing on the theology and another on the expansion of a missionary faith. Section 5 offers some comparative discussion and concludes.

2 Iranian Polytheism

2.1 Theology and Cosmogony

As in all the earliest forms of religion, ancient Iranians worshiped "nature" gods who personified some physical phenomena, as well as "cult" gods who personified some specialized cultic functions.[1] Then there were "abstract" gods personifying abstractions, usually in anthropomorphic form, who were the core of the pantheon.

The ancient Iranians believed that there was a natural law, known as *asha*, which ensured that the universe would keep on its orderly course and existence continue. Men's worship and sacrifices were felt to help maintain this cosmic order by strengthening both the gods themselves and the natural world. *Asha* was also thought to rule the human world as an ethical principle of truth and righteousness, and its opposite was the cosmic principle of disorder and falsehood, known as *drug*. One matter that was central to this opposition was the sacredness of man's given word—keeping one's pledge so that *asha* was upheld. Two types of pledges were recognized: the individual oath and the contract between two parties. These were hypostatized as divinities who would support the upright man who kept his word but smite the liar who broke it, and who were called Varuna and Mithra respectively—well known from the Vedas. The judicial procedure used to test the veracity of a man accused of breaking his word was the ordeal: an ordeal by water for an oath, an ordeal by fire for a covenant. Accordingly, Varuna (known in the Avesta only by its byname Apam Napat, "Son of the Waters") and Mithra became associated with

[1] Most of the information on Iranian religion, both before and after Zoroaster, in this paper is drawn from the work of Mary Boyce, which seems to have set a plumb line for modern Zoroastrian scholarship as well as providing a thorough coverage of the subject. See her seminal history of Zoroastrianism in several volumes (Boyce, 1975, 1982; Boyce & Grenet, 1991) and her very informative, nontechnical summary which covers all the ground from antiquity to the present day (Boyce, 1979). The older, once influential work of Zaehner (1961) has been occasionally used.

these elements and became gods of the waters and of fire (and of the greatest of all fires, the sun) respectively, and received the exalted title of *ahura* (lord). By logical extension, Mithra became further worshiped as a war god, fighting on behalf of the righteous, and as god of justice itself; and since it was believed that a just moral order brought prosperity to a realm, he was also invoked as bringer of rain and good crops and protector of rich pastures, i.e. a god of material plenty. Similarly, Apam Napat, the god of the waters, became a god of rain and the harvest. Above these divinities there was a third and greatest lord, probably inspired by the figure of the wise ruler in ultimate control of the law: Ahura Mazda, the Lord Wisdom, who was unconnected with any physical phenomenon but personified the power of wisdom which should control men and gods alike. The three *ahuras* are all ethical beings, who uphold *asha* and themselves submit to it.

Around Mithra, or both Mithra and Apam Napat, were grouped a number of lesser "abstract" divinities, all of them beneficent. Then there was a wholly different character: the war god Indra, the prototype of the Indo-Iranian warrior of the heroic age, an amoral being, bountiful to his worshipers only, fearless, reckless, hard-drinking. He is thus the opposite of the great *ahuras*, as shown by a Rig-Vedic hymn (RV 4.42) which contrasts Indra's and Varuna's different claims to greatness. Other amoral, warlike divinities were associated with Indra, and would be collectively designated as *daevas* and rejected under Zoroastrianism. We will see how important this contrast was for Zoroaster's reforms.

A key feature of this pantheon is common to the Vedic and Greek pantheons: through processes of logical association, personification of abstractions, and myth-making, most gods came to be seen as wielding broad powers affecting multiple, apparently distant areas, so each god could and would be petitioned for very diverse benefits. Inevitably, then, each of these boons belonged to an area that was also the responsibility and competence of several other divinities; as a consequence, the gods' jurisdictions overlapped, so that the same or similar benefits could—or indeed should—be sought of diverse divinities at the same time. For example, consider Aredvi Sura, originally a river-goddess and hence a goddess of the waters, and therefore a goddess of fertility—of humans, herds, and earth alike; not only, however, would maidens pray to her for a good husband and women giving birth for an easy delivery, but warriors would ask the goddess for swift horses and victory in battle, and priests would ask her for wisdom (Boyce, 1975, 71–73, 151–152). As we have seen, however, war was already presided over by both Mithra and Indra, even though with different nuances, and then there was the ancient god of victory, Verethraghna; on the other hand, both Mithra and Apam Napat brought prosperity to land and cattle, as did a specialized god of material prosperity, Baga; and women' fertility was especially cared for by Ashi, the goddess of fortune and abundance. So overlap abounded.

The priests, pondering on the details of their rituals, evolved a cosmogony, according to which the gods created the world in seven stages: the sky, the water, the earth, a single plant, a single animal, a single man, and finally fire, including the sun. This world was motionless, with the sun standing still overhead as if it were always noon. Then the gods offered a triple sacrifice: they crushed the plant and killed the animal and the man. From this primeval sacrifice the world was set in motion, more

plants, animals, and men came into being, death was followed by new life, and the sun began to move across the sky and to regulate the seasons and the cycle of existence according to *asha*.

The time of cosmic life was considered as unending, if men also did their part by sustaining the gods' creation. So the priests, who carried out the daily sacrifice (described below), saw themselves as re-enacting with plants and animals the primeval sacrifice, making sure that the world would continue in its motion.

The earliest form of belief was probably that after death the human soul went to an underground kingdom of the dead, where all the souls alike lived a shadowy, joyless existence and still relied on their living descendants to feed and clothe them. Then a belief developed that some great men—chieftains, warriors, and priests—if worthy enough, might ascend to a heaven of delight in the company of the gods, while the commoners were still doomed to the underworld—a dual conception of the afterlife shared by the Vedic Indians; probably on account of uncertainty about each individual's fate, however, the descendants' offerings remained for all the departed. With the hope of paradise a belief arose in the resurrection of the body for the individual to be able to experience the full joys of heaven, and this seemed incompatible with burial in the ground. Hence the Indians began to shift from burial to cremation, while the Iranians, out of utmost respect for fire, moved to the rite of exposure that would take center stage with Zoroastrianism.

2.2 The Cult and the Priests

The ancient Iranians devoted much time and resources to pleasing the gods with offerings and praises, with the double purpose of securing material and spiritual benefits for the supplicant and of strengthening the gods themselves, on whose work the maintenance of the "world of *asha*" depended. Among the various offerings, the blood sacrifice (Boyce, 1975, 149–151, 152–153) was always the rarest and most highly regarded, partly because it was the most costly to the supplicant, and partly because the taking of life—itself a dangerous act of destruction—had to be hedged about with strict rituals, so that the consecrated animal's soul could safely depart for the other world. Even though a sacrifice could be offered by any laymen, a priest's presence was always necessary as he alone was sufficiently pure to perform this high ritual act. The most prized of sacrificial animals was the cow or bull—a reminiscence of the remote pastoral period of the people—followed by the horse—clearly an aristocratic offering—and then more commonly goats, sheep, and fowl. Each sacrifice was dedicated to a particular deity, called down by name with proper ritual words.

In addition to sacrificing to the gods, the ancient Iranians had a particular cult around the two elements that played a vital part in the life of the steppe-dwelling pastoralists, and which have remained central to the Zoroastrian cult to this day: water and fire (Boyce, 1975, 153–156). Offerings to the waters were threefold: milk and the sap or leaves of two plants, representing the animal and vegetable kingdoms. As lighting a fire then was a laborious process, it was convenient to keep a hearth fire always burning, so a cult of ever-burning fire developed among the

Indo-Europeans. The offerings to fire were again threefold: clean dry wood, incense, and a small amount of animal fat—again two from the vegetable kingdom and one from the animal one. The offerings to both water and fire were thought to strengthen that element by returning to it the vital force it had given out.

As the food offerings to the gods could be performed by the laity, so the offerings to both water and fire were made regularly by each household; but the three also formed the basis of the *yasna*, the daily act of worship officiated by priests, which was intended to represent and strengthen all the seven creations (Boyce, 1975, 156–165). While the basic ritual was always the same, each *yasna* service was dedicated to an individual god through particular mantras, although it always included the offerings to fire and water. While the domestic offering of fat to fire was made whenever the family cooked meat, at the priestly rite the fat was obtained from animal sacrifice—which implies that such sacrifice was regularly made; and indeed it is likely that domestic animals were hardly ever butchered except in a sacrifice to the gods. Like the ancient Greeks, the Iranians believed that the gods were content with a symbolic portion of the meat and otherwise enjoyed the odor rising from the sacrifice, so the consecrated meat was shared between priests and worshipers. One of the plant offerings to the waters was the juice obtained from pounding the stems of a plant called *haoma* (the Indian *soma*), which was believed to confer untold powers when drunk by warriors, poets, or priests. The preparation and offering of *haoma* formed the center of the *yasna*, to the point that it was personified as a god Haoma, the divine priest who presided over the entire ritual and who, like most other gods, was endowed with vast and diverse powers; he also received a stipulated portion of the sacrificial meat. While the *haoma* cult has close parallels in the Vedas, in stark contrast with the Indians (to whom the dog, being omnivorous, is a symbol of uncleanness) the Iranians to this day give a fraction of the consecrated meat to a dog, which is always present at the service and receives the food on behalf of the gods—a striking legacy of the pastoral days, as is its regular attendance at funeral rites.

In keeping with the needs of nomadic peoples, these major rituals were performed in a sacred precinct that consisted simply of a piece of level ground marked off by a furrow and consecrated by prayers, with no fixed structure. Purity was thought essential in the presence of the gods, so the ground and the vessels used in the rituals were carefully washed with water, and the priests and all participants had to be in a state of ritual purity, which was achieved by preliminary bodily washing with water or cow or bull urine. (As in India, cattle urine was used also for purification in cases of serious pollution such as contact with a corpse). However, the pagan gods were selective in granting access to worshipers and accepting offerings from them: various gods forbade participation in the rituals devoted to themselves to various groups of people including prostitutes, liars, lepers, the physically impaired or deformed, the insane, or the sterile—old men and women, young girls and boys (Boyce, 1975,166). On the other hand, as in Brahmanism, propitiatory offerings were also made to the powers of evil and darkness—Zoroaster's wicked *daevas* (ibid., 170–171).

