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Economic behavior of indigenous peoples: the Mexican case

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Abstract Indigenous peoples have three features in common: their historical heritage, their current culture and their extreme poverty. This paper presents a hypothesis about the development of a cultural factor: indigenous people prefer to work on a small scale. This cultural factor developed during the colonial period and remains a part of current indigenous culture. To test the hypothesis, I elaborated a trade model and an economic growth model that take into account the cultural factor. As predicted, the results help to explain indigenous peoples' poverty. This article includes empirical evidence about Mexico's indigenous population.

Keywords Cultural trails · Tradition · Microeconomic behavior · Firm behavior · Trade · Economic growth

JEL Classification Z13 · D01 · F1 · O41

Abbreviations

EAP	Economically active population
ERI	Ethnolinguistic Replacement Index
INEGI	Instituto Nacional de Estadística y Geografía (National Institute of Statistics and Geography)
R&D	Research and development

1 Introduction

For the purposes of this article, indigenous people are defined as native or aboriginal people. In this regard, the first thing that is important to mention is that there is no

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widely accepted, or official, definition of indigenous peoples. Nonetheless, it is possible to identify certain characteristics in common among societies classed as indigenous, such as the following[1]: (a) they have a painful history of colonialism, which forced them to defend their land for a very long time; this struggle usually ended in the loss of their original possessions[2]; (b) they have constructed their own set of institutions and culture[3], which includes the tendency to prefer non-dominant social groups to hierarchical models; they developed a very strong attachment to their land as well as a preference for work in small family businesses or self-employment (especially in workshops or as land workers); and (c) in general, they have always been found among the lowest economic levels in their countries.[4]

Indigenous populations are widely considered to be "rural-based farmers engaging in small-scale production for subsistence and the market" (Radcliffe et al. 2008). Most indigenous peoples are primarily small-scale land workers, fishers, herders, hunters or gatherers in nearby forests (Lasimbang 2008). Others work in manufacturing, as weavers, carpenters or other skilled tradespeople. In fact, evidence indicates that indigenous individuals are more often self-employed than non-indigenous individuals.[5] Since indigenous people have worked on a small scale for centuries, they do not think about small-scale labor as a temporary trend or the result of some structural variable; small-scale work is part of their culture, as are communal resources, self-governance and the prevalence of non-dominant groups, to mention a few of the most important cultural characteristics.

As a subset of the indigenous world, native Mexicans have had a history of colonization, which has defined and shaped their current culture; this, in turn, strongly influences their economic behavior. In Mexico, according to language criteria, about 6 % of the population of 5 years of age or older are considered indigenous, or 6.3 million people. The communities with the highest number of inhabitants are the Nahuas (descendants of the Aztecs or Mexicas), the Mayas of the Yucatán Peninsula, the Tzeltal–Tzotzil or Mayas from Chiapas, and the Zapotecs and Mixtecs of Oaxaca, which together constitute just under 70 % of the indigenous

[1] For a complete description of the situation of indigenous peoples, country by country, see Hall and Patrinos (2006, 2010), and Patrinos and Skoufias (2007): for the United States, see Anderson and Parker (2009).

[2] For this topic, see Simons and Malmgren (2008).

[3] In fact, when researchers describe indigenous groups, they include both their historical experience and culture. For more information about this relationship, see Kingsbury (1998), Anderson et al. (2006), Peredo and Anderson (2006), Patrinos and Skoufias (2007).

[4] For a description of poverty in indigenous communities, see Cornell and Kalt (2000), Anderson and Parker (2009), Patrinos and Skoufias (2007), Psacharopoulos and Patrinos (1994), Hall and Patrinos (2006).

[5] Some studies that provide evidence for indigenous people being self-employed more often than non-indigenous people are: for Samoa, Chan (2008); for Vietnam, Hai-Anh (2010); for Bolivia, Jiménez Pozo et al. (2010); for Ethiopia, Getinet Astatike (2008); for Guatemala, Patrinos and Skoufias (2007). There are also many works on the economic situation of indigenous peoples of Canada, the United States, Australia and New Zealand; however, unemployment benefits and other concessions from governments have led to certain distortions to economic decisions. Furthermore, there is also a vast literature about ethnicity and self-employment, addressing cultural traits and constraints. The great majority of those studies, though, are about migrants in the United States, Canada and the United Kingdom, and/or they are about non-indigenous peoples, such as Latinos, Asians, etc.

population. The main economic activity for Mexican indigenous people is agriculture, which employs 45 % of the indigenous economically active population (EAP). In Mexico, the overall self-employment rate in the manufacturing sector is 16 %, but among the indigenous population it is 40 %. The manufacturing sectors with the highest self-employment rates among the indigenous population are textiles (68 %), furniture (51 %), clothing (42 %) and food (42 %). Finally, according to the Economic Marginalization Index, more than 50 % of indigenous municipalities[6] experience the highest degree of marginalization, and almost all (93 %) have at least a high degree marginalization, compared with 14 and 47 %, respectively, across the country. Needless to say, these groups are located in the poorest parts of Mexico.

This paper has two main goals. First, it presents a hypothesis regarding the development of a cultural factor that induces indigenous peoples to work on a small scale: indigenous peoples prefer workshop discipline (lack of hierarchy and work with little or no division of labor; for example, a craftsperson in a family workshop) to factory discipline (hierarchy and division of labor; for example, a worker on a production line). This is due to colonialism and other historical circumstances that indigenous peoples experienced. Second, the paper describes the effects of the aforementioned cultural factor on economic behavior, using a trade model and an economic growth model, the results of which help explain the current poverty of indigenous peoples. The paper includes empirical evidence about the indigenous Mexican population to support all arguments.

The article is, hence, structured as follows: after the introduction, I present a definition of culture and a description of the way to introduce cultural factors into the utility and production functions. Next, I demonstrate the hypothesis that the history of indigenous peoples is related to their current situation. In the following two sections, I develop models of trade and economic growth, and finally, I provide some brief conclusions.

2 Formal models of culture

It is uncommon to use formal models to analyze the relationship between culture and economics, the main reason being that the very concept of culture is ambiguous. Therefore, though I will initially use a widely accepted definition of culture, later on I will specify the cultural factor that interests us in a very precise form, so that the factor can be included in utility and production functions.

It can be said, as per Gelles and Levine (1995), that most definitions of culture have a common element: culture is *a set of factors shared by a society*, especially beliefs and values, as well as norms, traditions, symbols, language and technology. This definition has been used in several studies, as its broad meaning allows scholars to use their own criteria to determine shared factors, with beliefs and values being the most common.

Now, it is necessary to analyze and dissect the culture of the population under study to find specific patterns that affect economic behavior. For example, the

[6] Indigenous municipalities are defined as those in which at least 70 % of the population are indigenous.

influence of the "beliefs" factor on the labor supply is too general and difficult to research, as there are many beliefs; however, it is possible to analyze the effects of specific beliefs—such as the belief that *there is divine forgiveness in life*—on compliance with business agreements and contracts, as Blum and Dudley (2001) have done. In the case of our paper, the cultural factor is that *indigenous people prefer to work on a small scale, or indigenous people prefer workshop discipline to factory discipline*. This concept is specific enough to be included in a mathematical model. In this case, the utility function that I am going to use is the following:

$$u(\boldsymbol{x}, y, Z) \tag{1}$$

where $u(\cdot)$ is a continuous, monotonic and strictly quasiconcave utility function, $\boldsymbol{x}$ is a vector representing a bundle of goods and services, y is a cultural factor and Z is a number reflecting the intensity with which individuals adhere to the cultural factor, with $Z = 0$ meaning that the factor has no effect. The cultural factor y is a parameter, and it affects preferences for bundles of goods and services. The development of the cultural factor over time is explained in the next section.

3 Cultural factor: workshop discipline versus factory discipline

Before the Industrial Revolution in Great Britain, most people were employed in family workshops; in other words, they controlled their own pace, timing and behavior at work, and traditional family roles determined the division of labor. During and after the Industrial Revolution, factories paved the way for radical change, enabling employers to dictate how and when work was to be done (Clark 1994). The introduction of factories led to numerous cultural changes, including variations in family roles and also some family traditions (Hareven 1991; Smelser 1959; Weisdorf 2006), as well as changes in the way people worked, such as schedules and hierarchies. The tasks assigned to individuals could be very specific, so factories could take advantage of economies of scale.

Factory discipline is essential to the economy. Nevertheless, the change from workshop discipline to factory discipline has had a social cost, as it has led to changes in family roles, the loss of some traditions, and fixed schedules and hierarchies. For example, during the Industrial Revolution in Britain, there was a stir of public resentment about labor conditions. Parliamentary reform and the new economic structure brought about an increase in destruction of property and strikes. Today, however, most British workers (both white and blue collar) accept factory discipline and have forgotten many of the traditions that their ancestors followed when working in family workshops.

But indigenous communities have not gone through this cultural change. Rather, they have undergone other cultural changes that are reflected in their current economic behavior. Indigenous peoples experienced a long period of attacks by other societies, both indigenous and non-indigenous, who invaded their communities and took away most of their land; in some cases, they were forced to live a lifestyle that was wholly in conflict with their customs. Unlike landless Brits at the

time of the Industrial Revolution, who had the opportunity to adapt to the new situation, indigenous communities had no choice but to produce large amounts of public goods for a long period (to provide defense against attacks, to support passive opposition, etc.), and they had to use certain strategies that eventually became part of their culture.

There are several theories about the relationship between culture and the economic behavior of indigenous peoples (see Cancian 1989; Carrier 2005; Patrinos and Skoufias 2007; Wilk 1996). However, I am mainly interested in egalitarian norms. Egalitarian norms are all social beliefs, social values, traditions or rules (culture) aimed at reducing economic differences between the families in a community. According to Platteau (2000, 2009), egalitarian norms developed for three reasons: first, these kinds of rules were efficient in nomadic or agricultural societies with no land scarcity; second, they were needed to deal with risk collectively; and, finally, they supported the strong belief that human beings are part of nature.

In the next section, I will describe the process by which Mexican indigenous societies, who have shared a history of colonization, developed defensive strategies through the production of public goods, and how these strategies, over time, became part of their culture. This process is common to all indigenous communities.

3.1 Hypotheses on the development of egalitarian norms in the case of the Mexican indigenous population

The economic history of the largest surviving indigenous communities in Mexico, which are those considered in this paper, can be broadly summarized in terms of two phenomena. The first is the transition from a centrally planned economy with some economic specialization in the pre-Hispanic period (Carrasco 1977; Gibson 1964; Soustelle 1962) to a homogeneous economy without economic specialization in the Colonial period. The second is the presence in both the pre-Hispanic and Colonial periods of an economy whose objective was not economic growth through specialization, but rather the defense of territory and the reduction of an excessive tax burden. As such, indigenous peoples incorporated defensive strategies, such as a homogenous economy, into their culture. This led to economic stagnation, which appears to have begun during the Colonial period and continues to the present.

3.1.1 Brief history of indigenous communities

The following description[7] is about the central region of Mexico, in particular the Mexica (also known as Aztec) economy. Further on, we address the other communities analyzed in this article.

[7] For this and the subsequent sections, I use the following bibliography for each community: Acosta Márquez (2007), Báez (2004), Barrientos López (2004), Carreón Flores (2007), Coronel Ortiz (2006), Esperanza (2007), Flores López (2006), Gallardo Arias (2004), García and Martínez Sánchez (2007), Gómez Muñoz (2004), (Luna Ruiz 2007a, b), Mendoza et al. (2006), Mindek (2003), Monzoy Gutierrez (2006), Moreno et al. (2006), Obregón Rodríguez (2003), Questa and Utrilla (2006), Ruiz (2006), Valle Esquivel and Hernández Alvarado (2006), Valle Esquivel (2003) and Wacher Rodarte (2006).

In the pre-Hispanic period, the Mexica economy revolved around the government, which controlled the resources (land and work) and determined a significant amount of production and distribution of wealth (Carrasco 1977). There was commercial exchange within urban centers, in public markets, as well as wholesale trade between cities. Government income was based on tributes payed by the Mexica lay people and peoples under Mexica occupation. Indigenous lords or caciques[8], the nobility that governed the occupied peoples with the support of the central government, collected the tributes. Furthermore, government funds were used to provide for the king, his court, his relatives and the caciques, and to build temples and other public buildings.

As such, economic specialization already existed. People worked in tax collection, government, production and distribution (Carrasco 1977). Economic specialization was concentrated in urban centers, near the palaces and markets, where there were carpenters, masons, tanners, potters and so forth, some with their own guilds (Soustelle 1962). There was far-reaching trade with people specialized in wholesaling, who traveled great distances in caravans. Over time, this trade led some communities to specialize in the production of certain articles (Hardoy 1999). In sum, there were specialists and clients for their products—and not just within the empire—, and there was a constant supply of basic goods and products, as well as a market network that continuously ordered these elements (Martinez Veiga 1990).

However, this was not the case in rural areas or small towns, where most people lived, many of them subjugated. They had to pay heavy tribute, so there were no incentives for economic efficiency. In these cases, division of labor only occurred within the family, based on age and gender.

In the pre-Hispanic period, the economic situation of the other indigenous peoples was varied. There is abundant evidence that the Mayas were a developed people who engaged in economic specialization, as the multiple ruins of their empire suggest. The Mixtecs and especially the Zapotecs (Oaxaca) had large-scale trade, division of labor and economic specialization. However, in general, the other peoples were less advanced. There is no indication of significant economic development among the Chol, Tzeltal or Tzotzil peoples; rather, they were backward communities. Evidence points to a lack of economic specialization among the Mazahua and Otomi peoples. For their part, the Purépechas had little economic development, with the exception of certain urban regions.

Despite their differences, all the indigenous communities wound up being subjugated by the Spanish. Subjugation was due to war, alliances and betrayals, epidemics or a combination of the two. In the end, despite differences in the ways they were conquered, all the communities can be said to share the same story of abuse.

For their part, the Mazahua and Otomi peoples had been conquered by the Mexicas and paid them tribute. In fact, these communities helped the Spanish to defeat the Mexicas, to then be subjugated by the Spanish. The Mixtecs and Zapotecs received the Spanish very positively, but after a series of battles and violent revolts,

[8] A cacique is a person who exercises abusive power over a community or group. The word was initially used to refer to Caribbean chieftains, and this use was then extended to Mexico and Central America.

they ended up subjugated. The Chol, Tzeltal and Tzotzil peoples faced their conquerors with great violence. However, after several revolts, these peoples were also subjugated, although they continued to rebel afterwards, without success. Despite their advances, the conquest of the Mayan people was relatively simple, as in this period Mayan civilization was already decimated. Lastly, the Purépechas were never defeated in the pre-Hispanic era, as Purépecha communities were designed for efficient defense against attacks. However, they were conquered by the Spanish after the Mexicas were.

During the colonial period, which lasted from the sixteenth century until the beginning of the nineteenth century, urban centers were established in different parts of modern-day Mexico. Some of these were located on the sites of ancient indigenous settlements, while other were new, founded near mines or to ease trade. In these urban centers, the economy depended on craftspeople, who erected buildings and public works; in other words, economic specialization continued. However, it is important to mention that in general, Spain's strategy for its colonies was to prohibit or at least hinder the production of consumer goods, to stimulate industry on the Iberian Peninsula and to monopolize trade, which reduced the incentives toward greater economic specialization (García Martínez 1977). Nevertheless, little by little the populations of these cities increased, in large part due to settlement by indigenous people from the countryside. Together, natives, Spaniards, criollos, mestizos and other inhabitants formed a new colonial society and, later on, urban Mexican society.

However, the history of indigenous communities in rural areas was dissimilar. The main form of production during the beginning of the colonial period was the *encomiendas*, in which entire groups of indigenous people were appropriated to privileged conquistadors, called *encomenderos*, who had the right to demand tribute and labor from these indigenous people (Gibson 1964). The collection of tributes in the encomiendas followed the same pattern as in the pre-Hispanic period, using caciques and bureaucracy, which led to the functional collection structure in New Spain being practically identical to that which had existed in the pre-Hispanic era (García Martínez 1977).

The Spanish Crown appointed several changes, to reduce abuse of indigenous people. Among these changes, the Crown modified personal services, which were controlled by functionaries, and each town came to an agreement about provision of services (García Martínez 1977). The form of rural government also changed, with the introduction of the so-called Republics of Indians. This led to greater independence of indigenous communities and to their administration paralleling that of Castilian communities (García Martínez 1977). Also, the Crown recognized indigenous peoples as vassals of the king, so that they now had obligations and rights, such as the right to a justice system.

Over time, the encomiendas began to change into agricultural and ranching businesses. When new businesses formed or existing ones expanded, they demanded land, including that owned by indigenous peoples. In addition, as population increased, there were more mestizos, Spaniards and criollos, who preferred to live on small plantations; thus, demand for land grew even more. The more open system

of justice and the increased demand for land were the key factors in determining the development of many indigenous communities.

The development of indigenous communities was varied. Some had economic success, adapting to the new forms of production and changing their lifestyles, until they were completely integrated and lost their identity as indigenous peoples (García Martínez 1977). Epidemics practically eliminated some communities, leaving very few survivors to integrate themselves into other groups. There was also widespread migration of indigenous people from their communities to other areas, mainly in search of opportunities in haciendas, mines, cities or the new companies in the north; however, some people migrated to avoid the ever greater obligations demanded of indigenous communities (García Martínez 1977; Ruiz 1997), which I explain later on.

However, indigenous communities mainly focused on defending their rights, like the nullification of personal services, tax reduction, autonomy and, especially, defense of their lands in light of growing demand. To do so they adopted different strategies, mainly using the legal system. Ruiz Medrano (2010) has conducted a broad study of the legal strategies used by indigenous communities, from the Colonial era to the present. In general terms, these communities initially relied extensively on intermediaries (missionaries, royal functionaries, lawyers, interpreters and mixed-race individuals) for representation. However, indigenous people gradually learned to understand the legal system and demanded that their customs and practices be respected[9], which they achieved.

Communities adopted a communal defense strategy to pool resources and be recognized as a group with legitimate practices and customs. However, for this strategy to succeed and for communities to retain their lands, communities needed to facilitate and democratize internal decisions, and to minimize the success of tactics used by their opponents in trials, which essentially meant bribing or coming to terms with the caciques and lords (Lira and Muro 1977). Facilitating and democratizing decision making, as well as minimizing internal treachery, were clear incentives for communities to begin to change their internal organization. Lords and caciques disappeared, and communities began to work collectively, including in economic terms. Some characteristics of communities at this time were that they had communal savings chests and no longer had to provide personal services, though they payed the crown a tribute of a percentage of their community's production. Little by little indigenous peoples began to work independently and communally (p. 290).

The situation described in the above paragraphs first presented itself in the central region, where the Mexicas, Mazahuas and Otomies lived. Later on, with some local variations, indigenous communities in the Yucatán Peninsula, Oaxaca, Chiapas and the other places also decided to defend their rights. In fact, indigenous communities became, in the words of García Martínez (1977), experts at disputes, both legal and

[9] At this point, it is important to note the possibility that indigenous communities made their legal strategies into traditions. This has occurred in other communities, which invented traditions in reaction to different situations. See Hobsbawm and Ranger (1992).

extralegal, which sometimes even led to violence; according to Viceroy Enríquez, disputes were the main weapon of indigenous communities.

The new form of internal organization in indigenous communities included a *sui generis* system of government. This system of government has been widely studied by historians and anthropologists, who have not been able to agree if it was developed internally or imposed on communities. This is known as the *cargo* or *mayordomía system*. However, as we will see later on, this elaborate system was complemented by others, among which the tendency toward lack of economic specialization is especially notable.

In simplified terms, the cargo system, which still exists, is a scheme that requires certain members of a community (generally men) to meet regularly (usually once a year) to perform various functions, such as serving as judges, representatives, coordinators or other officials. These functions are usually religious, but they can also be administrative, economic and legal. Posts are generally prestigious but unpaid, so that individuals have a positive incentive to hold them (being part of the hierarchy and fulfilling a duty), as well as a strong negative incentive (lack of pay). There has been intense debate over the origins and purpose of this system[10], since in addition to being a hierarchical system with counterincentives toward service, it could also be a leveler of income, if communities select the members with the greatest income, so that at the end of the period they have less income and are on par with everyone else. The system first arose in the Center, and then spread to Michoacán, Oaxaca and finally Chiapas (Chance and Taylor 1985).

On the other hand, the indigenous economic system has not been widely studied. However, we can suppose that economic organization was contingent on achieving the main goal, the defense of autonomy—the defense the land and freedom from taxes, personal services and other impositions. This led labor to be organized in a way similar to how government was, in cooperatives for working the land, with changing authority, avoidance of a specialized economy, use of traditional technology (Gonzalez 1996) and a homogenization of internal production of goods. I will analyze this further on.

After Independence, toward the middle of the nineteenth century, the new liberal governments in power tried to promote legal equality and economic growth. To promote legal equality, they set up municipalities, so that everyone living in an area (natives, criollos, Spaniards, etc.) would have the same local government. To foment economic growth, they encouraged indigenous communities to adopt private property and expropriate unused land, including communal land (Bailon 1999).

The internal structure of indigenous communities proved to be very flexible. Communities were able to mobilize the people (Reina 1996, 2009), change their names or join a municipality to retain autonomy (Gonzalez 1996). Because these strategies were adaptable, even though policies were different in liberal Mexico and conservative Guatemala, indigenous communities in both countries were able to defend their rights and retain their autonomy.

The demand for indigenous lands began to grow again when the liberals left power and the conservative period began. The haciendas, which were supported by

[10] For a summary of the debate, see: Chance and Taylor (1985).

the government, were now demanding land, and entire indigenous communities sometimes lived within a hacienda. However, communities continued to defend their rights assiduously. According to Ruiz (1997), one of their strategies was to agree to work on the hacienda, but to organize themselves communally as before.

After the Revolution, agrarian reform expropriated land from the owners of the haciendas and divided it among the laborers. This led to the creation of the *ejidos*, which were communal lands owned by the state but to which the peasants had right of usufruct. Evidently, indigenous communities once again used codices and written accounts as strategies to recover their lands, with great success. The distribution of land began during the Revolution and continued until the 1970s. Also, communities have been able to adapt to different governments, making agreements that enable them to remain autonomous.

In 1994, the Zapatista Revolution began in the South of Mexico (in the state of Chiapas). It is interesting to note that some of the communal negotiation strategies that indigenous communities used in nineteenth century were similar to those used in negotiations toward the end of the twentieth century, in particular, that important decisions needed to be discussed internally.

3.1.2 The production of public goods

As can be seen in the previous section, the history of indigenous communities has been varied, but many communities have worked to defend their rights to their lands and reduce tax burdens, in addition to defending their lifestyles, especially in the nineteenth century. Communal defense is a public good; the more members of a community participate, and the more efficiently they do so, the more effective communal defense will be, and all members can enjoy it equally. Obviously, the production of this type of goods is problematic, because of decision-making costs (everyone must participate in production to enjoy the good, so it is essential to decide what resources the use, when, how, etc.), organizational costs (assigning and coordinating responsibilities) and supervisory costs (as they are clear incentives to reduce participation in production, since consumption is the same for all). However, it is widely known that the market solution (to let the market solve the provision of defense) is inefficient.

Nevertheless, there is a positive association between ethnic homogeneity or egalitarian communities and the provision of public goods (Habyarimana et al. 2007). This is because, from a theoretical standpoint and in the case of the egalitarian community, is more likely that all members of the community know the optimum roles of all community members (Pareto optimality), so theoretical solutions are easy to implement. For example, according to Salanié (2000), the vote is effective when the marginal rate of substitution for the representative agent is equal to the average of the marginal rates of substitution for all agents, which is the case when we have perfect economic equality. In the cases of the Lindahl's equilibrium taxes and the Groves mechanism (Luenberger 1995), the problem is information, since the participants have incentives to falsify information. In this sense, some papers have analyzed the problems that cooperatives face when they need to make decisions (MacLeod 2013; Dow and Putterman 2000). In fact, several

experiments confirm that the more homogeneous the community, the easier it is to produce public goods (Fehr and Gächter 2000; Reuben and Riedl 2013).

3.1.3 Egalitarian norms in Mexican indigenous communities

To reduce the costs of internal decision making, as well as to assign, coordinate and supervise defense tasks, indigenous communities created and/or adapted a series of strategies. The most widely known (and the most visible) is, of course, the cargo system, which was explained in the previous section and has been studied by a numbers of historians and anthropologists.[11] According to Greenberg (1981), who has performed in situ anthropological work, there can be no doubt that the cargo system is a norm that levels income, in particular, as Chance and Taylor (1985) note, when the financing of religious celebrations is considered. However, there are different points of view concerning the origin of the cargo system; there is doubt if it was developed by indigenous communities as an internal strategy, or if it was imposed upon communities from the outside by the Church or the owners of the haciendas.[12] Also, the cargo system has been complemented by a structure of familial and non-familial relationships—the latter due to religious bonds[13]—that implies a more intense type of cooperation than simple relationships between community members.

A system of government with these characteristics cannot be separate from the economic system. In particular, it would be ill advised to try to combine a government based on the cargo system with a system of economic freedom. A society cannot combine a system of government that tries to avoid economic, social and political inequality and encourages the use of temporary hierarchies, with a system of production and distribution that includes incentives toward economic inequality and medium- and long-term hierarchies.

It is possible to conceive a way to achieve economic efficiency and at the same time reduce the costs of decision making and supervision. Certainly, between the sixteenth century and the middle of the twentieth century, indigenous communities attempted to find a way several times, but there is no record of any community having succeeded. On this topic, historians have only described the form of work in indigenous towns as communal for agricultural production, and as family enterprises for the manufacture of goods. They have also described certain norms, like the *faena* (a system for exchanging work instead of money), for assisting neighbors and building public works. In sum, in different places and at different times, Mexican and Mesoamerican indigenous communities developed egalitarian norms to minimize the problems of collective decision making and organization, and to make the production of public goods more efficient, especially in terms of obtaining resources and producing strategies for legal defense of their lands.

[11] See a survey in: Chambers and Young (1979) and Chance and Taylor (1985).

[12] This debate among anthropologists may have been influenced by the substantivist and rationalist schools of anthropological theory.

[13] For this topic, see Bloch and Guggenheim (1981), Coy (1974), Sanders and Nee (1996). For the actual papers about kinship, see Hoff and Sen (2005) and Hoff and Pandey (2004).

A literature search[14] revealed all the indigenous communities considered in this paper:

- Use the cargo system, including those that are municipal seats, where they combine civil service with traditional offices; however, in some groups, community members who have emigrated and work outside the community finance religious ceremonies, though concrete data are not available.
- Produce agricultural goods communally, or at least appear to do so, using a system of ejidos or communal lands, with a rotating hierarchy (a practice that overlaps with the cargo system in some cases).
- Produce manufactures that do not require economic specialization, like crafts, in family businesses. The literature only revealed one case of some economic specialization, in a Mayan textile community in the state of Quintana Roo, where the most experienced women perform the most difficult embroidery. There is also evidence of cooperatives to foment trade, or production cooperatives, but members usually only share a space and do not take advantage of economies of scale.

As we can see in the previous section, the history of indigenous communities has been varied. Nevertheless, the evidence indicates that the communities that have survived to this day are those that have dedicated themselves to the defense of their lands and the reduction of tax burdens, as well as the defense of their lifestyle beginning in the nineteenth century, and that adopted egalitarian norms (communal land, cargo system of government and small-scale craft production). This does not mean that all communities that adopted these norms have survived, but rather that those that survived all follow these norms as a part of their daily life.

However, these days, the goal of egalitarian norms is no longer clear. On the contrary, indigenous communities currently demand that they be allowed to follow their customs and practices, which are precisely egalitarian norms. Thus, everything seems to indicate that these norms are now a part of indigenous culture. The repetition of a strategy used over several generations can become a part of culture—through beliefs, values and institutions—and, ultimately, also a part of the utility function.[15] This idea is reinforced by two points: first, indigenous communities have a very strong link to the past, because they are gerontocratic or pre-figurative societies (as defined by Margaret Mead 1972), and older generations tend to be resistant to change; second, the strategy has been incorporated into traditions, customs, taboos and/or myths (as in the case of religious traditions), which also makes cultural changes more complicated. Egalitarian norms are complemented by other customs, such as the cargo system in Mexico or the big-man system, present in some Asian indigenous communities (Sahlinis and Marshall 1963). Both systems

[14] See endnote 1.