Regarding the priests, what we can know of their profession and organization comes from the commonalities between Zoroastrianism and Brahmanism, which

must go back to their common Indo-Iranian past (Boyce, 1975, 8–11, 168–169). There was a common basic training in which young boys, probably from the age of 7–15, were apprenticed to a master, and there learned the mastering of rituals, the sacred words to accompany them, and the hymns to the gods. While these were learned by heart, thus preserving a sacred literature down the generations, the priests also learned the techniques for composing new additions to the literature, such as mantras and the "wisdom" poetry with instructive content (exemplified by Zoroaster's own *Gathas*). As in the early times there were no established cult centers to be served by priests, the latter, like their Indian colleagues of old, were attached to individual families, at whose behest they performed the rituals for a fee. Thus, payment for service by families to "their" priests was the latter's source of livelihood—a livelihood which would of course be humble or handsome depending on whether their employer was lowly or highborn. In contrast, Greek sources from the 5th century BCE mention a priestly "tribe", the Magi, among the Medes of western Iran—the first hint at an exclusive hereditary priesthood, whereas among the Avestan people of eastern Iran the priestly class seems to have had less rigid barriers (Zoroaster himself, a priest, married into a warrior family).

3 Zoroastrianism

3.1 Zoroaster's Reforms

The dating of Zoroaster's[2] life has been a difficult task for scholars as he lived in prehistoric times, when his people—who were later to migrate southward and settle on the north-eastern Iranian plateau—were still semi-nomadic pastoralists on the Central Asian steppes. In the absence of any external evidence, the language of the *Gathas* and the world-picture they convey suggest that he flourished in what for the Iranians was the transition from the Stone Age to the Bronze Age, which means some time in the second millennium BCE.[3] Even though a more precise dating is a moot question, we are anyway dealing with a religion of immense antiquity, which was already old when it entered recorded history in the 6th century BCE.

Zoroaster refers to himself as a fully qualified priest (*zaotar*), hence probably the scion of a priestly family. As such he must have begun training at the age of seven and been made a priest at fifteen. Like with the Vedic Indians, the training was carried out orally within hearing distance of a teacher, and consisted of learning rituals and doctrines and memorizing invocations and prayers. Thereafter he

[2] Zoroaster is the form of the prophet's name given by the ancient Greeks, who first introduced knowledge of him into western culture, and still current; many modern scholars, however, use the original Avestan form Zarathustra. The religion he founded, here called Zoroastrianism, is also known in English as Mazdaism, from the name of the creator god Ahura Mazda. This section is based on the detailed treatment in Boyce (1975, chs. 7, 8, 9) as well as the summary in Boyce (1979, chs. 2, 3).

[3] Our authority throughout this study, Mary Boyce, wavered somewhat over a narrower dating, from "between, say, 1400 and 1000 BC" (Boyce, 1975, 190) to "between 1700 and 1500 BC" (Boyce, 1979, 18) to "probably…. before 1200 BC" (Boyce, 1982, 3).

must have spent years wandering in a quest for higher knowledge from various teachers. He was thirty, according to the tradition, when revelation came to him, in the form of a series of visions in which he saw and talked to Ahura Mazda and six other shining divine figures. From that moment he felt empowered and called to a mission of spreading the newly gained truth for the rest of his life.

Zoroaster introduced three radical innovations into the framework of the old religion: he established a hierarchy in the pantheon, thus producing a supreme god; he created an antagonist to the supreme god and enjoined his people to shrink from worship of some of the previous "gods"; and he greatly expanded the purity ordinances and the ethical requirements for everyone, and therefore both the role of the priests and the demands made of them.

Beginning with the pantheon, Zoroaster proclaimed Ahura Mazda—who previously was already worshiped as the greatest of the three *ahuras*, the guardians of *asha*—to be the one and only eternal, uncreated God and Creator of everything that is good, including all other beneficent divinities. According to the new doctrine, the first act Ahura Mazda performed was the evocation of six lesser divinities, the Amesha Spentas (Holy Immortals)—the six divine beings of Zoroaster's visions, forming a heptad with the Lord Wisdom himself. This evocation is described in Zoroastrian works in ways that suggest the essential unity of beneficent deity; in one text Ahura Mazda's creation of them is likened to the lighting of torches from a torch (Boyce, 1979, 21). In turn, these six proceeded to evoke other divinities who are nothing but the beneficent gods of the old pantheon, including in particular the other two *ahuras*, Mithra and Apam Napat; these are collectively known as *yazatas* (beings worthy of worship). Then the six Amesha Spentas proceeded with their creator to shape the seven creations that make up the world, with each of them appointed as the maker and guardian of one creation—man belonging to Ahura Mazda himself. Thus the new theology was cast in the mold of the old cosmogony.

Zoroaster's theological reform did not stop at the reordering of the old pantheon. Opposite to, and coexisting with, Ahura Mazda he conceived a Hostile Spirit, Angra Mainyu, who was also uncreated and wholly malign. At their original encounter, these "two primal spirits, twins, renowned to be in conflict…. the good and the bad" (in the words of an ancient hymn; Boyce, 1979, 20) made a deliberate choice, one choosing righteousness (*asha*) and the other falsehood (*drug*). This is the doctrine of dualism, which has often been thought to sit awkwardly with monotheism (as further discussed in the concluding section). This primordial choice between good and evil prefigures the choice that all human beings are to make for themselves in this life, and it unfolded in the cosmological drama, for when Ahura Mazda and the other Immortals created the world, the Hostile Spirit set out to blight it precisely because it was good. So, according to the myth, he defiled the water, turning much of it salty, and the earth, creating deserts; next he withered the first plant, slayed the first animal and the first man, and finally sullied the fire with smoke. The Amesha Spentas, however, reacted and turned his malicious acts to benefit: the plant was pounded and its juice scattered over the world to raise more plants; the seeds of the animal and the man were purified and more animals and men sprang from them. So the beneficent primeval sacrifice that started the world in motion, attributed to the

gods in the ancient myth, was reassigned as an evil act to Angra Mainyu, as it was he who brought decay and death into the perfect creation.

Furthermore, a section of the old pantheon was disowned. Zoroaster singled out Indra and his associates, whom he called *daevas*, as amoral beings, destructive and warlike, and enjoined his followers not to worship but to shun them. These he saw as allies of Angra Mainyu in his evil works—wicked beings who, following him, chose *drug* instead of *asha*, or, in another rendering, who were begotten by him just as the Amesha Spentas were begotten by Ahura Mazda. So he put a part of the traditional priestly functions beyond the pale. One might wonder how the mighty but helpful, beneficent warrior-god Indra of the *Rig Veda* came to be perceived in Iran as the chief of the *daeva* band, the personification of *drug*, second only to Angra Mainyu himself (Boyce, 1975, 201, 211, 251–252; Cohn, 2001, 92–95). One answer may be that it reflected a developing cleavage in Zoroaster's own society between traditional, righteous cattle-rearing tribes and newly emerging cattle-stealing tribes headed by warrior chiefs (the "non-herders among the herders", in the words of an Avestan hymn); he identified with the former and abominated the latter, thus choosing right instead of might. But, more fundamentally perhaps, Indra and the *daevas* were seen as supreme embodiments of the forces of chaos, and therefore as arch-enemies of the restoration of the world to its original perfection that the prophet preached—the eschatology to which we now turn.

In the new doctrine, cosmic history was divided into three times, Creation, which was wholly good, being the first. Angra Mainyu's attack inaugurated the second time, that of Mixture, during which the world is a battleground between good and evil where the forces of darkness continue to inflict material ills and spiritual sufferings on mankind. To counter this, men must worship all beneficent divinities, seek their help, and in turn provide them with their help in the struggle to protect the good creation from evil. Thus it is incumbent upon every human being to make and uphold the same fundamental choice between *asha* and *drug* that started the cosmic drama, and to ally with the forces of good to overcome evil. Eventually the victory of righteousness will indeed happen in a great final event called Frasho-kereti (Making Wonderful), where Angra Mainyu and his minions will be utterly destroyed in a cataclysmic battle and the world restored to its original perfection. In this final battle, mankind will be led by the Saoshyant (Savior), a man born of the prophet's own seed miraculously preserved in a lake—in effect, a messiah. This conflagration will bring the end of history and usher in the third time, that of Separation, when goodness will again be separated from evil, the latter will disappear, and men and women and all the *yazatas* will live together forever on earth in perfect goodness and peace. This was a radical departure from earlier ideas: the old idea that cooperation between men and gods was necessary to maintain *asha* was retained, but it was no longer directed to preserving the world as it is but to achieving its ultimate perfection. Thus by imputing men's sorrows not to the will of the creator but to the actions of the Hostile Spirit, Zoroaster gave humankind an explanation for the evils they have to endure in this life, as well as a moral purpose to strive for by submitting to the demands of the new doctrine.

These doctrines had far-reaching consequences for the conception of the hereafter. For Zoroaster, paradise was not a preserve of high social rank but was

attainable by everyone, women and men, master and servant, noble and commoner, on the basis of moral merit. At death, all souls undergo a judgment presided over by Mithra, who holds the scales of justice. Here the soul's thoughts, words, and deeds are weighted, the good ones on one side, the bad ones on the other. If the good side weighs more heavily, the soul ascends to paradise; if the bad side is heavier, the soul sinks to hell, a place of torment presided over by Angra Mainyu—Zoroaster's own, wholly new concept. In case the two sides just balance out, the soul goes to an intermediate place of shadowy existence without suffering or joy, like the old underworld kingdom of the dead. Divine justice is unwavering and inflexible, and no capricious or merciful divine intervention, nor any intercession by the living, can change the balance of an individual's moral account. But this is not the end of it, as bliss is not perfect in paradise because the soul is disembodied. Complete happiness will have to wait until the end of time, at Frasho-kereti, when the soul will be reunited with its body at a general resurrection of the dead. Thereafter a Last Judgment will occur and divide for the last time the righteous from the wicked, both alive and dead. Then the wicked will be destroyed body and soul, while the righteous' bodies will become immortal and unaging and lead an everlasting life of joy in the kingdom of God on earth.