[15] For example, Hobsbawm and Ranger (1992) analyze the relationship between strategy and tradition. For transmission of culture, see Bisin and Verdier (2000, 2001). For cultural tradition and collective memory, see Dessí (2008).

avoid personal privilege, and the emergence of a power group is less likely, whereas there is a widespread reliance on kinship systems (Mesoamerica and Africa).[16]

If a style of work, such as working on a small scale with no economic specialization outside of the family, is integrated into beliefs and traditions, then it becomes a part of the culture, a factor shared by the community. It is in this sense that I argue that indigenous communities have a social preference for working on a small scale, using workshop discipline, without economic specialization.

Even though communal ownership of resources could imply some lack of efficiency, it also ensures equality, since the community controls resources. There is much literature about communal resources, especially since Hardin published his paper "The Tragedy of the Commons" in 1968. Nonetheless, the cultural factor of *preference for work on a small scale* could also imply a lack of hierarchy and, consequently, the absence of economic specialization, with traditional technologies and the inability of the community to build large factories. In other words, people prefer workshop discipline to factory discipline. For this paper, I take discipline to mean behavior in accordance with standards of conduct; thus, factory discipline is complying with hierarchies, rigid schedules, division of labor and so forth, while workshop discipline is understood as the absence of predefined conditions. Factory discipline applies to work in industrial plants, production lines and mass production, while workshop discipline applies to individual work, family work and work in small groups. It is worth noting that this definition of discipline is independent of the intensity or duration of work. The Cultural Factor promotes the development of family businesses and/or self-employment. Henceforth, in the rest of paper, the Cultural Factor, work on a small scale and workshop discipline will be used as synonyms.

The next section presents evidence about the persistence of the Cultural Factor in indigenous communities in Mexico. Section 4 discusses the effects of the Cultural Factor on economic behavior and material welfare in terms of trade, and Sect. 5 discusses these effects in terms of economic growth.

3.2 Empirical evidence for egalitarian norms in Mexico today

Since self-employment enables workshop discipline, I have used self-employment as an indication of the Cultural Factor, i.e., as the empirical proxy of the Cultural Factor. One or more unpaid helpers, usually relatives, may perhaps assist self-employed individuals. The complement of this concept is factory discipline or work on a large scale, which is defined as any work involving no family hierarchies. It is important to note here that the term *factory discipline* should not be understood as a military-style discipline, but rather only as a style of work where hierarchy is not determined by family structure; instead, structures are developed to complete specialized work, as in the case of office work (public or private), factory work and so forth.

[16] For this topic, see Bloch and Guggenheim (1981), Coy (1974), Sanders and Nee (1996). For the actual papers about kinship, see Hoff and Sen (2005) and Hoff and Pandey (2004).

The data I used in this and other empirical analyses were taken from the General Census of Population and Housing, carried out by the Instituto Nacional de Estadística, Geografía e Informática (INEGI, National Institute of Statistics and Geography) in 2010. The questionnaire applied by the interviewers included information relevant to our study, namely the type of work that individuals perform and if individuals belong to an indigenous group.

To determine if a person works on a small scale or not, I used a specific census question, in which the people surveyed had to define themselves as self-employed or unpaid helpers (workshop discipline), versus employees, day laborers (*jornaleros*), employers or paid helpers (factory discipline). On the other hand, individuals are defined as indigenous if they reported that they speak an indigenous language.[17]

Table 1 shows the main activities of the EAP in Mexico, in accordance with the criteria of the type of work that I just defined. Total work on a small scale is the sum of columns (1) to (4), where column (1) refers to land work, which includes the case of subsistence agriculture.[18] Column (5) indicates the percentage of the EAP working as employees, land workers, employers or paid helpers. It is important to note that, for Mexico as a whole, the percentage of work on a small scale is 28.6 %, with 24.7 % corresponding to self-employment and the rest corresponding to unpaid work; work outside of the family hierarchy comprises the other 71.4 %. Because 80.1 % of the indigenous communities are located in rural areas (communities of up to 15,000 inhabitants), I have also included the data for these areas. The percentage of self-employed workers and unpaid helpers is 31.1 % overall in rural areas, versus 58.7 % for indigenous communities located in rural areas.

To analyze the possible existence of the Cultural Factor within indigenous communities, I performed two empirical analyses. Both of the analyses compare the type of work in indigenous communities with that in non-indigenous populations.

3.2.1 Contrasts in self-employment rates

Our first approach to knowing whether or not the Cultural Factor affects the behavior of indigenous communities was extra-economic. I simply contrasted the rates of self-employment and unpaid help in indigenous and non-indigenous populations under similar economic conditions. The similarity of economic condition is very important, because economic conditions may affect the decision to become self-employed, or vice versa. The control group was made up of all families that live in rural areas of the six states with the largest percentages of indigenous inhabitants: Campeche, Chiapas, Quintana Roo, Oaxaca, Guerrero and Yucatán. Individuals in these communities are not involved in banking activities and, therefore, they are unaffected by liquidity restrictions and the price of bank loans. Furthermore, both indigenous and non-indigenous groups deal with similar

[17] The census also records self-ascription, that is, if a person is self-defined as indigenous. These data were not used in this work.

[18] Subsistence agriculture is understood in this paper as the production of corn and beans, two basic elements of the Mexican diet that are also a mainstay of the indigenous diet. Producing corn and beans on a small scale is not economically profitable, but it is a survival strategy in cases of extreme poverty; basically, the family consumes the products and the surplus is sold in local markets.

Table 1 Types of economic activities in Mexico (%)

	Small scale					Non small scale
	Agriculture		Manufacturing crafts	Trade	Other	
	Total	Subsistence agriculture				
	(1)		(2)	(3)	(4)	(5)
Total	7.1	3.1	13.6	5.9	2.0	71.4
Rural	15.6	6.0	10.3	3.9	1.3	68.9
Indigenous	45.1	30.2	10.2	2.5	0.9	41.3

Source: INEGI 2010

Table 2 Self-employment rate

	Mean	95 % interval	
Agriculture, manufacturing and trade			
Indigenous	0.5236	0.5226	0.5245
Non-indigenous	0.3665	0.3657	0.3672
Manufacturing			
Indigenous	0.5875	0.5839	0.5911
Non-indigenous	0.3417	0.3390	0.444

According to the statistical test, the means are statistically different

Source: INEGI 2010

aggregate variables (unemployment, price levels, etc.). Finally, only bilingual (Spanish and dialect speakers) indigenous individuals were chosen to avoid any influence that language discrimination may have.

In the rural areas of the six aforementioned states, the percentage of the non-indigenous EAP defined as self-employed or as unpaid helpers is 36.7 %, which is statistically lower than the indigenous rate of 52.4 %. The same contrast is present in the manufacturing sector (see Table 2).

3.2.2 Analysis of factors that determine self-employment

A second approach is to analyze the factors affecting self-employment, and examine when and under what circumstances indigenous ethnicity is one of these factors. This analysis does not include unpaid helpers, since other family members usually influence (affect) their decision-making process.

The literature on the factors that determine self-employment[19] considers the basic characteristics of the individual (such as gender, marital status, age, education, etc.), variables in the individual's immediate environment (such as access to financial aid

[19] For a complete summary, see Georgellis et al. (2005) and Parker (2004).

and liquidity constrains) and aggregated variables (such as the country's unemployment rate and degree of development).

It is important to mention that there is broad evidence of major differences in the self-employment rate based on ethnicity. Studies usually analyze the topic from two standpoints: cultural differences and structural factors. Studies about cultural difference mainly address religious characteristics, social skills (Clark et al. 1998), business skills (Lucas 1978), community risk aversion (Kihlstrom and Laffont 1979) and human capital (Nee and Sanders 1996). The structural factors studied include social networks (Masurel et al. 2002; Light et al. 2000), ethnic enclaves (Parker 2004), discrimination when hiring persons from a given ethnic group (Moore 1983), discrimination relating to consumption of goods produced or sold by another ethnic group (Borjas et al. 1989), the local capital market (Blanchflower and Oswald 1998) and strategies against discrimination, among others.

Further, a new trend in the topic has developed, indicating that self-employment leads to greater utility than being an employee (Benz and Frey 2003, 2006; Blanchflower and Oswald 1998). According to the authors, this is because of the satisfaction individuals experience due to flexible working schedules, autonomy and lack of hierarchy.

The analysis presented below combines the idea that cultural differences are a factor in self-employment with the idea that self-employment provides greater utility than being an employee does. The reason is that we are assuming that the Cultural Factor, which is a cultural bias toward self-employment, is an argument in the utility function.

I performed four Logit regressions to verify if Mexican indigenous people have an extra-economic tendency toward self-employment. In these regressions, the dependent variable is a dummy that identifies self-employment status (1 for self-employment, 0 for the other case). The independent variables are divided into the following: personal information (age, marital status, number of children and educational levels); close environment variables (size of the locality); variables that reflect the economic sector and a variable that indicates the ethnic status (1 if speak indigenous language, that is, if person is indigenous, 0 for the other case). As I explained in Sect. 3.2, the data correspond to the 2010 Census in Mexico. The results are presented in Table 3. Note that the data prove the hypothesis, given the statistical significance and positive correlation of ethnic status.

Moreover, the table includes regressions for the total EAP and the population working in the secondary (or manufacturing) sector. I have included data on the secondary sector because models introduced later on (about trade and economic growth) use the concept of economies of scale. The degree of economies of scale in the agricultural sector, in which the vast majority of indigenous people is employed, is unclear; that is, it is difficult to distinguish between agricultural products with and without economies of scale. However, in the manufacturing sector, products with low or no economies of scale are crafts, and, as I a saw in the previous section, these are the manufactures produced by indigenous communities.

The first and third columns of Table 3 show the results of two regressions, one containing people working in all sectors (agricultural, manufacturing and commercial), and the other including only those who work in the secondary sector. The

Table 3 Language and preference for self-employment

	Self-employed with no hired workers				Self-employed with hired workers
	Total		Secondary sector		Total
	Total sample	Rural sample, 6 States	Total sample	Rural sample, 6 States	Total sample
Observed mean	0.223	0.425	0.132	0.433	0.029
Results of Logit regressions[a]					
Estimated mean[b]	0.200	0.370	0.100	0.547	0.017
Personal information					
Age	0.006*	0.008*	0.006*	0.127*	0.001*
Age^2	0.000*	0.000*	0.000*	0.009*	0.000*
Married	0.025*	0.032*	0.019*	0.023*	0.005*
Unmarried	−0.045*	−0.068*	−0.030*	−0.052*	−0.008
Number of children	0.001*	0.004*	0.001*	0.005*	0.000*
Literacy	0.038*	0.056*	0.038*	0.127*	−0.009*
No education	0.176*	0.453*	0.006*	0.234*	−0.013*
Pre-school	0.142*	0.472*	0.023*	0.245*	−0.021*
Elementary school	0.163*	0.479*	−0.005*	0.265*	−0.009*
Middle school	0.128*	0.402*	−0.023*	0.134*	−0.006*
High school	0.083*	0.268*	0.001	0.043	0.002*
Teaching degree[c]	−0.173*	−0.233*	−0.049*	0.147	−0.014*
Ethnic status	0.083*	0.043*	0.144*	0.217*	−0.006*
Environment					
Semirural communities	0.004*	–	−0.015*	–	0.003*
Small cities	−0.016*	–	−0.043*	–	0.005*
Medium and large cities	−0.043*	–	−0.098*	–	0.001*

Table 3 continued

	Self-employed with no hired workers				Self-employed with hired workers
	Total		Secondary sector		Total
	Total sample	Rural sample, 6 States	Total sample	Rural sample, 6 States	Total sample
Economic Sector					
Second sector	−0.103*	0.184*	–	–	−0.001*
First sector	−0.127*	−0.032*	–	–	0.000
Number of observations	3,662,999	886,966	477,242	70,786	3,662,999
R^2 (Nagelkerke)	0.12	0.25	0.24	0.22	0.04

Source: The table was created with data from INEGI 2010

* Indicates that the parameter is 95 % significant

[a] The values are the marginal effects with respect to estimated mean or response probability when the characteristic applies

[b] The estimated mean or probability of the answer is the calculation of the mean using the estimated parameters from the Logit regression (see Scott Long 1997 and Wooldrige 2002), in which $\mu = \left(e^{g(\bar{x})}/1 + e^{g(\bar{x})}\right)$, with $g(\bar{x}) = \sum_i \widehat{\beta}_i \bar{x}_i$

[c] In Mexico, to be able to teach in a public school, a specific post-secondary teaching is required. This degree is in lieu of an undergraduate degree

results show that the variables representing personal characteristics are all significant, as are those variables related to a person's immediate environment and those associated with each sector. The variable related to ethnicity has positive values and is statistically significant.

To ensure that comparisons were made between people in similar environments, as well as to avoid endogeneity problems and to control unseen variables (mainly survival strategies), and given that the economies of indigenous communities have a high degree of marginalization, I included a control group restricted to individuals (indigenous or not) who live in similar conditions. The control group is similar to that for the first empirical analysis, as it is made up of individuals that live in rural areas of the six states with largest percentage of indigenous inhabitants. The results are similar for the total sample and the control group.

Finally, the last column shows the results of a regression where the dependent variable is comprised of people who hire workers (i.e., they are entrepreneurs). In this case, the correlation with indigenous ethnicity is negative, which is the expected sign given the Cultural Factor.

To identify the influence of the Cultural Factor for each indigenous community, Table 4 disaggregates the results for the five regressions presented in Table 3 for the 16 main indigenous communities in Mexico. All the regressions contain a dummy variable for each community (1 if a person speaks an indigenous language, 0 for the other case). Table 4 only presents the results corresponding to the analyzed communities. The results for the other variables (personal information, immediate environment and economic sector) are not included, since they are very similar to those reported in Table 3. Also, the penultimate row communicates the p value to test if, as a whole, the estimated parameters are different from zero.