Thus Zoroaster introduced to the world, in one stroke, the doctrines of individual judgment at death, heaven and hell, the future resurrection of the body, the final battle of good and evil, the messiah, the Last Judgment, and life everlasting on a perfected earth—that is, the apocalypse and the millennium. These doctrines were to have a long life in subsequent historical religions.

To entrench his theological and ethical doctrines, Zoroaster maintained but at the same time reformed the traditional observances. First, the great daily ritual, the *yasna*, was confirmed as fundamental but, while still centered on the offerings to water and fire, it was now dedicated to Ahura Mazda and the six Amesha Spentas. In later times the priests evolved a set liturgy for this ritual, incorporating in it Zoroaster's own *Gathas* and other ancient liturgical texts, which thus acquired a fixed, immutable form, and finally enclosing them within more recent texts. Second, the individual obligation of daily prayer, which used to be three times a day in pagan times, was now expanded to five times a day, and involved the believer first washing face, hands and feet and then praying while standing upright to face his Creator, his eyes fixed on the home fire, the symbol of righteousness. The final obligation was to celebrate seven annual high feasts, dedicated to Ahura Mazda and the six Amesha Spentas and to their seven creations—thus again fixing the essential doctrines in the minds of everyone. Each feast was celebrated communally, sharing the consecrated food with rich and poor alike. These high feasts were originally seasonal and pastoral festivals in pagan days, which Zoroaster re-dedicated to the divinities of his doctrine—thus making the transition easier for the people.

3.2 Spread and Development of Zoroastrianism

Zoroastrianism outlived its prophet and slowly developed for many centuries before entering recorded history, so knowledge of its infancy has to be gleaned from

meager indications in the Avesta and the tradition.[4] After his enlightening vision, Zoroaster preached his new doctrine to his fellow tribesmen for many years but met only rejection, after which he traveled to a new tribe where he managed to convert the prince and his court. The prince apparently went to war with neighboring chieftains in defense of the new religion and won, thus giving the prophet and his teaching an established home and shelter for the rest of his life. Thereafter, it seems, the faith slowly spread by mission among the eastern Iranian peoples, before it finally reached the Medes and Persians of western Iran centuries later.

Several aspects of the new religion required a break with the pagan community on the part of the convert. First, Zoroaster preached to women as well as men, to the poor and uneducated as well as to the wealthy and learned, offering to all who would follow his teaching and seek righteousness the hope of salvation in heaven while threatening with hell and ultimate annihilation all, however mighty, who would choose evil. This involved a sharp break with the old aristocratic and priestly tradition which, as we have seen, promised heaven to the elite and consigned the common people and the women to the shadows of an underground kingdom of the dead. Second, most difficult and divisive for all the people was the utter rejection of *daeva* worship, a rejection which was feared to bring down the wrath of those beings on the whole community. Traditionally, Iranians used to propitiate both the evil powers, to turn aside their malice, and the good powers, to secure their protection—a "kind of double insurance" which was "an entirely normal religious instinct", as also found with the Vedic Indians (Zaehner, 1961, 123). As a consequence, this rejection was likely the most conspicuous mark of one's break with the old beliefs and adherence to the new ones; it is significant that abjuration of the *daevas* figures prominently in the ancient confession of faith, which is still routinely recited today but seems to incorporate the original avowal made by converts in the early days. Relatedly, Zoroastrian believers, men and women alike, are required to this day to wear an outward badge of membership in the faith, the sacred girdle (*kusti*), which is first put on when reaching maturity and then untied and retied every day of their life. Third, and crucial, there was the code of purity laws, which became so characteristic of Zoroastrianism as to set it in a class apart from most other religions.

The purity laws are rooted both in Zoroastrianism's dualistic doctrine and in its linking of spiritual and material: the seven creations had been brought into being by Ahura Mazda in a state of perfection and were then marred by Angra Mainyu; hence, preventing or reducing any of these blemishes—dirt, disease, stench, decay, etc.—contributes to the defense of the good creation and the fight against evil, and so ultimately to the achievement of Frasho-kereti. Every member of the community is thus permanently enlisted to fight evil through the ordinary tasks of daily life. Some of the rules probably go back to Indo-Iranian times, since Brahmanism has similar prescriptions regarding cultic purity; but Zoroastrian rules regarding daily living proliferated down the centuries, even though it is impossible exactly to determine which observances were original and which later extensions at the hands of

[4] This section is based on the detailed treatment in Boyce (1975, chs. 10, 12) and the summary in Boyce (1979, ch. 4).

generations of priests. The final result was the raising of a barrier between believer and unbeliever almost as tall as that which separates caste Hindus from everyone else. Further, the divide between good and evil was all-encompassing and knew no middle ground: as an ancient text says, "all actions and ways of behaving are either meritorious or sinful", no neutral areas are recognized (cited in Boyce, 1975, 294), unlike in Islam. This code must have been an important reason for the failure of Zoroastrianism to spread beyond Iranian peoples: the demands are too irksome and the self-discipline needed too strict for anyone who was not accustomed to it from birth, while since Iranian paganism knew some of the same rules, the difficulty would have been less for Iranian converts. Moreover, the stringency of the rules explains why, even though historically the religion was fully open to conversion, no unbeliever is allowed to be present at a religious service, since no unbeliever will ever keep all the Zoroastrian purity laws. This self-segregation is in contrast with the liberality with which sympathetic Gentiles ("God-fearers") were admitted to the synagogues in the Diaspora of late-Second Temple Judaism, which apparently was a key engine of soft proselytizing (Ferrero, 2014b). While this contrast must stem from the different workings of the respective purity codes, it too functioned as a disincentive to conversion.

Turning to the content of the purity rules, first of all people should keep themselves scrupulously clean in person, clothing, and abode. Next, they should vigilantly care for the other six creations, keeping earth fertile and unsullied, plants growing, animals healthy, and preparing food with strict cleanliness. Special precautions should, however, be taken with regard to water and fire, which are central to the Zoroastrian cult; and the rules concerning these set its believers apart from all other peoples.

In most cultures, water and fire are regarded as the chief cleansing agents, used to restore an unclean or defiled object, person or place to purity. In stark contrast, in Zoroastrianism it is water and fire which, being among the seven good creations, must be kept clean. Nothing impure should be allowed in direct contact with a natural source of water; if anything ritually unclean is to be washed, water should be drawn off for this purpose, and the impure object should first be cleansed with cow's urine, then dried with sand or in sunlight, and only then washed in water. Similarly with fire, only clean, dry wood and pure offerings may be laid upon the flames, special care must be taken lest cooking pots spill over and sully the hearth fire, and burning rubbish is unthinkable. Dry and clean waste may be buried, but the rest was thrown into a windowless building and then periodically destroyed with acid.

As regards plants and animals, in striking contrast with other religions loaded with purity rules such as Judaism and Islam, Zoroastrianism in general has no food prohibitions. However, for plant and animal, as for man, perfection is seen in healthy maturity; hence it is sinful to cut down a sapling tree and kill a lamb or a calf. Furthermore, all creatures harmful or repulsive to man, from insects to reptiles to beasts of prey—collectively called *khrafstra*—are regarded as the work of Angra Mainyu, so killing them is highly meritorious (the products of the silkworm and the honeybee are, however, beneficial and hence permissible). Down to modern times communities have engaged in ritual killing expeditions around the village—not the champions of biodiversity!

Death is regarded as the chief single cause of pollution, and the greatest pollution is from a human corpse. This explains the practice of exposure of the body, as it secures the swift destruction of the polluting flesh. Since medieval times the place of exposure has been a funerary tower (*dakhma*); in ancient times it was simply a bare mountain side or stretch of stony ground, so that the body would not come into contact with the good earth or water or plants, after which the dried bones were buried to await Judgment Day. In the same vein, dead bodies were handled only by professional corpse-bearers, who submitted to an ordeal of ritual precautions and cleansing procedures.

Apart from putrefying flesh, the other chief source of pollution is anything that issues from the living body, whether in sickness or in health: not only excrement, but also blood, saliva, semen, dead skin, cut nails and hair. As a consequence, daily life becomes hedged about with regulations of all sorts. Thus detailed prescriptions surround the disposal of nail and hair trimmings; you should not spit, sneeze, drink from a common vessel or eat from a common dish. Above all, the doctrine of the impurity of blood has pressed hard on women. Every woman during her monthly menses was ritually unclean and had to withdraw from her family, abstaining from domestic tasks and especially from preparing food, keeping away even from her tiny children, and not even saying her private prayers—since one must be pure to approach the divine beings. Childbirth was likewise regarded as a heavy pollution, requiring similar isolation of the new mother for 40 days—not to mention the dread of bearing a dead child, which carried the double contamination of childbearing and death, and therefore called for especially rigorous purification rituals.

The purity laws weighed particularly heavily on the priests, who had to be "the cleanest of the clean" for their intermediation with divinity to be effective. In addition to the restrictions incumbent on the laity, a priest would not eat food prepared by a lay person, not to mention an unbeliever, nor make a physical link with anyone else such as a common cloth while eating. And priests subjected themselves to the purification rituals with a frequency and intensity beyond comparison with a lay person, as we will now see.

Since it was impossible for a woman, and very difficult for a man, to avoid all ritual uncleanness, purification rites were necessary, as in all societies that have purity laws. The simplest ones, involving washing from head to foot, were performed by people at home, but the rituals prescribed for more serious contaminations were administered by priests with recitation of mantras. The most elaborate of these, prescribed for the heaviest contaminations—such as touching a dead body or mingling with impure strangers while traveling—was called *barashnom* and was a nine-day affair, in which the person retired to a secluded precinct and there underwent successive triple cleansings with consecrated cattle urine, sand, and water, passed to him by a priest, while moving through nine stones; this was followed by nine days and nights of segregation and further ablutions and prayers. Besides attending to the rituals for the laity, the priests themselves undergo *barashnom* many times in their lives in preparation for the highest ceremonies.

At some point, a practice established itself of undergoing *barashnom* vicariously, either for the living or the dead. A devout person might go through it for a relative who committed suicide, or who was drowned or burnt to death (both of which acts

are sinful as they contaminate the water or the fire with death). Among the living, people who have both means and a high opportunity cost of time, such as wealthy merchants or farmers, may hire someone to take the purification in their stead when they incur pollution; and since the purer and better trained the performer, the more effective the ritual will be, it is priests who are naturally chosen as substitutes and paid for it. Although one can see the doctrinal logic of this development—some harrowing deaths are involuntary, so it seems only fair to afford these people a chance of salvation; and then if the dead can be cleansed by proxy, why not the living also?—the whole idea of interceding for the dead seems alien to Zoroaster's teaching of everyone's personal responsibility for their own fate. It is, however, an element of continuity with the ancient Indo-Iranian tradition of caring for the souls of the departed, and it could therefore be seen as a tempering of the stern original doctrine to accommodate the new converts as the religion expanded.

3.3 The Zoroastrian Priests

As we have seen in a previous section, priests were important in the traditional religion, as were their cousins among the Vedic Indians, and formed a specialized profession, entry to which was passed down along the male line. But no doubt Zoroaster's reforms and their subsequent elaboration greatly increased the demands on them, and hence their social role, even in the long centuries before Zoroastrianism surfaced to history in the 6th century BCE. This was in part a self-reinforcing process as it was the priestly scholastics themselves who, in the course of time, extended and codified the liturgy, the purity rules, and the purification rituals, which in turn gave them an ever more prominent and ubiquitous role. To summarize, Zoroastrian priests:

- Performed the daily *yasna* ceremony, which in its developed form takes about two hours.
- Performed services for the laity at initiation, marriage, and death, as well as on special family occasions.
- Performed the ritual services for the community at the seven high feasts.
- Administered the *barashnom* and other purification rites to the laity upon request.
- Frequently underwent the *barashnom* themselves to ensure their fitness to their tasks.
- Underwent it as proxies for lay people when hired to do so.

So, since the prehistoric period, the laity depended on the priests for their religious life, and the priests depended on the laity for their livelihood as they lived off the fees for their services. A close, usually hereditary bond formed between lay and priestly families to support and stabilize this exchange. This close relationship has continued into modern times, during and after the age of state religion.

From the 6th century BCE, Zoroastrianism became for some twelve centuries an imperial religion, endowed with court chaplains, fixed ceremonial places, and

the newly invented, signature Zoroastrian shrines—the fire temples (Boyce, 1982, 221–225, 228–230, 1979, 63–66). The priests also became teachers in elite schools and at court, as in any state religion. All of this further enhanced the social role of the priesthood and multiplied its numbers, bringing in its wake high incomes and political influence. As a consequence, at least in the Sasanian period, if not before, the profession acquired a hierarchical structure headed by a chief priest who oversaw orthodox doctrine and practice, which makes it possible to speak of a Zoroastrian "church".

The imperial era waned with the fall of the Sasanian Empire to the Muslim conquest in the 7th century CE. Thereafter, in the long age of repression and decline to this day, the priesthood basically returned to what it was in its earlier pre-state days, with the addition of the specialized service of fire temples which became a fixture of Zoroastrian communities—as well as an added demand on their resources.

4 Modeling Zoroastrianism

The foregoing account of the rise and growth of Zoroastrianism from the cradle of traditional Iranian religion suggests two points that can benefit from insight from economic analysis: the theological conception and the turn from age-old community religion to successful proselytizing. The two models that follow reinforce each other. The theological model shows that Zoroaster's reform makes it possible for the supplicant to save resources devoted to religion and thereby to reduce, if not entirely eliminate, his choice dilemma, thus increasing his utility. This explains Zoroastrianism's potential attraction for the polytheistic public and therefore the enhanced status and power that the priests stand to gain if they engage in mission. The mission model shows that Zoroastrian missionary expansion can be welfare-improving for both the traditional community and the priesthood—something that would not have been possible in the old religion.

4.1 Divine Preferences: The Zoroastrian Hierarchy

Zoroaster's theological reform amounts in effect to introducing specialization and hierarchy into the traditional pantheon—as well as chasing some "bad" gods from it. The *daevas* that were thus rejected can be thought of as gods who, by their very nature and attributes, would not submit to the hierarchy presided over by Ahura Mazda. Using the same technique as used by Ferrero and Tridimas (2018) and Basuchoudhary et al. (2020) for the Greco-Roman and Hindu religions, respectively, this reform can be pinned down by means of a model of divine preferences.

Imagine that there are two gods who may—though need not, as we will see—have overlapping jurisdictions over two matters. Let A and B be two gods, each of whom is thought to be able to affect outcomes in two fields, x and y. For example, x might be victory in war and y wealth, and A might be Mithra and B Indra—both war gods and both gods of material plenty, the first as the lord of covenant and justice and the second through plunder and war booty. Let x_A and x_B (respectively, y_A

and y_B) denote the amounts of sacrifices or offerings of an agent to gods A and B in pursuit of a favorable outcome in field x (respectively, y). Further, let $\bar{x}$ and $\bar{y}$ be the amounts of resources that the agent can or will devote as offerings to each outcome. As a starting point, these amounts are fixed. We will see below that if x and y are measured in the same units—such as money or time devoted to religious observance—so that they are perfectly substitutable across outcomes, these amounts can be made variable subject to an overall constraint $\bar{z} = x + y$.

The agent maximizes utility on behalf of each god by choosing his offerings basket with a view to satisfying the god as best he can. Analytically, gods are perceived to be pleased by the offerings dedicated to them, thankful for it, and willing to reward the supplicant by bestowing favors on him towards fulfillment of the supplicant's wishes. These wishes, and the corresponding benefits expected from the god, can be worldly and/or otherworldly. The happier the god, the fuller and more effective are his/her blessings. Each god is supposed to have a satiation point, which is, in principle, within the supplicant's reach and consists of a bundle of offerings that makes the god wholly satisfied. This point is again a subjective belief of a typical supplicant, grounded in the current theology, which sees the gods as eager for acknowledgment and offerings but amenable to be pacified with sufficient effort. The theology, mythology, and cult practices of ancient polytheistic religions strongly suggest that such satiation points were thought to be knowable by the supplicants and/or their priests—they "knew" what the gods wanted—and relatively immune to disconfirmation from perceived failures of past offerings to fulfill one's wishes—puzzling as this may seem to modern observers.[5] If the supplicant cannot or will not make offerings that match the satiation point, he believes he will face in return less satisfactory or more haphazard blessings from the god. Any offering above this ideal bundle, however, does not turn the offering from a "good" into a "bad" but into a "neutral"—i.e., the god is indifferent to the excess offerings which, therefore, would neither benefit nor harm the supplicant. With these assumptions, the transition from polytheism to Zoroastrianism can be modeled by means of an Edgeworth box. This depicts indifference maps over the perceived preferences of gods A and B with respect to offerings x and y. The sides of the box measure the total amounts of resources devoted to each outcome, $\bar{x}$ and $\bar{y}$.

As we have seen, the traditional Iranian pantheon was similar to the Vedic one and generally to Indo-European polytheism in that it exhibited substantial overlap of jurisdictions, as divine functions were not tightly defined and multiple gods were appealed to for similar motives. We can see this in fully developed form in the Greek and Roman pantheons of historic times. In such a setting, each god is sensitive to his/her being recognized as influential in both fields and the gods are "jealous" of one another because, under the constraint of scarcity, the supplicant cannot fully satisfy all gods concerned with a particular matter and therefore faces a dilemma. In

[5] One referee has made the intriguing suggestion that if beliefs about gods' demands depend on the perceived success of past offerings, satiation points become endogenous and would best be addressed by a dynamic model with updating of beliefs. Such a development may be an interesting direction for future work.

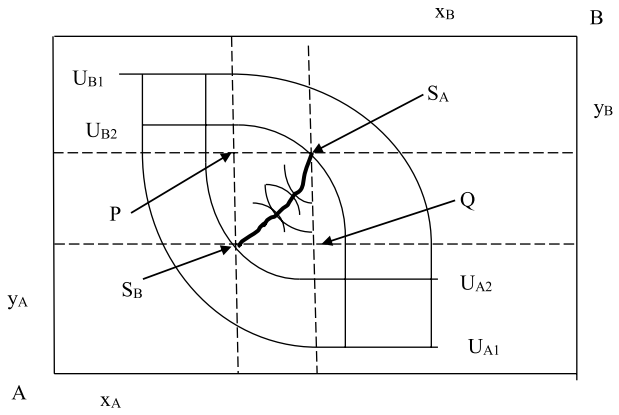

Fig. 1 Polytheism's jealous gods: both A and B care about both *x* and *y*

an Edgeworth box, this can be captured by strictly convex preferences of both gods, with each god's indifference map culminating at an interior satiation point and one god's satiation point lying beyond the other god's satiation point from the first god's point of view. This last geometric specification captures the constraint of scarcity: here this means that the satiation points cannot *both* be achieved at the same time. The model is symmetric as the two gods are similarly conceived.

The Zoroastrian pantheon, by contrast, is asymmetric: Ahura Mazda is supreme and has an all-encompassing jurisdiction, while all the other divine beings—the great Amesha Spentas and the other *yazatas*—were created and appointed by him to preside over a well-defined field, without encroachment upon one another's jurisdiction—that is, they are specialized deities. As such, a *yazata*'s satiation level can be captured by a point on "his" side of the Edgeworth box, denoting the offering he cares for, while the other offering is considered as "neutral". The effects of this theological reform are far-reaching.