To facilitate the interpretation of the estimated parameters, in Table 4, the indigenous communities are arranged according to their degree of traditionalism, with the first communities being the most traditional. To determine traditionalism, I used the Ethnolinguistic Replacement Index (ERI; see Ordorica et al. 2009). ERI measures the tendency of the new generations of an ethnolinguistic group to continue to use the group's language. ERI ranges from 0 to 2, where 2 indicate an increase in the use of the language, while 0 is a rapid trend toward loss of the language. ERI is important because it indicates the influence of tradition within communities (a higher ERI means that customs and traditions are more influential and, therefore, so is the Cultural Factor we are analyzing); it is also is independent of current income and current economic conditions. Further, if we arrange communities according to their degree of traditionalism, we can divide them into three groups, where the first is the most traditional and the last the least traditional. The Groups are as follows: Group 1: Tlapanecs, Tzotzils, Tzeltals and Chols; Group 2: Huastecs, Mixtecs, Mazatecs, Chinantecs, Mixes, Nahuas and Totonacs; Group 3: Purépechas, Zapotecs, Mayas, Otomies and Mazahuas. I have employed this classification because the groups have certain common characteristics, which will be useful throughout the empirical analysis in this article.

The results presented in Table 4 indicate that, overall, the disaggregated results contribute new information to the regressions (all the p values in the penultimate row tend toward zero). As expected, the estimated parameters for the first regression

Table 4 Language and preference for self-employment

	Self-employed with no hired workers				Self-employed with hired workers
	Total		Secondary sector		Total
	Total sample	Rural sample, 6 States	Total sample	Rural sample, 6 states	Total sample
Observed mean	0.223	0.464	0.132	0.473	0.029
Results of Logit regressions[a]					
Estimated mean	0.183	0.348	0.100	0.575	0.016
Personal information, environment and economic sector, see Table 3					
Group 1					
Tlapanecs	0.176*	0.198*	0.125*	0.125*	−0.019*
Tzeltals	0.245*	0.307*	0.185*	0.129*	−0.003*
Tzotzils	0.245*	0.231*	0.255*	0.291*	−0.003*
Chols	−0.005	−0.084*	0.093*	−0.208*	−0.026*
Group 2					
Huastecs	0.043*	–	0.176*	–	−0.031*
Mixes	0.127*	0.029*	0.241*	0.256*	−0.010*
Mazatecs	0.089*	0.027*	0.200*	0.104*	−0.005*
Chinantecs	0.046*	−0.156*	0.179*	−0.182*	−0.010*
Mixtecs	0.133*	0.028*	0.208*	0.155*	−0.020*
Nahuas	0.071*	0.140*	0.112*	0.289*	−0.005*
Totonacs	0.045*	–	0.092*	–	−0.016*
Group 3					
Purépechas	0.190*	–	0.170*	–	−0.003*
Zapotecs	0.198*	0.106*	0.278*	0.264*	−0.015*
Mayas	0.019*	−0.089*	0.073*	−0.134*	−0.006*

Table 4 continued

	Self-employed with no hired workers				Self-employed with hired workers
	Total		Secondary sector		Total
	Total sample	Rural sample, 6 States	Total sample	Rural sample, 6 states	Total sample
Otomies	0.047*	–	0.097*	–	−0.004*
Mazahuas	0.037*	–	0.061*	–	−0.021*
Number of observations	3,662,999	886,966	477,242	70,786	3,662,999
$Pr(\beta_1 = \beta_2 = \cdots = 0)$[b]	0.00	0.00	0.00	0.00	0.00
R^2 (Nagelkerke)	0.14	0.24	0.26	0.24	0.13

Source: The table was created with data from INEGI 2010

* Indicates that the parameter is 95 % significant

[a] The values are the marginal effects with respect to estimated mean or response probability when the characteristic applies

[b] $Pr(\beta_1 = \beta_2 = \cdots = 0)$ refers to the probability that all the parameters concerning the indigenous communities are not significantly different from zero, in which the value of the cell is the p value of the test

Table 5 Relationship between self-employment and ERI

	Self-employed with no hired workers			
	Total		Secondary sector	
	Total sample	Rural sample, 6 States	Total sample	Rural sample, 6 states
Constant	0.00	−0.19	0.09*	0.00
ERI	0.11*	0.25*	0.08*	0.10
R^2	0.28	0.36	0.19	0.03
Constant	−0.02*	−0.26*	0.04*	−0.18
ERI	0.16*	0.33*	0.11*	0.22
Chols	−0.18*	−0.22*	−0.07*	−0.35*
Group 2	−0.05*	–	0.04	–
Purépechas	0.11*	0.15	0.03	0.23
Zapotecs	0.14*	–	0.15*	–
R^2	0.86	0.65	0.70	0.49

Source: Table 4 and ERI data (Ordorica et al. 2009)

(all sectors) and the third regression (secondary sector) are positive and statistically significant for all the indigenous communities, with only one exception, in the Chols case (in this case, the first regression is negative and not statistically significant). It is difficult to determine why the Chols do not conform to the general pattern, especially because three of the first four communities (Tzeltals, Tzotzils and Chols) live in the same state (Chiapas) and have faced similar problems: conflicts over land tenure, religious difficulties, migration of indigenous individuals from Guatemala and the consequences of the Zapatista rebellion. Also, the self-employment rates for these four communities are the highest among the 16 communities analyzed, while the hectares of land per family and the percentages of agricultural day laborers are the lowest among the communities analyzed. According to the sources consulted for this article, the difference between the Chols and the other communities is the degree of difficulties experienced by the Chols, which has led to very high migration rate, even if only to nearby communities. Thus, a large share of the Chol community is currently landless, and Chols are employed mainly in the production of crafts. This is why the first coefficient is not statistically significant, while the second is.

Continuing the analysis of the value of the estimated parameters, Table 5 includes a series of regressions (OLS) in which the independent variable is the marginal change in the probability (the values of the estimated parameters from the columns in Table 4, by community), and the dependent variable is the degree of traditionalism, measured using ERI. There is a positive and significant correlation between these two variables for the first three regressions from Table 4. Thus, as traditionalism increases, self-employment—a proxy variable for the Cultural Factor—increases. Complementing this, the second part of Table 5 includes the results for these same regressions, but adds dummy variables for the Chol, Purépecha and Zapotec communities, as well as a dummy variable for Group 2

communities (1 if a community is part of the second group, 0 in the other case). The reason for the dummy variable for the Chols is explained in the previous paragraph; as I explain further on, the dummy variables for the Purépechas and Zapotecs are due to the fact that these communities have adapted very well to economic changes while maintaining a high level of self-employment, by adopting commercial crops and trade in crafts.

Lastly, for the overall sample, the dummy variable for Group 2 has a negative sign and is significant; however, this is not the case for the third regression. This indicates that the parameters for this group for all sectors are lesser than those for the secondary sector. The following interpretation helps explain this phenomenon. In the case of the second group, the percentage of agricultural day laborers is greater than that for the other groups, reducing self-employment; that is, in the regions where these communities live, it is necessary to own land to be a self-employed agricultural worker. But in the case of the first group (Chols excepted), everyone owns land (that is, the percentage of agricultural day laborers is very low), although usually only very small plots, and they produce their crafts on this land. In other words, the number of hectares per family is only sufficient for subsistence agriculture, so families produce crafts to have income.

The results are similar for the control group and the total sample; except for the Mayas and the Chinantecs, the values are positive and statistically significant. In the case of the Mayas, the negative values are possibly due to the fact that tourism is very important in their region, and some tourist centers have been developed within indigenous communities.

Given the regressions in Tables 3, 4 and 5, we can conclude that indigenous people still have a greater degree of self-employment than non-indigenous people, even when the communities compared are highly similar. This evidence proves that, in indigenous communities, non-economic incentives toward self-employment do exist. It also shows that Mexican indigenous people do exhibit the Cultural Factor analyzed here.

4 The waste of trade benefits

Trade between societies comes mainly from two sources: economies of scale and diversity. Economies of scale are the same for all countries, and each one takes them to reduce costs. Diversity can come from different elements, mainly differences in technology (Ricardo's model) and factor endowments (Heckscher–Ohlin model); but it can also arise from cultural differences. This is because values, beliefs and other cultural factors may influence the production function, and the influence may be precisely through differences in the economies of scale.

To explain the relationship between a society with the cultural factor of work on a small scale and its external trade, I will adapt an intra-industrial trade model (Krugman 1979). This model is adequate for analyzing cultural factors since it is possible to use it to study families that face the dilemma of producing in association with others families (and, thus, taking advantage of the economies of scale), or

producing in small groups or by themselves; in this model, the focus is on the influence of Cultural Factor on both type of trade and business size.[20]

4.1 The model

Suppose that a society under a regime of monopolistic competition is composed of M identical families or individuals and N goods, where both figures are large. Production technology for each commodity, c_i with $i = 1, 2, \ldots, N$ is calculated using the following production function:

$$c_i = f_i(S_i) \tag{2}$$

with $(\partial c_i/\partial S_i) > 0$ for $i = 1, 2, \ldots, N$, where $S_i \in [1, M]$ indicates the number of families producing the ith good. Technology is the same for all goods, except for the degree of economies of scale, which is measured by σ_i, that is, output elasticity with respect to only one input S_i. In all cases, $\sigma_i > 1$ and it is assumed that if $\sigma_i > \sigma_j$ for one given S^o, it will also be for another S. In other words, I assume that if a large-scale production process provides higher returns than a small-scale process in one case, this applies in all cases. Also, it is assumed that output elasticity decreases with respect to S_i, i.e.,

$$\frac{\partial \sigma_i}{\partial S_i} < 0 \tag{3}$$

The preferences of each family j, with $j = 1, 2, \ldots, M$ are represented using a utility function such as function (1), where a cultural characteristic negatively influences the preference to work in groups. Specifically, let the utility function be

$$U_j = \sum_{i=1}^{N} v(c_i) + Zg(M - S_i) \tag{4}$$

with $v' > 0, v'' < 0$. The second term is the increase in utility due to the cultural factor of work on a small scale that causes the rejection of work in large groups, measured with S (the greater S is, the lesser utility becomes), with $(\partial g/\partial S) < 0$ and $\left(\partial^2 g/\partial S^2\right) < 0$. Also, Z measures the intensity with which an individual follows the cultural factor. The M families are completely free to join and produce any of the goods; therefore, N would be one variable in the model. The decision of the production group size (i.e., the size of the company) is based on both the preference (in case $Z > 0$) and the family income (π); the latter is defined as the amount of sales, divided by the number of families producing the same good. For the case of a family j (which belongs to a production group with other identical families) that produces the ith good, the following restriction applies:

[20] There are several determinants of firm size: economies of scale and transaction cost (Canbäck 1997), financial situation (Beck et al. 2008), inflation rate (Wu and Zhang 2001); also, there is a literature about firm size distribution (Cabral and Mata 2003; Sutton 2007). Culture as a determinant of firm size is a new area.

$$\pi_{ji} = \frac{p_i}{S_i} f_i(S_i) = \sum_{i=1}^{N} p_{ij} c_{ij}. \tag{5}$$

The left side of the restriction equation is the income that family j received for producing good i, and this income is defined as the production function $f_i(S_i)$ of the ith good, multiplied by its price (p_i), and divided by the number of families (S_i) that produce this good. The right side is the family's total expenses, where I assume, for simplicity, that the good produced is bought on the market for consumption. Given Eqs. (4) and (5), I can postulate the following utility maximization program for a representative family:

$$\max U_j = \sum_{i=1}^{N} v(c_i) + Z g_i(M - S_i) \tag{6}$$

subject to

$$\pi_{ji} = \sum_{i=1}^{N} p_{ij} c_{ij} \tag{7}$$

Intuitively we can observe that, *ceteris paribus*, the optimum size of the company S_i^* depends negatively on Z, as higher values of the variable indicate the family's greater aversion to producing with other individuals.

4.2 Equilibrium in the model

The Eqs. (6, 7) define the maximization program of each family. To facilitate the analysis, I assume that: the cross-elasticity of demand of good i with regard to the price of good j, with $i \neq j$, is negligible; the influence of the purchase of the good produced by the representative family is also insignificant; and finally, the Lagrange multiplier is constant with respect to the price of each product. The previous assumptions are valid when N and M are large numbers.[21] To obtain elasticity (inverse) of the demand for a good, we must differentiate the first-order conditions regarding the price. Note that the inverse of the elasticity depends only on the utility with respect to such a good, i.e.,

$$\eta_i = -\frac{\partial p_i}{\partial c_i} \frac{c_i}{p_i} = -\frac{c_i \frac{\partial^2 v_i}{\partial c_i^2}}{\frac{\partial v_i}{\partial c_i}} \tag{8}$$

with $0 < \eta_i < 1$ for $i = 1, 2, \ldots, N$. To establish an equilibrium, let us first consider the case where $Z = 0$. There are two conditions to be met: the first is that each

[21] This situation is valid for the type of utility function (4). The logic is that there are so many goods that, when there is a change in one of them, its influence on the demand of other goods is so small that there is no reason to concentrate on it; see Dixit and Norman (2002, p. 269), Dixit and Stiglitz (1977), Krugman (1979), Feenstra (2004, p. 138). The same logic implies that the influence on purchasing decisions of the number of goods produced and sold is negligible. Finally, for the assumption of the constant Lagrange multiplier, see Feenstra (2004).

individual join others to form a company, until the marginal profit of doing so is null (i.e., $\partial\pi/\partial S = 0$). From the latter equation and (8), as well as the first-order conditions of programs (6, 7), we have

$$\varepsilon_{ji} = \sigma_i(1 + \eta_i) - 1 = 0 \tag{9}$$

where ε_i is the income elasticity of family j producing good i, and where the assumption is

$$\frac{\partial \varepsilon_{ji}}{\partial S_i} < 0 \tag{10}$$

for every $i = 1, 2, \ldots, N$. This first condition is enough to ensure equilibrium; by increasing S (when another family joins the group that produces i) profits decrease.[22] The second condition is, given that entry costs are null, the benefits for a family of producing the ith good shall be the same among groups, that is $\pi_i = \pi_k = \pi^0$, for $i, k = 1, 2, \ldots, N$. Therefore, we have $N * 2$ equations, in which the N prices (p_i) may be defined, as well as the size of the N companies (S_i).