A short road map may help the reader navigate through the following figures. We begin with an Edgeworth box that illustrates the polytheistic theology and the tradeoff it implies with fixed total offerings in each field. With these same offerings, hence an unchanged size of the box, we then switch to the Zoroastrian theology with one specialized divinity subordinate to the supreme god and see what this change implies for the tradeoff. Next, exploiting the Zoroastrian subordination, we change the box's sizes by shifting resources from *y* to *x* while keeping the total unchanged, and show that this allows the elimination, or at least the reduction, of the scarcity and the attendant tradeoff and thereby the attainment of a more efficient allocation. Finally, we return to the original sizes of the box and show that, turning both gods into specialized Zoroastrian divinities, not only scarcity and tradeoff disappear entirely but part of the resources previously committed to religion can be efficiently saved for other uses.

Figure 1 (taken from Ferrero and Tridimas (2018)) depicts the polytheistic theology. The gods' preferences are monotonic and strictly convex to the origin, with each god's indifference map culminating at satiation points S_A and S_B. Above

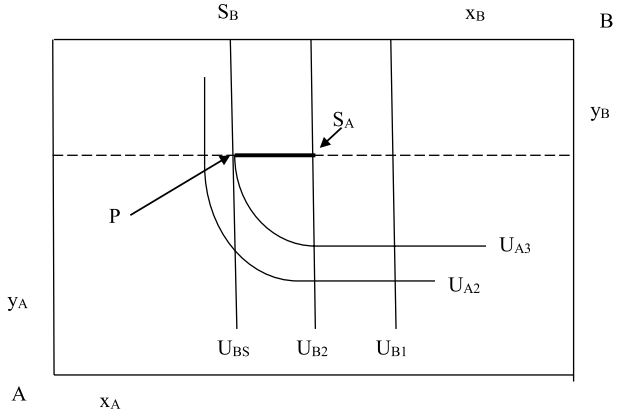

Fig. 2 Zoroaster's divine hierarchy: Ahura Mazda (A) and a *yazata* (B)

satiation levels (identified by the pair of horizontal and vertical dashed lines drawn through each satiation point), the indifference curves become straight lines as the excess offering leaves the god indifferent—i.e. the "good" becomes a "neutral". Two such indifference curves are drawn for each god. As drawn, the supplicant's available resources toward offerings x and y are scarce as he cannot simultaneously satiate both gods; hence within the rectangle $S_B\ P\ S_A\ Q$ the gods are jealous of each other and angry at the supplicant who is not entirely satisfying them. The thickened curve connecting S_A and S_B is the locus of Pareto optimal allocations of offerings—the "contract curve" between the two gods. It depicts the tradeoff faced by the supplicant: by increasing his offerings to placate one god, he will incur the displeasure of the other god. Choosing a point on the S_AS_B curve is the best that can be done under the existing resource constraint to minimize the harm from gods' displeasure.[6] This is the *supplicant's dilemma*.

Let us now turn to the divine hierarchy introduced by Zoroaster. For our analysis to be meaningful, the effects of this theological reform must be evaluated *ceteris paribus*. To this end, the height and width of the Edgeworth box in Fig. 2 are exactly the same as in Fig. 1, implying that the total available offerings in each field, $\bar{x}$ and $\bar{y}$, are the same. Within the box, god A—now the supreme god Ahura Mazda—has the same strictly convex preferences—implying that he still has jurisdiction over both fields—and the same satiation levels x_A^S and y_A^S (and hence the same satiation point S_A) as in Fig. 1. By contrast, god B—now a *yazata*—influences only and therefore cares only about good x and considers good y as "neutral"; hence his indifference curves are straight vertical lines starting from each point on the upper side of

[6] In theory, there could have been "bargaining between the gods" to find a mutually acceptable sharing of the offerings, i.e. a particular point on the contract curve, for example a Nash solution to the bargaining problem. This did not happen as Zoroaster took a different way out of the supplicant's dilemma. The reason is probably to be sought in the fact that the priesthood was not specialized, so the different gods were not "represented" by different priests who would bargain on their behalf. I am indebted to a referee for suggesting the possibility of a bargaining game.

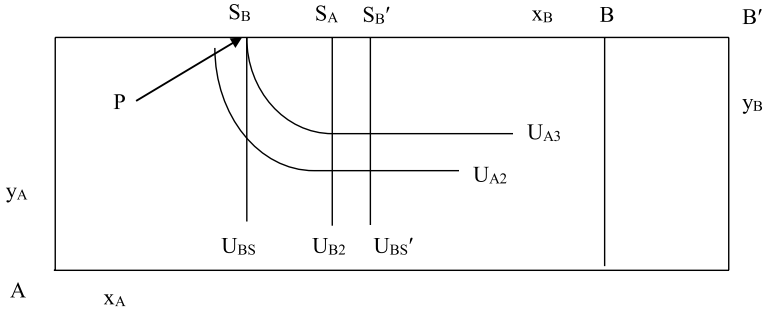

Fig. 3 Efficient allocation of worship under divine hierarchy

the box. His satiation bundles are described by point S_B and by the indifference line U_{BS} starting from it; this line passes through the interior satiation point S_B of Fig. 1, meaning that his satiation level of x, x_B^S, is unchanged. For clarity, an indifference curve U_{A3} is drawn to capture A's utility level at B's satiation point; similarly, an indifference line U_{B2} is drawn to capture B's utility level at A's satiation point. As a consequence of these changes, the contract curve S_AS_B of Fig. 1 is no more and is replaced by the thickened horizontal segment PS_A, which is the set of "efficient" allocations that represents the tradeoff the supplicant now faces between satisfying the two divinities. Thus scarcity of resources is still there, implying that the supplicant cannot satiate both divinities, but now it involves only good x.

Noting that good y is in excess supply (at any of the allocations on PS_A, adding or subtracting the corresponding quantity y_B leaves either divinity indifferent) immediately suggests that even if an allocation within this box may be efficient, the size of the box itself is inefficient as it unnecessarily ties down valuable resources to a useless expenditure of offering y. If resources committed to offering y can be costlessly shifted to offering x, leaving the total expenditure of resources $\bar{z}$ unchanged, this can be improved upon. In Fig. 3, the box is shortened in height and lengthened in width with respect to Fig. 2 in such a way that the total expenditure $\bar{x} + \bar{y}$ is unchanged (the horizontal segment BB' in Fig. 3 is equal to the vertical segment PS_B in Fig. 2), thus turning all the excess amount of y into additional x. A's position is unchanged, except that his satiation point S_A is now found on the upper side of the box. B's geometry is, however, changed because his point of origin is moved from the original B to B' and therefore his satiation point is moved from the previous S_B (reproduced here from Fig. 2 for clarity) to $S_B{}'$. As a result, $S_B{}'$ lies now to the right of S_A and scarcity has disappeared, as has the supplicant's tradeoff: the additional x allows the supplicant to fully satiate both divinities. (Of course, the box as drawn is now too wide; excess resources x can be shifted from religion to other uses until S_A and $S_B{}'$ coincide, thus reducing the total resource commitment $\bar{z}$ to everyone's full satisfaction).

It should be stressed that the general result to take home is not the *elimination* of scarcity but its *reduction*; it might well be that the horizontal distance between satiation points S_A and S_B under polytheism (in Fig. 1) was so large to begin with that the reallocation from y to x under Zoroastrianism is not sufficient to achieve satiation of

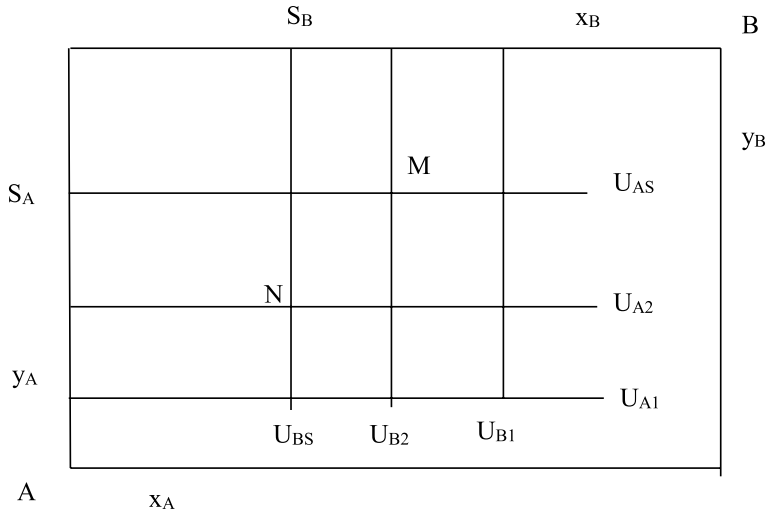

Fig. 4 Two specialized *yazatas*: A cares only about *y*, B cares only about *x*

both divinities (in Fig. 3, S_B' would then still be somewhat to the left of S_A). What is certain is that this reallocation—made possible by the reduction of B from god with encompassing jurisdiction, overlapping with A's, to specialized, subordinate *yazata*—allows the saving of resources previously tied to pleasing everyone on everything and thus the attainment of a superior religious outcome for the supplicant, reducing—even when not eliminating—his dilemma.

This conditional result seems apposite. In Greek and Roman religion no moral obligations or purity laws were incumbent upon the supplicant, and in traditional Iranian polytheism there was little of either, and above all there was no general expectation of reward or punishment associated with the supplicant's moral choices either in the afterlife or at the end of days. By contrast, as we have seen, in the Zoroastrian religion there were lots of both, as morality was intertwined with purity at the core of the faith. As a consequence, the expenditure of resources that determine the size of the Edgeworth box, and which may be in scarce supply compared to the full demands of the faith, here must be understood as opportunity costs. These include not just the direct cost of the offerings (and the upkeep of the priests) but also the value of the time and effort that the supplicant is asked to devote, and of the consumption that he is asked to forgo, for the discharge of his individual ceremonial and behavioral duties—duties which are particularly testing and time-consuming in this religion. So the supplicant may not be able to fully live up to the demands and may again be forced to submit to a (reduced) choice dilemma.