Let us now consider the case where $Z > 0$. From the first-order conditions of programs (6, 7), with $Z > 0$, the following equality can be derived:

$$\phi_{ji} = \frac{\frac{\partial g_i}{\partial S_i} Z S_i}{\sum_{i=1}^{N} \frac{\partial v(c_{ji})}{\partial c_{ji}} c_{ji}} = \frac{\partial \pi_{ji}}{\partial S_i} \frac{S_i}{\pi_{ji}} = \varepsilon_{ji} \tag{11}$$

Variable ϕ_{ji} is defined as the substitution rate (of family j when it produces good i) of working with more people versus consuming more goods, which, when in a state of equilibrium, should be equal to the rate of increase in income due to working in larger groups. That is

$$\phi_{ji} = \frac{\eta_S g(M - S_i) Z}{\sum_{i=1}^{N} \eta_{ji} c_{ji}}$$

Observe that if $Z = 0$, then $\phi_{ji} = 0$, and ϕ_{ji} grows as Z does. Adding ϕ_{ji} and (8) to the left side of condition (9), we have

$$\varepsilon_{ji} = \sigma_i(1 + \eta_i) - 1 = \phi_{ji} \tag{12}$$

while assuming that condition (10) is still met. In the case of $Z > 0$ and the model being in a state of equilibrium, the benefits per family cannot be the same, as the type of work affects the utility. Those families working in large groups (which decreases their utility) must receive a higher income. Therefore, with $Z > 0$, a necessary condition for equilibrium requires that the utility of the families producing good i be the same as that of the families producing good k, that is, $U_i = U_k = U^0$, with $i, k = 1, 2, \ldots, N$. Therefore, we have $N * 2$ equations [(12) corresponding to utilities equal to U^0, for each of the N products] and $N * 2$ unknown variables (S_i and p_i, for the same N products).

[22] Condition $(\partial\varepsilon/\partial S) < 0$ implies $(\partial\pi/\partial S) < 0$.

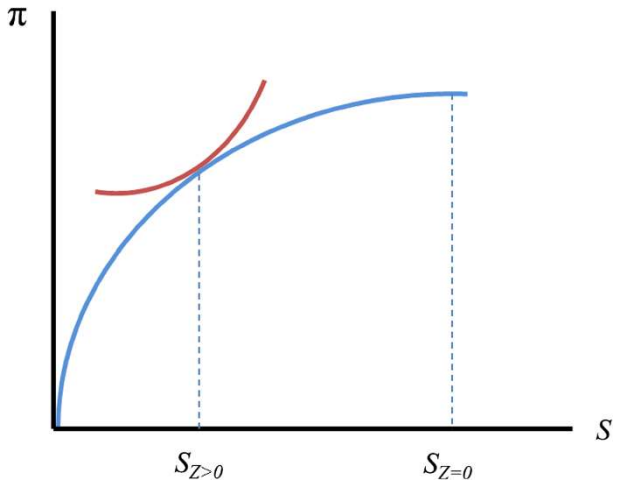

Fig. 1 Equilibrium with only one good. Source: Figure elaborated by the author

The relation between the size of company i (S_i) and the weight of the cultural factor (Z) is negative, which can be proven with the first-order conditions of the programs (6, 7) or simply by comparing the balance conditions (9–12): for any good, a greater Z produces a larger substitution rate ϕ (see 11). To be in a state of equilibrium, the elasticity ε_{ji} must increase [given (12)], which can only occur if S_i decreases [given (10)]. For instance, let us assume that there is only one good, as seen in Fig. 1. The curve with a positive and decreasing slope is the income per family (π), which, because of (10), is concave. With $Z = 0$, the maximum exists where the curve turns flat, forming a company size of $S_{Z=0}$. When $Z > 0$, the maximum exists at the point that the slope of the income curve is tangent to the indifference curve between income and size of the work group. Such an indifference curve may be derived from the utility function (4) with only one good. Observe that a higher value of Z will result in an indifference curve that is more to the left, thus reducing the optimum size of the company and therefore the earnings. This can be interpreted as the cost (or waste) of following the Cultural Factor.[23]

4.3 The model and its relationship with cultural patterns of trade

According to the model presented in the last section, the trade pattern for societies could be affected by the cultural factor of work on a small scale in the following way: the Cultural Factor promotes working in small groups and discourages specialization; therefore, *ceteris paribus*, this type of society has lower priced products with lower economies of scale, when compared to those societies without this Cultural Factor.

[23] According to Altman (2001), following cultural patterns could have a cost. In this article, the cost is the loss of efficiency due to the smaller size of the company.

To analyze trade, let us assume we have two communities, A and B, identical in everything except in Z_A and Z_B, where community A has the Cultural Factor of work on a small scale and community B does not have it. To start, we assume that $Z_A = Z_B = 0$. In this scenario, each one of the two communities specializes in production of certain goods. Their trade allows them to profit from large economies of scale, which is known as the Krugman result (Krugman 1979; Feenstra 2004). Now, as will be demonstrated later, if $Z_A > Z_B$, the families of community A will focus on producing unspecialized goods, with low or no economies of scale. In this case, the relative prices are as follows:

$$\left(\frac{p_A^{NE}}{p_B^{NE}}\right) < \left(\frac{p_A^{E}}{p_B^{E}}\right) \tag{13}$$

where p_i^{NE}, with $i = A, B$, indicates the prices of goods with low or non-existent economies of scale and p_i^E indicates the prices of goods with large economies of scale. This is relevant since, originally, trade incentives were the profits derived from economies of scale (Krugman's model) but, in this model, these incentives are the result of Cultural Factor. The next two Propositions will serve to determine trade patterns:

Proposition 1 *In a state of equilibrium, the economy will produce more goods with greater economies of scale, regardless of the value of Z.*

Proof Let S^0 be a set of families, and $i, j = 1, 2, \ldots, N$ being any of two goods, under the following condition $\sigma_i(S^0) > \sigma_j(S^0)$. As the inverse elasticity of demand complies with $0 < \eta_i < 1$, and is the same demand for all goods, then $\sigma_i(S^0)\{1 + \eta[c_i(S^0)]\} > \sigma_j(S^0)\{1 + \eta[c_j(S^0)]\}$, therefore $\varepsilon_i > \varepsilon_j$ [see (10) and (12)]. However, given that ϕ is independent of the production process, given condition (11), we have $\phi_i(S^0, Z) = \phi_j(S^0, Z)$, and in particular, $\phi_i(S^0, Z) = \phi_j(S^0, Z)$ for $Z = 0$.

The above is due to the fact that the individuals are indifferent to producing good i or j. To be in a state of equilibrium and comply with (10), if $Z = 0$, or with (12), if $Z > 0$, then S_i needs to be greater than S_j, which implies that $c_i > c_j$ (the production of i is greater than j). In addition, since $0 < \eta < 1$, then $p_i < p_j$.

Proposition 2 *In a state of equilibrium, as Z is increased, the economy will produce less of any given good. This effect is more intense when the production functions present greater economies of scale.*

Proof Let S^0 be a set of families, and $i = 1, 2, \ldots, N$ be any good and let Z_1, Z_2 be the weights so that $Z_1 > Z_2$. By (11) we know that $\phi_i(S^0, Z_1) > \phi_i(S^0, Z_2)$. To be in a state of equilibrium and to comply with (12), the income elasticity of Z_1 needs to be greater than that of Z_2, therefore $S_{i1} > S_{i2}$. In addition, because $0 < \eta < 1$, then $p_{i1} < p_{i2}$. The second part of that statement indicates that the decrease in production will be greater as long as the economies of scale also grow. Let us compare two goods, i and j, such that $\sigma_i(S^0) > \sigma_j(S^0)$. Since ϕ is independent of the economies of

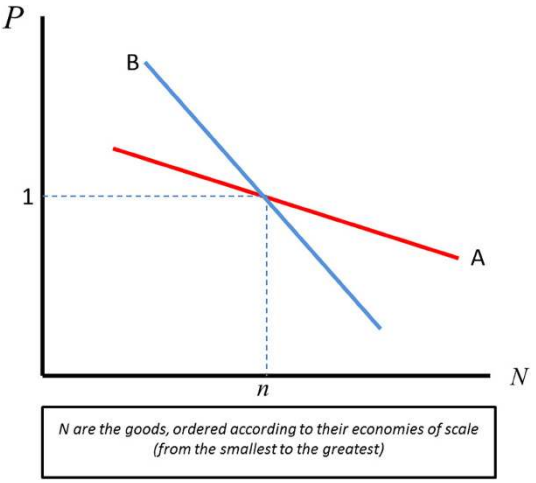

Fig. 2 Price equilibrium with two communities. Source: Figure elaborated by the author

scale, thus $\phi_i(S^0, Z_1) - \phi_i(S^0, Z_2) = \phi_j(S^0, Z_1) - \phi_j(S^0, Z_2)$, but $\varepsilon_i(S^0) > \varepsilon_j(S^0)$. Therefore, S_i will need to grow more than S_j to be in a state of equilibrium.

Proposition 1 shows that prices for those products with greater economies of scale will be lower, regardless of the presence of the cultural factor effect. However, given Proposition 2, the decrease in prices will be less profound as Z grows, a result that depends on the Cultural Factor. In the example of the two communities, if $Z_A > Z_B$, inequality (13) will be met, causing community B to export to A the goods produced with greater economies of scale and consequently, community A will export the goods with lower economies of scale to B. Under this scheme, trade patterns are determined by the difference in the communities' Cultural Factor.

To illustrate the trade flow more clearly, let us continue with the example of the two communities, with $Z_A > Z_B$. The horizontal axis of Fig. 2 represents the goods, ordered according to their economies of scale (from the smallest to the greatest), and the vertical axis shows relative prices. The price of goods with a low economy of scale is higher for community B than for A, as the latter prefers to produce them, thus increasing the supply. Proposition 1 tells us that the price line decreases as economies of scale grow, and Proposition 2 shows that this line will have a smaller slope as Z grows (i.e., the price line will have a greater slope for community B than for A). Therefore, it is easy to see that prices for goods with large economies of scale and those with lower economies of scale are higher for community B than those for A. In this scenario, trade exists due to economies of scale, and it is determined by the differential price derived from the Cultural Factor.

The final outcome is rather interesting. Community A has a free exchange of goods: each household maximizes its utility function and there are no externalities. In fact, community A is a Pareto optimum, due to the fact that each family is maximizing its program (6, 7), given that other families are also optimizing their own programs. However, since the Cultural Factor affects the economic organization directly, community A does not take advantage of economies of scale. In fact,

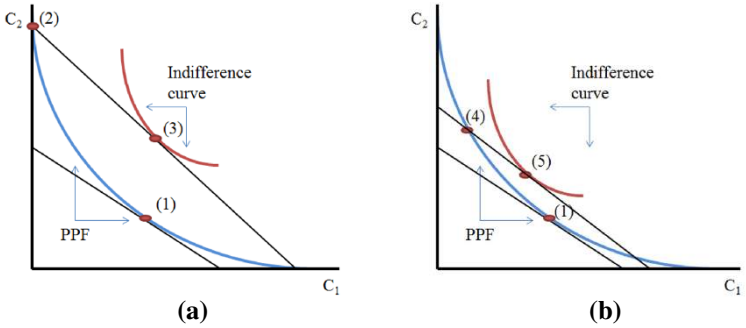

Fig. 3 Equilibrium with two communities. **a** Community *A* without the influence of the cultural factor. **b** Community *A* with the influence of the cultural factor. Source: Figure elaborated by the author

the families of community *A* could produce and consume more, but the consequential changes in their level of organization would diminish the utility function and, therefore, they tend to avoid economies of scale. In conclusion, community *A* is at Pareto optimum and, at the same time, is missing out on trade advantages.

It is possible to observe equilibrium graphically in two societies (*A* and *B*) with two families each and two goods each, C_1 and C_2, where C_2 production has lower economies of scale than C_1 production, whereby the production possibility frontier (PPF) in Fig. 3 is convex. The representative utility function of the *A* families is $U_A = v(C_1) + v(C_2) + Z_A g(2 - S_i)$. If $Z_A = 0$, the community does not have the Cultural Factor, then the balance would be represented by point (3) on the left graphic of Fig. 3. Once in economic equilibrium, society *A* only produces item C_2 (point 2) or only item C_1. However, in the event that society *A* had the Cultural Factor, the relative prices before the trade would be the following:

$$\left(\frac{p_A^2}{p_B^2}\right) < \left(\frac{p_A^1}{p_B^1}\right)$$

In community *A*, item 2 is cheaper relative to item 1 than in community *B*. When trade is a possibility, community *A* could specialize in C_2, but specialization reduces the utility of members of community *A*. If Z_A is strong, then community *A* will produce C_1 and C_2, and in the graphic on the right, the optimum point is point (5), and at this point there is no specialization. Note that the indifference curve in both graphs is just between the two goods and it does not necessarily consider the expression $Z_A g(2 - S_i)$ of the utility function, whereby an indifference curve farther from the origin does not necessarily have more utility. In particular, the right graph's indifference curve has more utility than the left graph's indifference curve, since the latter does not take into account the Cultural Factor. We can also observe that with the Cultural Factor, society *A* has a higher level of utility in (5) than in (3), because specializing in the production of C_2 only strongly affects its utility, even when in (3) it would consume more of both goods. In this case, the indifference curve is between the two goods, but with the second term $Z_A g(1) > 0$. This is the

reason that the indifference curve in the right graph is closer to the origin, but it represents more utility.

Because community A does not specialize, B is also forced to produce both types of goods, so B suffers a loss of utility. Obviously, community B looks for other economies with which to trade.

Finally, we can suppose there are many communities, such as $A, B, C, \ldots$, etc., that do not exhibit the Cultural Factor, i.e., $Z_A = Z_B = Z_C = \cdots = 0$. In this case, trade would result in each economy specializing in certain products, to take advantage of economies of scale. Now, if we suppose that community A has a Cultural Factor, i.e., $Z_A > 0$, whereas the rest of the communities do not, i.e., $Z_B = Z_C = \cdots = 0$, then community A would specialize and would sell goods to other communities with no economies of scale, and vice versa. However, if the number of communities is large, and all goods have some kind of economy of scale, then there will always be another community that could specialize and sell goods with low economies of scale at a lower cost than community A could. In this case, community A would have to sell its products at lower prices (or subsidize them) to buy products with economies of scale.

4.4 Empirical evidence about the cultural factor and trade

In Sect. 3.2, I presented empirical evidence showing that Mexican indigenous people exhibit the Culture Factor; now I need to show that they sell goods with low economies of scale. Although there are no data on the type of products that indigenous communities' trade, I will use indirect information to show the kinds of exports of these communities.

Under the assumptions of the model, when there are many communities without the Cultural Factor, commerce and trade will make communities specialize in certain products to exploit economies of scale. Indeed, this is what has happened in recent decades, both in Mexico and the rest of the world, following free market trade. In Mexico, some industries have grown, such as the automotive industry, while others have decreased, such as textiles; many companies have shifted geographically, and the wages by industry have been modified. As indicated by the trade model presented above, one would expect that these changes be reflected in the economies of the indigenous communities, depending on the Cultural Factor; if an indigenous community has a large Z, its economy would continue to produce goods with small or no economies of scale, regardless of what happens outside of the community. However, with a small Z, indigenous economies could begin to specialize.

Table 6 shows the percentage of the EAP in Mexico that engages in different economic activities. As can be seen, the largest indigenous occupation is agriculture, particularly subsistence agriculture, which is a type of work carried out on a small scale, as evidenced by the high self-employment rate shown in Table 7. However, the production of corn and beans is for self-consumption and the surplus is sold locally, so it is generally not exported. According to the Census, flowers, coffee, cacao, fruits and vegetables are the main commercial crops produced by indigenous communities; they produce these items on a small scale, as

Table 6 Percentage of Mexican EAP by economic activity

	Total		Rural		Rural (6 States)	
	Non-indigenous	Indigenous	Non-indigenous	Indigenous	Non-indigenous	Indigenous
Primary sector	**11.1**	**44.1**	**32.8**	**59.9**	**58.2**	**74.7**
Corn and bean crops	2.5	23.9	8.0	33.0	25.3	52.4
Commercial crops	4.1	10.7	12.0	14.3	19.2	13.9
Land workers	4.5	9.5	12.8	12.6	13.7	8.4
Secondary sector	**41.5**	**28.4**	**34.0**	**22.5**	**20.4**	**14.7**
Crafts	2.3	4.7	2.4	5.2	2.0	3.6
Construction	7.0	8.8	9.6	8.0	6.8	5.5
Other	32.2	14.9	22.0	9.3	11.6	5.6
Tertiary sector	**47.4**	**27.5**	**33.2**	**17.6**	**21.4**	**10.7**
Trade	11.4	7.4	9.4	5.2	6.2	3.3
Other	36.0	20.1	23.8	12.4	15.2	7.4
Total	**100**	**100**	**100**	**100**	**100**	**100**

Source: INEGI 2010

reflected in their self-employment rate, which is always greater for the indigenous population than for the non-indigenous population, even when facing the same economic conditions [Table 6, column Rural (6 States)]. This shows that in these communities, smallholders produce the commercial crops for export, with a little economic specialization. Even though these types of production processes require extra labor at certain times to achieve greater efficiency, anthropological literature[24] suggests that, in these cases, the indigenous communities have old practices that are not monetized and exchange work instead.

The secondary and tertiary sectors have less importance in indigenous communities than in other societies and, again, in all cases, the self-employment rate is higher for the indigenous population than for the non-indigenous population. Crafts deserve special attention; they are the manufactures most often exported by indigenous communities. It is worth noting that Tables 6 and 7 include data for persons whose principal activity is the making of crafts; the production of these kinds of goods is one of the most common secondary activities within indigenous communities. Here we are talking about products with small or no economies of scale because their main characteristic is that they are not produced in series. However, to achieve greater efficiency, it could be possible to take advantage of economic specialization, and workshops could include several families; as in previous cases, indigenous craft production has higher levels of self-employment than non-indigenous production does. For example, in rural indigenous

[24] The anthropological literature reviewed is: Argueta (1995), Durston (1992), Millán and Valle (2003), Warman (1985).

Table 7 Percentage of Mexican EAP self-employment by economic activity

	Total		Rural		Rural (6 states)	
	Non-indigenous	Indigenous	Non-indigenous	Indigenous	Non-indigenous	Indigenous
Primary sector	**33.8**	**51.0**	**34.7**	**51.4**	**49.7**	**60.0**
Corn and bean crops	51.3	60.6	51.3	60.5	60.8	64.0
Commercial crops	35.3	48.8	36.0	49.1	45.4	55.6
Land workers	22.8	29.4	23.3	29.9	35.1	42.6
Secondary sector	**17.7**	**32.6**	**19.2**	**36.8**	**27.6**	**39.0**
Crafts	40.3	68.6	41.8	72.2	63.8	76.2
Construction	24.0	22.9	18.5	19.2	19.1	20.7
Other	14.8	27.1	17.0	32.2	26.5	33.3
Tertiary sector	**25.6**	**32.1**	**28.2**	**34.1**	**33.5**	**35.4**
Trade	44.9	51.7	46.4	54.3	53.6	52.1
Other	19.6	24.9	21.1	25.5	25.3	27.9
Total	**23.3**	**40.6**	**27.3**	**45.0**	**41.7**	**54.3**

Source: INEGI 2010

communities, the self-employment rate is 72.2 %, but the rural non-indigenous rate is 41.8 %. Again, craft production is under workshop discipline. It is important to note that, given the importance of this area of production, indigenous people organize themselves in cooperatives for sale and promotion, but not for joint production. In contrast, the percentage of the indigenous EAP working in specialized activities, such as employees or helpers, is always smaller than for the non-indigenous population, except in the construction sector, in which virtually all indigenous communities have a part of their work force dedicated to this activity, either as builders or helpers.

Information about the imports of indigenous communities is scarce and scattered. According to anthropological literature, indigenous communities generally purchase products with economies of scale (radios, tennis shoes, etc.) or supplies for their work (hammers, knives, etc.).

In conclusion, based on the above data, indigenous economies produce and export goods with small or no economies of scale, such as commercial crops and crafts, and the self-employment rate is higher than that for non-indigenous communities.

However, it is necessary to compare the types of production among indigenous communities, to have more evidence about the influence of the Cultural Factor on trade.

The relationship between the rate of self-employment and the ERI was shown in Sect. 3.2.2. From this, it follows that there is a relationship between the degree of traditionalism and the Cultural Factor. In this sense, indigenous economies with higher ERI would have a less economic specialization than economies with low ERI levels.

Subsistence agriculture is the most important economic activity of Group 1, with 55.0 % of the EAP. Group 1 produces very few commercial goods, so trade is

Table 8 Type of activities and self-employment rates for indigenous groups

	EAP type of activity			Self-employment rate		
	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3
Primary sector	**83.0**	**62.1**	**41.7**	**93.9**	**68.5**	**74.6**
Corn and bean crops	66.0	31.8	19.7	96.1	75.9	87.4
Commercial crops	11.4	17.7	12.2	88.0	64.5	71.5
Land workers	5.6	12.6	9.8	79.7	55.6	52.9
Secondary sector	**8.6**	**21.0**	**34.6**	**50.2**	**45.6**	**41.6**
Crafts	2.6	5.4	8.3	91.2	83.5	77.5
Construction	3.2	7.6	11.8	15.6	22.4	22.7
Other	2.9	8.1	14.5	51.8	42.3	36.4
Tertiary sector	**8.4**	**16.9**	**23.7**	**40.8**	**39.4**	**44.6**
Trade	2.7	5.2	7.0	66.5	69.3	71.0
ther	5.7	11.7	16.7	28.4	26.0	33.5
Total	**100.0**	**100.0**	**100.0**	**85.7**	**58.8**	**56.1**

Percentage of families receiving assistance from relatives who have migrated					
National			International		
0.10	0.94	0.95	1.72	4.23	4.32

Source: INEGI 2010

limited. The ERI of group 1 is the highest, and this is also the most traditional group. The second group has a strong inclination toward commercial crops. It also has the highest percentage of land workers and the lowest percentage of self-employment in the production of commercial crops. Thus, farmers tend to hire day laborers, but when they need more help, they use ancient practices for exchanging work instead of offering a salary (like the faena). Finally, commercial crops usually are sold to middlemen who trade them outside the communities. Unlike for the first group, the economical behavior of the farmers in the second group depends on market conditions.

Finally, the third group (with the lowest ERI) has the highest percentage of EAP in the secondary and tertiary sectors. In the secondary sector, crafts are very important. This group has a lower self-employment rate than the other groups, indicating economic specialization; something similar happens with the tertiary sector, in particular with trade. This is evidence of some vertical integration, in which the craftsperson, with or without hired workers, is part of an economic process that implies delivery schedules and a possible specialization in one part of the production process (e.g., sales, or production of crafts with some particular characteristics). Also, the third group has the highest percentage of jobs that involve some kind of hierarchy, which are the ones classified as *other* in Table 8.

The data shown above is evidence that indigenous communities continue to work under workshop discipline and export goods with low or no economics of scale, as the model predicts when Z is large. However, evidence also indicates that certain

changes occur when ERI decreases and, therefore, so does the influence of the Cultural Factor. These changes are, first, the production of goods aimed at the market, with all that it implies; second, in some cases, both farmers and craftspeople have employees and are a part of an economic process; and third, more people are willing to work in non-family hierarchies. It is important to note that groups 2 and 3 receive help from relatives abroad, as we can see in Table 6, and migrants work usually under factory discipline.

5 Egalitarian norms and economic growth

Just as the Cultural Factor causes a decrease in the material benefits of trade, it also reduces economic growth. I analyze this phenomenon in this section.

The section develops an economic growth model that includes the Cultural Factor. First, I assume that the total economy (indigenous and non-indigenous) can be represented as an AK model (with human and physical capital). When the weight of Z is small, the economic growth of indigenous communities (and the total economy) can also be characterized as following an AK model, as the factors that keep these communities economically poor could be exogenous, such as lack of opportunities, discrimination and so forth. However, when the weight of Z is large, the Cultural Factor influences economic behavior; thus, the economies of indigenous communities could be characterized as following a Neoclassical model, with economic growth tending toward zero. In this case, the factors that keep these communities in economic poverty are both endogenous (like the Cultural Factor) and exogenous. In this section, we analyze how Neoclassical economies can be expanded into AK model economies.

With this purpose in mind, I define a discipline index, denoted by θ, with $\theta \in [\underline{\theta}, \bar{\theta}]$; and I express it as $(\bar{\theta} - \theta)$, where $(\bar{\theta})$ is the maximum level of discipline (factory discipline), and $(\underline{\theta})$ is the lowest discipline index. The expression $(\bar{\theta} - \theta)$ will be included in the utility function. At this point, it is important to mention, as I said in Sect. 3.1, that we understand discipline as behavior in accordance with certain standards of conduct (Clark 1994); thus, factory discipline implies acceptance and respect of hierarchies, rigid schedules, division and specialization of labor and so forth, whereas workshop discipline is understood as the nonexistence of such terms. As noted previously, this definition of discipline is independent of work intensity and duration.

As is common in this kind of economic growth model, I suppose a representative family that wants to maximize an intertemporal utility function. This utility function is subject to some type of accumulation of economic resources (economic and physical capital) and restricted by an added production function.

5.1 Added output

Let $Y = F[K, R, (\bar{\theta} - \theta)]$ be the production function, with constant returns to scale in K and R, where K is the physical capital without depreciation and R is work,

which is defined as $R = \max\left[(\bar{\theta} - \theta)H, L\right]$, where H is the human capital without depreciation, $(\bar{\theta} - \theta)$ is the discipline index and L is the labor force, and I assume that it is constant, $L = \bar{L}$.

There are two kinds of production technology: first we have those without any economic specialization and without hierarchies; production technology may be inherited from ancestors and/or brought from non-indigenous but unspecialized economies. Examples include subsistence agriculture, traditional crafts, door-to-door sales and so forth. Obviously, this kind of production technology does not have any kind of indivisibilities. The other kind of production technology requires a minimum of economic specialization, and thus some degree of hierarchy and indivisibilities. The same specialization induces profitable investment in human capital, however, basic it may be. This production technology is not necessarily associated with large-scale production; it includes specialization as part of some process. For example, production technology can include both traditional and modern aspects; such is the case of crafts that include marketing (i.e., specifically designed and custom-made for some sector, advertising, distribution, etc.); some families work in manufacturing, others in distribution, and so on. Other examples include some commercial agricultural processes; ecological activities, such as ecotourism, which are part of some tourist services, and so forth. This technology can also be used for medium- and large-scale production.

If the representative family tries to work with specialized production, but with a low discipline index, that is $(\bar{\theta} - \theta) \rightarrow \underline{\theta}$, the outcome would be an output without specialization; in the same way, if the representative family uses specialization, that is $(\bar{\theta} - \theta) \rightarrow \bar{\theta}$, for technology without specialization, it would be, to say the least, useless. In this sense, there is a level of discipline, denoted by $\left(\bar{\theta} - \widehat{\theta}\right)$, such that, above this level, work is more efficient when using specialized production technology and the investment in human and physical capital will be economically profitable.

In this regard, if $(\bar{\theta} - \theta) \leq \left(\bar{\theta} - \widehat{\theta}\right)$, then $(\bar{\theta} - \theta)H \leq \bar{L}$, and people are not willing to invest in human capital, and the production function will be $Y = F\left[K, \bar{L}, (\bar{\theta} - \theta)\right]$. On the other hand, if $(\bar{\theta} - \theta) > \left(\bar{\theta} - \widehat{\theta}\right)$ then people are willing to invest in human capital (and develop and/or import new production technologies), which they will use to increase the production quantity and quality; to accomplish this, they are willing to accept to work with other people that have some specialization, and they also accept work schedules and hierarchies, as well as economic differences between their members. In this scenario, $(\bar{\theta} - \theta)H > \bar{L}$, and the production function would be $Y = F\left[K, H, (\bar{\theta} - \theta)\right]$, and representative family will invest in both types of capital; i.e., $\dot{H} + \dot{K} = F\left[K, H, (\bar{\theta} - \theta)\right] - c$, where c is consume. Both types of assets may be interpreted as perfect substitutes, implying that the profit rates for human and physical capital must be equal (Barro and Sala-i-Martin 2004). When both profit rates are the same and positive, the representative family invests in physical and human capital, and so the production function will be

$Y = A\left(\bar{\theta} - \theta\right)K$ (see Appendix A.1). This is the case of an economic growth model in which technological change is endogenous (Acemoglu 2009, Chapter 11; Barro and Sala-i-Martin 2004, Chapter 4).[25] When the production function is $Y = F\left[K, \bar{L}, \left(\bar{\theta} - \theta\right)\right]$, we will call it a Neoclassical growth model, and when the production function is $Y = A\left(\bar{\theta} - \theta\right)K$, we will call it an Endogenous growth model.