Finally, consider the situation down the hierarchical pyramid, where formerly independent gods have been turned by Zoroaster into subordinate, specialized divinities. In Fig. 4, the size of the Edgeworth box is again the same as in Fig. 1 to ensure a *ceteris paribus* comparison. Now A has jurisdiction only over *y* and B only over *x*, while for each divinity the other good is a "neutral". Their indifference curves are then horizontal and vertical straight lines starting from points on the left and on the

upper sides of the box, respectively; the satiation bundles for B, denoted by point S_B and by line U_{BS}, correspond to the same satiation level of x, x_B^S, as characterized the interior satiation point S_B in Fig. 1, and the same holds for A (for clarity, points N and M here denote points S_B and S_A of Fig. 1, respectively). As a consequence of these changes, the contract curve S_AS_B of Fig. 1 has disappeared (it would now connect points N and M) and so has scarcity: the specialization of jurisdictions allows the supplicant to fully satiate both divinities, getting rid of the supplicant' dilemma. Note that this is a general result that necessarily obtains if starting from interior satiation points inside the box. As a consequence, the box is now oversized, unnecessarily committing excess resources to religious offerings; it can and should be efficiently downsized so as to make points S_A and S_B coincide at the NW vertex.

4.2 The Zoroastrian Mission: A Discriminating Cooperative

Traditional polytheistic religions are not missionary enterprises and one does not "convert" to them (except perhaps spouses and slaves), so we can think of traditional Iranian religion as a religious community that from time immemorial had structured itself in such a way as to provide the maximum net benefits to its members; alternatively, one that had acquired a level of membership that was efficiently maximizing net benefits, or welfare, per capita. The switch to Zoroastrian monotheism and the start of a mission to convert other Iranian peoples inevitably involved, on the one hand, a fall in per capita benefits because the community was diluted and the priests distracted toward missionary work, and on the other hand an increase in the marginal and average cost borne by members, as new members were naturally more and more difficult to convert and retain as the expansion proceeded. Nevertheless, the switch to mission—the road that ultimately led to an empire-wide religion—could be made acceptable to the original community and still remain viable if the *total* net benefits generated by the *new* members were sufficient to both fully compensate the old members *and* leave a residual—a rent—to support the expanded priestly class that the missionary spread of Zoroastrianism, as we have seen, entailed. Thus described, the move involved the equivalent of a kind of wage discrimination—unequal post-transfer benefits for old and new members.

If we think of religious consumption as the output of a household production process that employs only the members' "labor" as an input, the traditional community equilibrium described above can be modeled as the solution to the problem of a producer cooperative that chooses its membership level to maximize net benefits per member—measured as the difference between gross benefits and cost of participation. Starting from here, expansion yields net benefits from new members; these can be partly siphoned off to compensate the original members and partly used to provide a rent to the new priests, while still leaving a nonnegative residual net benefit to the new members themselves. Hence, the new equilibrium level of total membership is constrained by the condition that the total net benefits generated by the new members be strictly greater than the total losses of the old members. The full model is developed in Appendix.

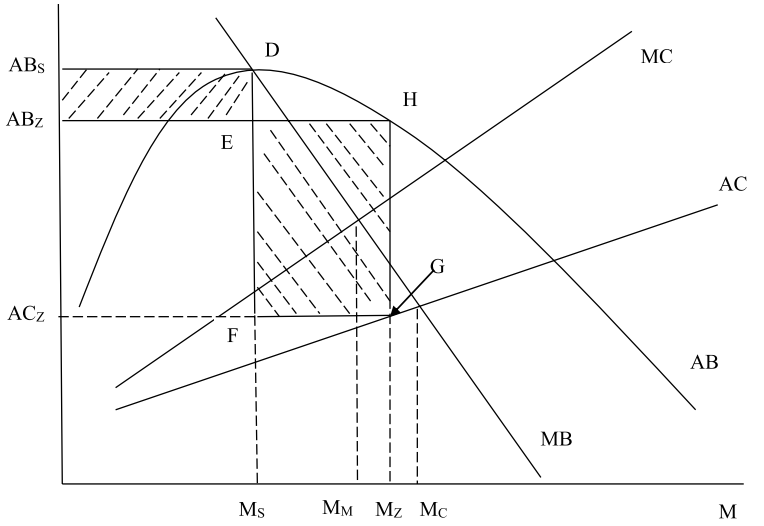

Fig. 5 The Zoroastrian mission and the priests' rents

Figure 5 depicts benefit and cost curves as a function of membership *M*. Zoroastrian levels of the variables are denoted by a subscript Z while traditional community levels—which are analytically identical with those of a closed sect that maximizes its members' average benefits—are denote by a subscript S. Given that a finite optimal membership exists, it occurs where the average benefit (*AB*) curve peaks, i.e. where it crosses the marginal benefit (*MB*) curve from additional members, determining membership M_S and benefits per member AB_S. This will be the equilibrium of the sect—the classic solution of a dividend-maximizing producer cooperative.[7] Missionary expansion, following the Zoroastrian reform, starts from here. New members (exactly like the old members) have an average cost of joining *AC* and a marginal cost *MC*; both are assumed increasing with new members because, at least beyond a certain point, conversion involves people who are more removed from the original group and whose opportunity cost is therefore higher.[8] Seen from another angle, the Zoroastrian community enjoys potential market power as it is the

[7] The theory of the producer cooperative or labor-managed firm is old, and seems now out of fashion. For a good introduction to the model see the survey by Bonin and Putterman (1987) and the literature cited therein. A full analytical treatment is in Ireland and Law (1982). The labor-supply constraint is analyzed by Domar (1966) and the inegalitarian or discriminating cooperative by Meade (1972). Nowhere in this literature, however, not even by Meade, is our special constrained optimization problem addressed.

[8] Although we have next to no information on the prehistoric spread of the religion, it may well be that for an initial range of expansion the average cost of new members would have decreased, for example because of a fixed cost or of network effects. Appendix shows that, under some conditions, the Zoroastrian solution can survive this extension. Contrary to the increasing cost case, however, it may (though need not) imply a level of membership lower than in the "monopsony" solution because the rapid expansion of *M* triggered by the decreasing *AC* also involves a rapid fall of *AB* and hence a large loss for the old members.

only supplier of that brand of religion, and so it faces a supply curve of members which will sooner or later slope upward; symmetrically, the marginal benefit curve *MB* can be thought of as its demand curve for members. Even through its expansion process, however, it remains a cooperative organization bound by the constraint to protect the welfare of the original group—in effect, a discriminating cooperative that redistributes benefits from new to old members.

To help visualize the choice involved, we show two more solutions. One is where the organization does exploit its market power and chooses its membership so as to equate *MB* to *MC*, akin to a profit-maximizing monopsony, which yields membership M_M. The other solution is where the organization does not exploit its market power but submits to average cost as if it were a market parameter (a "wage") and equates *MB* to *AC*, akin to a profit-maximizing competitive firm, which yields membership M_C. It can be proved (see Appendix) that the compensation constraint above is satisfied at both solutions. The cooperative, however, can do better than either and *maximize the difference* between total net benefits generated by the new members and total losses of the old members. This yields the Zoroastrian equilibrium at M_Z, which turns out to lie somewhere in between M_M and M_C. As can be seen in the figure, the move from M_S to M_Z (or to any other level of M greater than M_Z) would not be acceptable to the old members without redistribution and discrimination because average benefits fall from AB_S to AB_Z. The outcome at this equilibrium is shown by the two shaded rectangles: the area EFGH measures the net benefits from the new members while the area AB_S DE AB_Z measures the total losses of the old members; the difference between these two areas, though positive also at other membership levels such as M_M and M_C, reaches a maximum at M_Z. This confirms that the switch to missionary monotheism can be Pareto-improving and therefore unanimously accepted.

We have hardly any direct observation of the missionary, pre-state period, so one wonders what the compensation to the old members may have been then. Enhanced reputation and influence, which facilitated profitable trade connections in the newly gained territories, are a fair guess (cf. Boyce, 1982, 7–9, for the spread of Zoroastrianism in western Iran). In the longer run, however, there was one great new benefit: the fire temples, which began under the Achaemenians and spread all over the empire, including the northeastern region of the Iranian plateau which was the homeland of the original Zoroastrian community. These "old members" surely drew benefits from such institutionalization of the cult—witness the fact that the fire temples became a fixture of Zoroastrian communities the world over, down to the tiny groups surviving today.

5 Discussion and Conclusion

Two issues have long made it problematic to identify Zoroastrianism as true monotheism: the presence of lesser deities and dualism. Before hastening to conclude that the Amesha Spentas and the other *yazatas* compromise the purity of monotheism, it is well to consider that the other historical monotheisms too made room for other figures endowed with supernatural powers to bridge the gulf between the exalted,

remote Creator God and the human world: the angels in all of them (whose conception in post-exilic Judaism was apparently developed after the pattern of the Amesha Spentas; Boyce and Grenet, 1991, 404–405), the saints and the Virgin Mary in several Christian churches, and the other persons of the Trinity in all of Christianity. Despite the vast differences with Zoroastrian theology, the common thread is that all these beings are subordinate to the Godhead as helpers or (in the case of the persons of the Trinity) co-equals, hence they do not pursue different interests and are worshiped jointly with the Godhead, not separately; therefore the supplicant's dilemma does not arise. Also, while the three divine persons, Mary, and the angels are not seen as specialized entities appointed to different realms of creation or fields of human life, the Roman Catholic saints to some extent are worshiped as special patrons of things, people, or activities, somewhat like the *yazatas*. Rather, the lesser Zoroastrian divinities are distinctive in two ways: most of them have their origin in the pagan pantheon, and still they are worthy of worship in their own right as specialized protectors of the various realms and functions of creation under the lordship of their creator, Ahura Mazda, which makes them more than angels—but they are usually not called "gods" either in the Avesta. So they represent a concept unique to Zoroastrianism and their Avestan appellation, *yazatas*, is best left untranslated (Boyce, 1975, 195–196). The pagan origin of the *yazatas* is important because it must have made conversion relatively easy for the Iranian peoples, as it did not involve a complete turnaround of beliefs.