As mentioned in Sect. 2, each society's culture is what really determines the importance of cultural factors, which are measured in the utility function using the variable Z, where $Z = 0$ indicates no influence and, as we will see later, a higher $\left(\bar{\theta} - \theta\right)$ value. In addition, the lower the level of Z, the greater the flexibility of the society will be, regarding deviations from workshop discipline; an excessively high Z indicates that society has rejected factory discipline, and $\left(\bar{\theta} - \theta\right)$ will have a low value. For instance, high values of Z would be characteristic of societies with broad sectors working on a small scale or in small groups, such as Great Britain before the Industrial Revolution (Clark 1994; Hareven 1991; Smelser 1959; Weisdorf 2006), or in the indigenous communities that apply egalitarian norms and possess a strong Cultural Factor.

5.2 The utility function and the maximization program

The main goal of our representative family is to maximize the present value of its utility function, discounted by the rate ρ. The utility function depends on the consumption level c_t in the period t, and on discipline index $\left(\bar{\theta} - \theta_t\right)$, which represents the difference between maximum discipline $\left(\bar{\theta}\right)$ and the actual degree of discipline $\left(\theta_t\right)$. The term $\left(\bar{\theta} - \theta_t\right)$ represents either the preference for workshop discipline or the rejection of factory discipline.[26] Finally, the intensity of the Cultural Factor is $Z \in \left[0, \overline{Z}\right]$. The result of this is the following utility function:

$$U(0) = \int_0^{\infty} \mathrm{e}^{-\rho t}\left[u(c) - Zg\left(\bar{\theta} - \theta\right)\right]\mathrm{d}t$$

with $u' > 0$, $u'' < 0$, $g' > 0$. In the simple growth model, there is a tradeoff between saving more resources and converting them into capital, so one is able to consume more in the future, versus saving less and consuming more in the present than in the future. In this model, in addition to the above dilemma, there is another tradeoff. According to the previous equation, a greater value of $\left(\bar{\theta} - \theta\right)$ implies a lower utility, but, according to the aforementioned production function, $\left(\partial Y/\partial\left(\bar{\theta} - \theta\right)\right) > 0$, which implies an increase in production and more consumption. In this sense, there is another tradeoff between the discipline values and production: more discipline reduces utility but increases production, and vice versa. The Hamiltonian of this maximization problem may be written as:

[25] The AK model used in the paper has the drawback that physical and human capital can grow negatively; a similar model that does not have this problem is the Lucas model, but this model addresses some complications that are not relevant for our purposes.

[26] There is some literature about culture in the utility function; for a recent and similar model, see Gorodnichenko and Roland (2010).

Table 9 Solution of the Neoclassical model

$\frac{\dot{c}}{c} = \frac{1}{\sigma_c}\left(F'_K - \rho\right)$ (T9.1)		
$\frac{\dot{(\bar{\theta}-\theta)}}{(\bar{\theta}-\theta)} = \frac{1}{\delta}\left(\sigma_c\left(\frac{\dot{c}}{c}\right) - \emptyset_{(\bar{\theta}-\theta)K}\left(\frac{\dot{K}}{K}\right)\right)$ (T9.2)		
$\frac{\dot{K}}{K} = \frac{F\left[K,R,(\bar{\theta}-\theta)\right]}{K} - \frac{c}{K}$ (T9.3)		
$\sigma_c = -\frac{u''}{u'}c$	$\delta = \sigma_{(\bar{\theta}-\theta)} - \emptyset_{(\bar{\theta}-\theta)}$	$\emptyset_{(\bar{\theta}-\theta)} = -\frac{F''_{(\bar{\theta}-\theta)}}{F'_{(\bar{\theta}-\theta)}}\left(\bar{\theta}-\theta\right)$
$\sigma_{(\bar{\theta}-\theta)} = -\frac{g''}{g'}\left(\bar{\theta}-\theta\right)$		$\emptyset_{(\bar{\theta}-\theta)K} = -\frac{F'_{(\bar{\theta}-\theta)K}}{F'_{(\bar{\theta}-\theta)}}K$

Source: Table elaborated by the author

$$\max_{c,(\bar{\theta}-\theta)} H = e^{-\rho t}\left[u(c) + Zg\left(\bar{\theta}-\theta\right)\right] + \lambda\left[F\left[K, R\left(\bar{\theta}-\theta\right),\right] - c\right] \tag{14}$$

The results of consumption and the degree of discipline over time, for the Neoclassical case, in which the discipline index is low, i.e., $\left(\bar{\theta}-\theta\right) \leq \left(\bar{\theta}-\widehat{\theta}\right)$, are shown in Table 9 (for the derivation of this equation, see Appendix A.2):

The first equation in Table 9 shows the path of consumption, which is the marginal productivity of capital, minus the discount rate. This expression is modified by the inverse of the marginal utility elasticity (σ_c). In the same way, the growth rate in discipline results from the percentage of consumption growth minus the capital growth. Since $F'_K > 0$ and $F''_K < 0$, eventually, the accumulation of physical capital will stop being profitable, so that its growth rate will be zero. As the growth of physical capital is zero, the ratio $\left(c/K\right)$ is constant (see Table 9, equation T9.3), which means zero growth in both consumption (T9.1) and the discipline index (T9. 2).

In the case of the Endogenous model (Table 10), first, the expression $\emptyset_{\left(\bar{\theta}-\theta\right)}$ is zero, because the production function is $Y = A\left(\bar{\theta}-\theta\right)K$, and $\left(\partial^2 Y/\partial\theta^2\right) = 0$. Also, growth is steady when the growth rate of consumption and capital are equal, i.e., $\frac{\dot{c}}{c} = \frac{\dot{K}}{K} = \gamma$. Replacing the growth rate (γ) in T10.2, we have $\frac{\dot{(\bar{\theta}-\theta)}}{(\bar{\theta}-\theta)} = \left[\frac{\sigma_c - 1}{\sigma_{(\bar{\theta}-\theta)}}\right]\gamma$. If $\sigma_c < 1$ and $\sigma_{(\bar{\theta}-\theta)} > 0$, then $\frac{\dot{(\bar{\theta}-\theta)}}{(\bar{\theta}-\theta)}$ will have the opposite sign to γ. In this case, the discipline is like a buffer or damper of the economic activity; if the economy is growing, people relax the discipline, but when the economy decreases, people are willing to accept more discipline, precisely to prevent further economic decline. According to the value of σ_c and the values and signs of γ and $\sigma_{(\bar{\theta}-\theta)}$, the term $\frac{\dot{(\bar{\theta}-\theta)}}{(\bar{\theta}-\theta)}$ will be positive or negative.

Table 10 Solution of the Endogenous model

$\frac{\dot{c}}{c} = \frac{1}{\sigma_c}\left[\left(A\left(\bar{\theta}-\theta\right)\right)-\rho\right]$	(T10.1)
$\frac{\left(\dot{\bar{\theta}}-\theta\right)}{\left(\bar{\theta}-\theta\right)} = \frac{1}{\sigma_{\bar{\theta}-\theta}}\left(\sigma_c \frac{\dot{c}}{c} - \frac{\dot{K}}{K}\right)$	(T10.2)
$\frac{\dot{K}}{K} = \left(A\left(\bar{\theta}-\theta\right)\right) - \frac{c}{K}$	(T10.3)

Source: Table elaborated by the author

As already mentioned, I assume there is a level of $\left(\bar{\theta}-\theta\right)$, denoted by $\left(\bar{\theta}-\widehat{\theta}\right)$, such that, below this level, the investment in human capital is zero; whereas, above this level, the investment is positive. Under the Neoclassical scenario, long-term growth is always zero, while in the Endogenous model it can be either negative or positive. As the representative family can choose the type of production function (depending on whether they invest in human capital or not), they choose the Neoclassical model when the Endogenous model leads to a negative growth rate, and vice versa. As a matter of fact, it can be shown (see Appendix A.3) that the Endogenous model leads to greater utility when the growth rate of capital is positive; i.e., let τ be the time when the economic growth in the Neoclassical model is zero, so, if $\frac{\dot{K}}{K} > 0$ for $t \geq \tau$, then $V_{Ht} > V_{Lt}$, where V_{Ht} is the indirect utility function under the Endogenous model in time t, and V_L is the indirect utility function under the Neoclassical model in time t.

Since the rate of discipline in equilibrium is a function of Z, i.e., $\theta^* = \theta\left(Z, K_{t=0}, \bar{L}, H_{t=0}, \bar{\theta}, \underline{\theta}, \rho\right)$ and $\left(\partial\theta^*/\partial Z\right) < 0$, then high levels of Z indicate a tendency to continue using traditional technology, and investment in human capital would not be profitable; in this case, we say that the representative family follows the Neoclassical model. On the other hand, for low values of Z, the representative household would be willing to specialize, to take advantage of economies of scale, to accept or generate new production technology, and hence, to make human capital investment profitable. In this case, we said the representative family would be in the Endogenous model. Using this idea, we can build a figure showing the indirect utility functions in relation to the value of Z. First, we know that $V_H(Z=0) > V_L(Z=0)$, $V_H(Z=\bar{Z}) < V_L(Z=\bar{Z})$ and that $V(\cdot)$ is continuous; then, there is a value of Z, denoted $\widehat{Z}$ such that $Z < \widehat{Z}$, and the indirect utility function of the Endogenous model will be greater than the indirect utility function using the Neoclassical model.

If we combine what was said in the last two paragraphs, then $\widehat{Z}$ can also be defined as a Z such that in equilibrium $\left(\bar{\theta}-\theta^*\right) = \left(\bar{\theta}-\widehat{\theta}\right)$. Also, the graphical representation of the indirect utility function is the upper envelope curve of the two lines (V_H and V_L) in Fig. 4.

We can determine certain characteristics of a family in accordance with the family's position with respect to point $\widehat{Z}$—or what is the same, with respect to point $\left(\bar{\theta}-\widehat{\theta}\right)$. When the representative family follows the Neoclassical model, economic growth is zero, but when it follows the Endogenous model, economic growth is

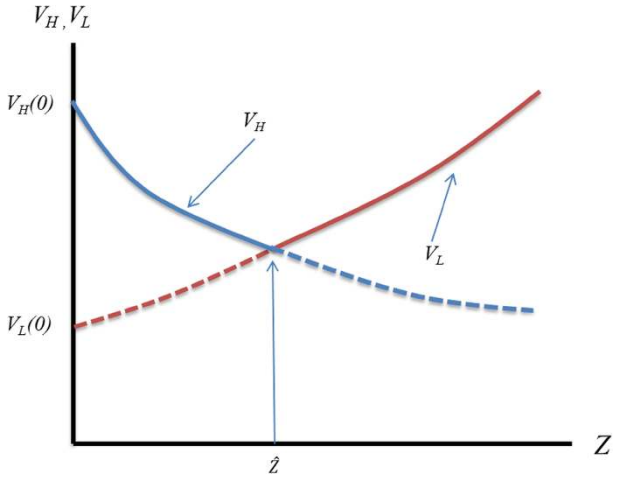

Fig. 4 Indirect utility for Neoclassical and Endogenous models. Source: Figure elaborated by the author

positive. Nonetheless, the transition only implies a small change in the economic behavior of the representative family. Really, this change has three implications. The first is a move from zero economic growth (Neoclassical model, equation T8.1) to very low economic growth (Endogenous model, equation T9.1, in which the term $A\left(\bar{\theta}-\theta\right)-\rho$ is close to zero). Second, it assumes that the representative household begins to place greater importance on the use of new production technology, and it is willing to accept some economic specialization, some hierarchies and so forth, although still on a limited basis. Third, it assumes that the representative family is willing to change production technologies, to absorb new knowledge, to accumulate knowledge and, finally, to spread and expand on knowledge. The transition between the two models should be smooth. It is basically a change, possibly imperceptible, in incentives.

The next section shows empirical evidence for the economic growth of Mexican indigenous communities. The section focuses on the relationship between weight of Z and the economic growth rate, and the type of economic growth model (Neoclassical or Endogenous) with which indigenous societies can be analyzed.

5.3 Empirical evidence about economic growth and the cultural factor

The conclusion of the theoretical economic growth model is that, if Z is large, growth is going to be very slow or non-existent, because communities will not be making use of economic specialization. In Sect. 3.2 I included evidence that Mexican indigenous people prefer to work on a small scale (the Cultural Factor), and in Sect. 4.4 I showed that they sell goods with low economies of scale, which is consistent with the Cultural Factor. But, if the Cultural Factor influences the economic behavior of Mexican indigenous people, then, according with the economic growth model shown in the previous section, this population's economic growth must be very slow or non-existent.

Table 11 Public services and house building materials

	Piped water (%)	Resistant home construction materials (%)	Water, electricity and drainage (mean [0–3])
1950	17.1	21.0	
1960	23.5	30.3	
2010	88.5	70.9	2.58
Rural areas			
Non-indigenous	78.8	50.4	2.11
Indigenous	67.9	30.3	1.76

Source: INEGI

Traditionally, the way to determine economic growth is using data about production over a specific time period, but this kind of data is not available for the Mexican indigenous population. Thus, we are going to compare the material welfare of the indigenous population in two time periods and analyze the differences, to make conclusion about economic growth.

The first time period is the decade of the 1930s, and the second is the year 2010. There is a very good study about the lifestyles of indigenous people in Mexico in the 1930s (Basauri 1940); the writer (and/or his assistants) visited almost all indigenous communities, so he could be able describe the environment, the economy, the lifestyle and so forth. According to this research, indigenous people lived in rural communities, did not have access to any public services (like electricity or running water or pipes) and lived in houses built with traditional materials, depending on the climate and natural resources available locally. In general, the floors in houses were not made of cement, the walls were made of adobe, mud, palm, wood or clay, and the roofs were constructed with straw, wood, shingles or roof tiles with beams.