Dualism is one way for a religion to address the problem of evil which is inherent in monotheism—how can a God who is thought to be all-powerful, all-knowing, and wholly good tolerate evil? Zoroaster's answer is a radical, unbridgeable separation between the two principles: God did not create evil, nor does he tolerate it; rather, evil has always existed from before time, uncreated and personified as the Hostile Spirit, but will meet its end at Frasho-kereti someday; and it is God's purpose and unceasing work to fight it to its extinction with the help of all the divine and worldly creatures. So one could say that while God is not quite the One and Only so long as the present time of Mixture lasts, he will indeed "become" such at the End, as the final victory of the good over evil is not to be doubted; and with the disappearance of Angra Mainyu and his cohorts, dualism will leave the field to unqualified monotheism. Other monotheistic religions which, like Judaism, Christianity and Islam, posit that God is the creator of everything, including evil, were driven to explain evil by resort to fallen angels (like Satan) or inferior supernatural beings who vie with God for man's soul, thus replacing a philosophical conundrum with another (Boyce, 1982, 195; Cohn, 2001, 182 ff.; Pagels, 1996).

That the dualistic belief was problematic even within the religion is indicated by the fact that it sparked a heresy, known as Zurvanism (Boyce, 1979, 67–70, 1982, 231–242)—which in turn is strongly suggestive of a monotheistic frame of mind since, almost by definition, heresy is unknown to polytheism. It seem to have originated in scholastic speculation in some priestly circles: if, as per the hymn cited above, Ahura Mazda and Angra Mainyu are "twins", they must have had a "father", and this could be nothing but time (*zurvan*), which thus pre-existed to the two primeval spirits. So a personification of Time, Zurvan, was born to satisfy the monistic quest of theologians, even though he remained a remote First Cause, was never

the object of worship, and changed nothing in the traditional observances which continued to center on the furtherance of the good against the evil. Nevertheless, it was indeed a heresy as it betrayed Zoroaster's fundamental doctrine of the utter separation of good and evil. Zurvanism was apparently conceived in late Achaemenian times and then, much later, became the official state religion of the Sasanians. However, an orthodox strand of priests, custodians of the dualistic tradition, must have continued to exist alongside the Zurvanites, because when state support waned and Zoroastrianism was set on its long-term decline after the Muslim conquest, the orthodox doctrine came back into its own and Zurvanism disappeared without a trace.

The strength of the Zoroastrian solution to the riddle of evil is that it lays the foundation of a militant faith:[9] it involves the faithful in a struggle that will continue unabated till the end of days, and which, in the meantime, thoroughly pervades their daily life through the prescribed rituals and the observance of the purity laws, allowing no temporary leave or excuse. Such a stern system of moral and behavioral demands makes acceptance difficult to begin with, but exit or lapsing just as difficult for the same reasons. The difficulty of entry, as discussed in a previous section, largely accounts for the fact that Zoroastrianism—in principle a universal religion for the whole world—in fact historically became a national religion of the Iranian peoples.[10] The difficulty of exit, on the other hand, goes a long way toward explaining the extraordinary permanence of the religion against all odds—something that deserves some more discussion.

As mentioned in a previous section, Zoroastrian doctrines had a profound influence on Second-Temple Judaism and, through it, on early Christianity.[11] It began with the prophet called Second Isaiah during the Jews' Babylonian exile in the 6th century BCE and continued through the following centuries via the sustained contact between Iranian and Jewish neighbors in the Near East. Among these doctrines, the most important were the notion of a Creator God, which helped turn the religion of Yahweh from a tribal religion to true monotheism; a purity code centered on individuals' daily lives rather than just regulation of cultic matters, which in time enabled Judaism to survive the destruction of the Temple; and, most important for our purposes, the expectation of an end of time that was to bring the utter defeat of evil, a Last Judgment and a kingdom of God on earth, which became the centerpiece of Jewish, and then Christian, apocalyptic. As is well known, infant Christianity, dismayed at the non-event of the Second Coming of Christ, waged a long-drawn-out

[9] Hint of a militant faith immediately brings Islam to mind, but the contrast between the two religions is sharp. Islam makes it incumbent upon every competent Muslim to join the struggle to bring the whole world into submission to Islam—that is, *jihad*; in contrast, for a Zoroastrian the struggle to perfect the world and defeat evil is primarily a struggle within one's daily life and immediate surroundings. Conversion of infidels to Zoroastrianism is indeed desirable but must occur through their recognition of the believers' moral superiority—witness the remarkable tolerance of other religions which (with some exceptions in late Sasanian times) was a distinctive mark of all three Iranian empires.

[10] However, after coming under Parthian rule in the first century BCE, Armenia became a predominantly Zoroastrian land until it converted to Christianity (Boyce, 1979, 84–85).

[11] For a detailed comparison of texts and analysis of historical developments see Boyce (1982, 43–47, 188–195), Boyce and Grenet (1991, 401–436, 440–446), Smith (1971), Cohn (2001, chs. 4, 5, 8–13).

struggle to shelve its millenarian eschatology and turn into an established church, thus coming to terms with the need to survive for an indefinite time in the Roman Empire of this world. In stark contrast, Zoroastrianism down the centuries never bracketed out its apocalyptic expectation, and yet its belief in this respect must have been as hardly tested as Christianity's (Cohn, 2001, 99–101). The *Gathas* do convey a sense of urgency, suggesting that the "Making Wonderful" was expected to happen in the very near future, so the first generations of Zoroastrians must have been as bitterly disappointed as the early Christians were to be, more than a thousand years later. They must have rested their hopes on the coming of the future world savior, the Saoshyant, in whom Zoroaster would be, as it were, reincarnated, and who would fulfill his prophecy; Zoroaster himself seems to have foreshadowed it. Still, in what seems a striking rehearsal for the future Christian drama, even the Saoshyant failed to arrive. How could the Zoroastrian millenarian belief survive such a disconfirmation?

Part of the answer must be sought in the fact that, unlike Christianity, Zoroastrianism for more than two thousand years did not have to live under heathen rule: in prehistoric times it grew and spread through a network of petty chieftainships, and then it became the official religion of a great empire. More fundamentally, however, a key factor to account for the difference was the purity laws. Early Christianity shed the Jewish purity code and rested its alienation from the surrounding pagan society entirely on the prohibition of idolatry and its moral implications, not on behavioral rules; hence, any apocalyptic expectation would have had to rely purely on faith. By contrast, Zoroastrianism translated the apocalyptic belief into a struggle between good and evil in which everyone was involved at all times and to which he or she was to contribute in every smallest way, and embedded this struggle in a strenuous system of observances shot through with purity regulations. This essentially turned eschatology into daily behavior for all believers, and correspondingly gave priests an enormous, indispensable role as overseers of daily life. This personal, all-embracing twist to apocalypticism was made even more compelling by the fact that Zoroastrianism, unlike Christianity, had no room for asceticism, monasticism, or self-chosen heightened piety: all men and women, led by their priests, were equally enlisted full-time.

This rooting of eschatology into daily behavior for normal times, without any set deadline, seems unique to Zoroastrianism, as other millenarian movements either fizzled out or normalized when the millennium failed to materialize (Ferrero, 2014a).[12] Indeed, this religion seems to have maintained not just orthodoxy but orthopraxis more or less unabridged and unreformed through its periods of rise and decline, down to modern times. This highlights a problem that underlies the now standard approach of the new economics of religion (Iyer, 2016), and at the same

[12] Manichaeism—perhaps the most important dualistic religion of later times, and itself an offshoot of Zoroastrianism mixed with Gnosticism—never normalized and became a very successful competitor of Christianity for a few centuries after its foundation in the 3rd century CE, but eventually died out under heavy persecution. Opposite to Zoroastrianism, however, it sought man's salvation in the rejection and ultimate destruction of the material world, not in its redemption, which must go some way toward explaining its demise.

time suggests a solution to it. Building on Iannaccone's (1992) seminal paper, this approach models a religious sect as a club whose members collectively produce a local, excludable public good, or club good. As all collective groups, religious clubs are plagued by free riding. To reduce free riding, sects impose costly sacrifices on members in the form of restrictions or prohibitions on behavior (diet, drink, dress, sex, social intercourse, deviant beliefs). The economic rationale for this is that of an efficient tax on externalities: instead of subsidizing participation, which is not easily observable, sects resort to taxation of secular consumption, reducing the value of outside activities. As a result, fewer people join but those who do supply more intense participation to everyone's benefit; hence the sacrifice is efficient, not irrational. This explains why today strict churches in a competitive religious market are strong and grow.

The effectiveness of these prohibitions, however, crucially depends on interaction with outsiders and so cannot be independent of the existence and strength of the competition. When the religion has expanded so much that it includes most of the relevant population and the competition is in disarray, alternative activities have little value and hence their sacrifice has little effect; that is, behavioral prohibitions are subject to diminishing returns to size. For example, drinking alcohol is typically a social activity, so a prohibition on drinking reduces the attractiveness of social intercourse with outsiders and enhances the value of activities inside the group. This makes sense in the USA, where the Mormons are a minority and secular activities compete for the members' time and effort; but in a society where nearly everybody is a Mormon the usefulness of prohibiting drinking sinks. This is a problem that the club model of the sect, as it stands, is not equipped to address. Zoroastrianism's unique wedding of apocalyptic belief and individual everyday behavior provides one way out of this problem: by tying one's prospect of salvation to one's own contribution to the daily battle of good and evil and not to everyone else's choice of behavior, it breaks out of the diminishing returns trap and enables this strenuous religion to survive enormous changes in its numbers unscathed.

To conclude, Zoroastrianism represents one of the three outcomes of the history of ancient Indo-European polytheism. One is extinction at the hands of monotheism, which was the fate of Greco-Roman religion and of the Celtic and Germanic branches of Indo-European religion—an extinction that included a part of genuine voluntary conversion and an overwhelming component of coercion, especially outside the Roman Empire; a second is mutation into a theistic sectarianism that underpins an essential monotheism, which was the fate of the Hindu branch of Indian religions; and the third is reform or transformation into a monotheistic faith out of the materials of former polytheism, which was the Iranian story.

What can account for these divergent outcomes? The different fate is not explained by temples to be tended by priests (like in the temple cities of the Semitic religions of the Near East) nor by state patronage. The Greeks had stone temples from the very beginning of recorded history and the Romans even more so, whereas in both India and Iran temples came very late.[13] As for state patronage, in Greece it

[13] In India the earliest surviving self-standing temples date to the middle of the first millennium CE, under the Gupta Empire in north India and the Pallava Empire in south India, while in Iran fire temples

was there from the beginning, typically at the level of city-states, while in India it came and went in the course of time, and in Iran it turned Zoroastrianism into a state religion when it was perhaps already 1,000 years old. Rather, theology and priesthood seem to be the keys. It seems that the original Indo-European pantheon tended to grow and gods to multiply, through specification and localization and/or through absorption of local deities, often in the aftermath of migration or territorial conquest. At least this is what the better-documented Greco-Roman and Hindu examples suggest. Such developments increased the jurisdictional overlap among the gods, and with it the costs and risks borne by supplicants and thus the inefficiency of the system. Therefore, there were welfare gains to be had from simplification and concentration of the pantheon, overcoming the overlap; but these steps required a human agent with the appropriate capacity and incentives. Indo-Iranian priests were a corporate professional body, unlike the Greek and Roman ones, and they had ancient scriptures, priestly schools, and hereditary transmission of learning, unlike the Celts and the Germans; so they had a vested interest in self-preservation and expansion. Setting about these tasks, they parted company: the Iranians overcame the overlap through divine hierarchy and ethics, the Indians by changing the pantheon and giving each of the major Hindu gods an encompassing jurisdiction. Expansion did follow: in Iran through the missionary work described in this paper, in India through the settlement of Brahmins in countries far beyond Hinduism's original homeland, including Nepal, Indonesia, Cambodia, and elsewhere in South Asia. The economic models offered in this paper, together with those developed by Ferrero and Tridimas (2018) and Basuchoudhary et al. (2020), suggest how both the success stories and the failures can be understood as outcomes of rational choices.

Appendix

With little loss of generality, we use quadratic average and marginal benefit functions and, to start with, linear average and marginal cost functions to derive easily comparable closed-form results. Let $TB = \alpha M^2 - \beta M^3$ (with α, $\beta > 0$) be the religious community's total benefits as a function of membership M. This yields average benefits per member:

$$AB = \alpha M - \beta M^2 \tag{1}$$

and marginal benefits:

$$MB = 2\alpha M - 3\beta M^2 \tag{2}$$

Function (1) has an interior maximum, which is found by equating (1) and (2) and yields the level of membership M_S:

Footnote 13 (continued)
and shrines to individual *yazatas* began only in the late Achaemenian Empire, probably under Artaxerxes II in the early 4th century BCE.

$$M_S = \alpha/2\beta \tag{3}$$

This is the standard solution of a producer cooperative that determines its membership so as to maximize benefits (or income) per member, and will be the solution that describes the equilibrium of our traditional religious community, which functions as a closed sect *S*. Note that this solution is not responsive to the availability of outsiders who might be willing to join the community to partake in the benefits (for a producer cooperative, the labor supply), for their admission would lower the existing members' average benefits.

This changes when the community undergoes the Zoroastrian reform and starts on a missionary expansion. Now the outsiders' average opportunity cost of joining (in production, the labor supply price or wage) becomes relevant. As a first step, this average cost is assumed increasing with every new recruit and is $AC = \gamma M$, $\gamma > 0$, for simplicity; the corresponding marginal cost is $MC = 2\gamma M$. The case of interest is when, at the starting equilibrium M_S, there are people whose cost of joining is lower than the current average benefit level, so they are willing to join. This implies that the *AC* curve crosses the *AB* curve in its decreasing region, which is ensured by the condition $\alpha > 2\gamma$, i.e. the slope of the marginal cost curve must be lower than the slope of the average benefits curve at its start ($dAB/dM_{M=0} = \alpha$).

As benchmarks, it is useful to compute two standard solutions. The first is the "competitive" solution *C*, which would be the solution of a community that maximizes *total* benefits net of the cost (in production, total profits) taking average cost (like a market wage) as parametric. This solution is found by equating *AC* to marginal benefits *MB* (Eq. 2) and yields membership M_C:

$$M_C = (2\alpha - \gamma)/3\beta \tag{4}$$

The second benchmark is the solution that maximizes total net benefits taking account of the community's market power vis-à-vis potential new members—in effect, the "monopsony" solution *M*. This is found by equating *MB* (Eq. 2) to marginal cost *MC* and yields membership M_M:

$$M_M = 2(\alpha - \gamma)/3\beta \tag{5}$$

M_M is greater than M_S, hence relevant here, only if the *MC* (not just the *AC*) curve crosses the *AB* curve in its decreasing region, which requires the more stringent condition $\alpha > 4\gamma$. On the other hand, $M_C > M_S$ requires only $\alpha > 2\gamma$. Obviously, as can be easily checked, $M_C > M_M$ in any case.

The condition for the missionary expansion to be both viable and acceptable to the traditional community is that the *total net* benefits brought in by the *new* members be strictly greater than the losses incurred by the *old* members from the lowering of their traditional benefits. If the former is greater than the latter, it allows for full compensation of the old members while still leaving a positive residual to finance the missionary expansion and/or to provide net after-tax benefits to the new members. At any membership level $M > M_S$, the difference between these two measures is:

$$(AB - AC)\left(M - M_S\right) - \left(AB_S - AB\right)M_S \tag{6}$$

where AB_S is found by substituting (3) into (1).

Calculation shows that (6) is greater than zero at both M_C and M_M. However, the community can do better than either. If we think of the community as seeking the maximum feasible expansion consistent with fully compensating the old members, this is tantamount to maximizing (6) with respect to M. Using the above expressions to substitute into (6), the FOC for a maximum is:

$$2(\alpha - \gamma)M - 3\beta M^2 + (\alpha\gamma)/(2\beta) = 0 \tag{7}$$

which can be rewritten as:

$$2\alpha M - 3\beta M^2 - 2\gamma M = -(\alpha\gamma)/(2\beta) = -\gamma M_S < 0 \tag{8}$$

or:

$$2\alpha M - 3\beta M^2 - \gamma M = \gamma M - (\alpha\gamma)/(2\beta) = \gamma\left(M - M_S\right) > 0 \tag{9}$$

The positive root of (7) yields the Zoroastrian solution M_Z:

$$M_Z = \left[2(\alpha - \gamma) + \sqrt{4(\alpha - \gamma)^2 + 6\alpha\gamma}\right]/6\beta \tag{10}$$

Direct comparison of (3), (4), (5), and (7) shows that if $\alpha > 2\gamma$, either $M_S < M_M < M_Z < M_C$ or $M_M < M_S < M_Z < M_C$, depending on whether $M_S < M_M$ or vice versa (i.e. whether also $\alpha > 4\gamma$ or not). Expressions (8) and (9) provide analytical proofs of these results. The LHS of (8) is $MB - MC$, which is equal to zero at M_M but negative here, proving that $M_Z > M_M$. The LHS of (9) is $MB - AC$, which is equal to zero at M_C but positive here, proving that $M_Z < M_C$.

It can be further shown that the Zoroastrian solution can be generalized to include an initial region of decreasing average cost of membership. Unfortunately, it did not prove possible to find a closed-form expression (or a useful characterization of the solution) with a general, U-shaped average cost function, so we use as illustration a total cost function $TC = k + \gamma M$ composed of a fixed cost k and a constant marginal cost γ. This yields the ever-decreasing average cost:

$$AC = k/M + \gamma \tag{11}$$

to be used with the same average and marginal benefits (Eqs. 1 and 2) as used above.

Of course a "competitive" solution is not meaningful with decreasing average cost, but the "monopsony" solution can be found in the same way as above by equating MB to MC. This yields a quadratic equation where one of the roots is ruled out by the second-order condition; hence, assuming the radical to be greater than zero, we get the unique solution:

$$M_M = \left(\alpha + \sqrt{\alpha^2 - 3\beta\gamma}\right)/3\beta \tag{12}$$

As should be obvious, M_M is greater than M_S (Eq. 3) if $\alpha^2/(4\beta) > \gamma$, i.e. the constant MC is lower than AB_S (average benefits at the sect equilibrium M_S).

To find the Zoroastrian solution, we again seek the level of M that maximizes expression (6) using (1), (3), and (11). The FOC is:

$$2\alpha M - 3\beta M^2 - (k\alpha)/\left(2\beta M^2\right) - \gamma = 0 \tag{13}$$

An explicit solution for M_Z cannot be found; however, analysis of the FOC and the second-order condition (not reported) shows that the optimal solution must be bounded from above and below as $\alpha/(3\beta) < M_Z < (2\alpha)/(3\beta)$. Recalling that $M_S = \alpha/2\beta$ (Eq. 3), the lower bound allows for the possibility that $M_Z < M_S$, which would turn expression (6) negative and make nonsense of the whole process. Clearly, it is the non-convexity in costs that creates the problem. We must therefore ensure that $M_Z > M_S$, which can be done by substituting M_S for M into the LHS of (13) and looking for conditions for it to be greater than zero. This will be the case if both (a) $AB_S > MC$, implying $M_M > M_S$ (see above), and further (b) the fixed cost k is low enough relative to the marginal cost γ.

Given $M_Z > M_S$, we may ask if still $M_Z > M_M$—a result that always obtains with increasing cost (see above). Applying again the procedure of substituting M_M for M into the LHS of (13) and checking its sign, it turns out that a positive sign may or may not obtain: $M_Z > M_M$ requires, among other things, a very low level of k. The fall of AC as membership expands does bring in a rapid increase in the total benefits generated by the new members but also a rapid fall in the old members' benefits and therefore a tightening of the compensation constraint which is embedded in the maximand (6); this countervailing effect works as a brake in the process of Zoroastrian mission relative to straightforward "profit" maximization.

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