In the 1930s, it was fairly common for there to be a lack of public services and for houses to be built with rustic materials, both in rural communities and in cities. There are no census data available for the decade of the 1930s, but there is information from the 1950 and 1960 censuses. As shown in Table 11, in 1950, only 17.1 % of houses had running water, mostly in major cities. In contrast, in 2010, 88.5 % of houses had running water, including 78.8 % in non-indigenous communities in rural area and 70 % in rural indigenous communities. Also, in 1950, only 21 % of houses were built with resistant materials, most located in the cities or on large haciendas. In 2010, 70.9 % of houses were built with resistant materials; the rate is 50.4 % for non-indigenous inhabitants of rural areas and 30.3 % for rural indigenous families.

Public services and building materials are better today that those in the 1930s, but this is not necessarily due to positive economic growth in indigenous communities. To begin with, the government provides public services. Also, decisions about house building materials are influenced by customs and adaptation to the environment; thus, building materials do not necessary respond to budge constraints. In addition, there are also assistance programs that finance the materials used to build houses.

Table 12 Gas or electric stoves and televisions

	Total	Four states with the highest percentage of indigenous inhabitants			
		Chiapas	Oaxaca	Quintana Roo	Yucatán
Gas or electric stoves (%)					
1960	17.5	3.6	2.0	3.0	5.6
2010	90.0	60.1	67.4	84.7	73.9
Rural areas					
Non-indigenous	84.9	59.0	73.8	79.6	73.2
Indigenous	36.9	11.4	40.1	32.7	38.6
Televisions (%)					
1960	0.4	0.0	0.1	0.1	0.1
2010	93.2	76.7	76.1	92.5	92.9
Rural areas					
Non-indigenous	89.3	80.4	80.8	84.4	94.0
Indigenous	62.1	43.5	57.8	75.6	83.1

Source: INEGI

To directly examine the economic growth of indigenous societies in light of endogenous factors, I am going to analyze domestic commodities, which depend directly on the budget constraints. I chose to compare possession of gas or electric stoves and televisions in 2010 with possession in 1960, because there are no data available for earlier periods. The source consulted for the 1930s does not even mention the existence of stoves or televisions in indigenous houses. However, as with public services and other indicators, this was typical in Mexico at the time, as we can see in Table 12. In 1960, only 17.5 % of homes had gas or electric stoves, and virtually no one had a television. Currently, 90 % of families have a stove; the rate is 84.9 % for the non-indigenous population in rural areas, and only 36.9 % in indigenous rural communities. Only 11.4 % of indigenous households in Chiapas own a stove, and this rate declines to 8.6 % for Tzeltal communities in Chiapas. Currently, 93.2 % of households own a television; the rate is 89.3 % in non-indigenous rural area, and 62.1 % for indigenous families.

After analyzing these data, we can conclude that, on average, the material welfare of indigenous communities has increased since the 1930s, but this increase has been significantly lower than that for the general Mexican population.

The differences between communities provide valuable evidence. To analyze the current situation of indigenous communities, we separated domestic commodities into basic commodities (gas or electric stove, refrigerator, shower, boiler, washing machine and telephone) and non-basic commodities (television, cell phone, computer, Internet access and car). Also, we once again separated communities in three groups, as in Sect. 3.2.2.

As noted in Table 13, on average Mexicans have 4 of the 6 basic domestic commodities. Yet, this number decreases to 2.81 in non-indigenous rural areas, and to only 1.18 for indigenous communities. Group 1, on average, only has 0.41 of 6

Table 13 Material welfare indicators by group

	Stoves %	Basic commodities Mean [0–6]	Non-basic commodities Mean [0–5]	Public services Mean [0–3]	RET
Total	90.0	4.00	2.57	2.58	
Rural areas	77.2	2.81	1.81	2.11	
Indigenous	36.9	1.18	0.97	1.76	
Group 1					
Tlapanecs	18.9	0.53	0.49	1.32	1.52
Tzeltals	8.5	0.33	0.49	1.73	1.46
Tzotzils	12.3	0.38	0.64	1.91	1.37
Chols	14.5	0.53	0.58	1.81	1.20
Mean Group 1	**12.1**	**0.41**	**0.56**	**1.77**	
Group 2					
Huastecs	25.3	0.80	0.83	1.29	1.07
Mixes	39.6	1.01	0.78	1.71	1.07
Mazatecs	26.9	0.76	0.72	1.35	0.94
Chinantecs	38.1	1.39	0.91	1.57	0.91
Mixtecs	37.9	1.07	0.83	1.64	0.91
Nahuas	37.5	1.12	0.99	1.80	0.81
Totonacs	31.1	0.97	0.86	1.84	0.79
Mean Group 2	**35.7**	**1.06**	**0.91**	**1.70**	
Group 3					
Purépechas	41.3	1.39	1.35	2.03	0.77
Zapotecs	56.3	1.77	1.14	1.94	0.66
Mayas	39.3	1.96	1.38	1.86	0.41
Otomies	71.7	2.05	1.38	2.03	0.39
Mazahua	74.3	1.56	1.36	1.82	0.24
Mean Group 3	**53.3**	**1.86**	**1.32**	**1.92**	

Source: INEGI 2010

possible basic commodities and 0.56 non-basic commodities, even when public services (such as electricity and running water) are available. Their high level of self-employment, which means they do not take advantage of economies of scale, coupled with their limited trade, has led to virtually non-existent economic growth. In fact, except for government and private sector assistance programs, a large share of the population of this group lives in the same way as they did in the 1930s.

The second group, as noted in Sect. 4.4, specializes in the production of commercial crops. In some cases, farmers hire employees; generally, these employees are also part of a very important migration group. So, the indigenous communities of Group 2 take advantage of economies of scale, albeit to a limited degree. Ultimately, they have at least one basic and one non-basic commodity. The economic growth of Group 2, although modest, has been positive.

Finally, the third group has the smallest ERI, meaning the lowest influence of the Cultural Factor. This has led the group to have the highest levels of migration and the lowest self-employment levels, and to take greater advantage of economies of scale and significant trade, all of which has resulted in Group 3 communities having more basic and non-basic commodities than other groups.

Previous analysis does not distinguish between the exogenous and endogenous factors that affect the economic growth of indigenous communities. To analyze the origin of the factors, Table 14 includes the results of an intra-community analysis of economic wellbeing in relation to employment status. This Table shows the average number of basic and non-basic goods and average quality of housing, for people who are self-employed, employees or agricultural day laborers. It is important to point out that most employees in these communities are public workers, such as teachers, but there are also employees that work in private firms, with similar incomes in all communities studied and thus the limited disparities for the three indicators for employees in the different communities, especially in terms of basic commodities.

I can provide the following analysis: for Group 1, indicators differ greatly for employees and for self-employed individuals and day laborers. This difference is mainly due to problems with land tenure, religious conflicts and the consequences of the Zapatista revolution. As we saw in Sect. 3.2.2, these factors have led families to own small parcels of land (mainly for subsistence agriculture) and to produce crafts to have monetary income, so that their income is extremely low. On the other hand, employees receive a salary and the same benefits as employees in other communities do. Also, as the degree of traditionalism in a community decreases, basic and non-basic indicators of welfare increase, as does quality of housing; thus, the differences between self-employed individuals, employees and agricultural day laborers decrease.

Exogenous factors affect the whole community. (For example, if there is discrimination, it is against everyone). However, Table 14 shows that the income of employees is similar across indigenous communities. This is not the case for those (self-employed individuals and agricultural day laborers, the most representative workers in each indigenous society) whose welfare depends on their degree of traditionalism (i.e., welfare depends on ERI and, therefore, on the Cultural Factor). If the origin of the Cultural Factor were exogenous, then there would not be a gap in incomes within communities.

The conclusion of the theoretical economic growth model is that, if Z (measured in terms of ERI) is large, growth (measured in terms of commodities) is going to be very slow or non-existent, as I show in Fig. 5. This is because the economy will not be making use of economic specialization.

So, what happened between the 1930s and today?

First, it is important to keep in mind that the indigenous communities that exist today are the ones that have made extensive use of their defense mechanisms. Many others lost their indigenous status because, as they incorporated new production technologies and new forms of work organization, their members would stop using their indigenous language and, therefore, in time would no longer be considered indigenous. It can be said then that current indigenous communities are those with a

Table 14 Material welfare indicators by group and employment status

	Basic commodities			Non-basic commodities			Quality of housing		
	Mean [0–6]			Mean [0–5]			Mean [0–3]		
	Self-employed	Employees	Agricultural day laborers	Self-employed	Employees	Agricultural day laborers	Self-employed	Employees	Agricultural day laborers
Group 1									
Tlapanecs	0.47	2.06	1.08	0.43	1.61	1.07	0.25	0.67	0.42
Tzeltal	0.43	2.14	0.71	0.57	1.76	0.71	0.38	0.65	0.40
Tzotzil	0.50	1.73	0.44	0.74	1.64	0.68	0.48	0.63	0.47
Chol	0.61	2.25	0.85	0.65	1.80	0.78	0.44	0.67	0.49
Group 2									
Huastecs	0.88	2.73	0.57	0.92	1.92	0.77	0.43	0.70	0.35
Mixes	1.27	2.97	0.80	0.98	2.04	0.73	0.54	0.75	0.51
Mazatecs	1.21	2.37	0.54	1.03	1.69	0.61	0.48	0.71	0.36
Chinantecs	1.62	2.66	1.36	1.12	1.83	0.92	0.52	0.67	0.47
Mixtecs	1.45	2.91	1.44	1.11	2.03	1.30	0.52	0.73	0.52
Nahuas	1.58	2.83	0.86	1.26	2.00	0.86	0.58	0.75	0.50
Totonacs	1.34	2.72	0.74	1.10	1.80	0.76	0.60	0.71	0.50
Group 3									
Purépecha	1.76	2.88	0.95	1.58	2.27	1.15	0.55	0.63	0.46
Zapotecs	2.07	3.51	1.38	1.38	2.48	1.03	0.61	0.75	0.57
Mayas	2.21	3.13	1.71	1.55	2.23	1.26	0.71	0.76	0.71
Otomies	2.44	3.11	1.75	1.69	2.04	1.26	0.78	0.84	0.74
Mazahuas	2.28	2.67	1.55	1.83	1.72	1.47	0.73	0.84	0.66

Source: INEGI 2010

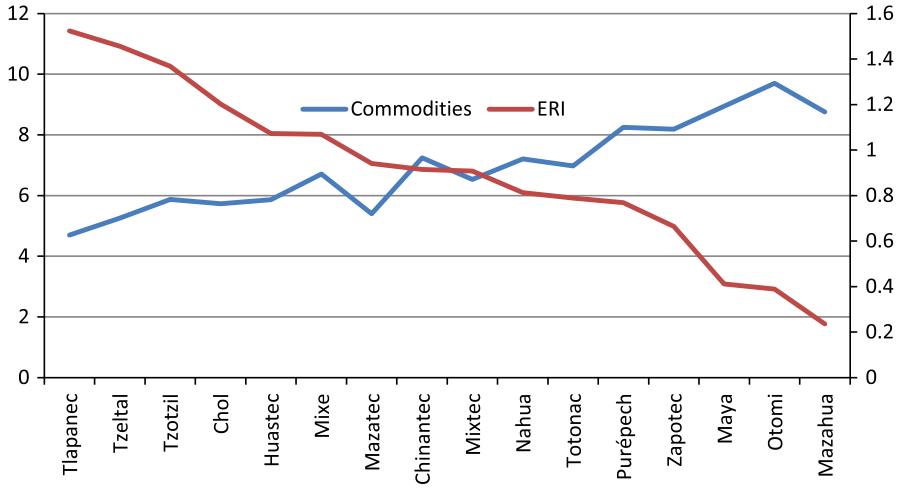

Fig. 5 Basic commodities versus the ERI. Source: INEGI 2010 and ERI data (Ordorica et al. 2009)

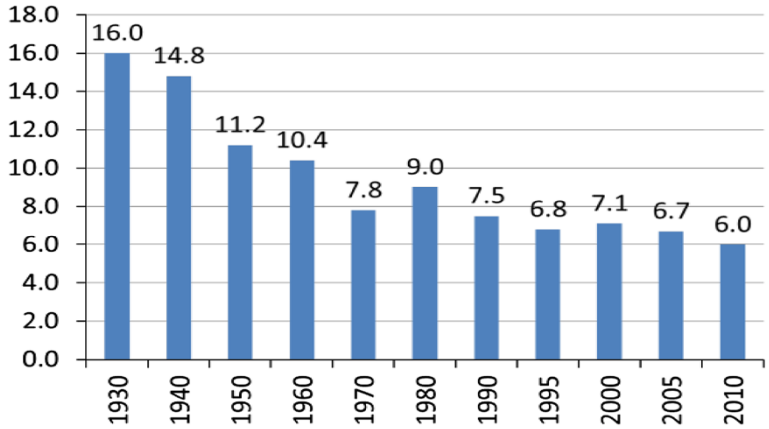

Fig. 6 Percentage of indigenous inhabitants with respect to total population. Source: INEGI

heavy cultural influence (Z). Figure 6 shows the percentage of indigenous inhabitants with respect to total population, according to census data. We can see that, from 1930 onwards, the percent of indigenous inhabitants has decreased significantly, especially between 1940 and 1950; this is due to migration and the loss of the migrant's indigenous status. Lack of land, culture and high birth rates led many indigenous communities to become "ejectors" of people in dire conditions.

Second, the Cultural Factor is a very strong deterrent against growth, and the differences in growth between indigenous communities and the rest of society increase directly with economic specialization, which has become more evident since globalization took off.

6 Economic situation of the indigenous communities

As mentioned at the beginning of this paper, indigenous communities have always been located in the poorest parts of their countries.[27] This situation has internal and external causes. The main external causes are lack of opportunities, discrimination, liquidity constraints, barriers to increasing human capital and so forth; there are numerous of papers on this topic.[28] There are also several internal causes, such as the Cultural Factor analyzed in this paper, which is obviously an element that disrupts trade and hinders economic growth. Given the economic situation, it is desirable to implement social programs that increase the material welfare of indigenous communities, but the incentives must be different if communities conform to a Neoclassical model or an Endogenous model. In the first case, it is necessary to focus on internal causes of poverty and give communities incentives to move from the Neoclassical to the Endogenous model. Later, it will be necessary to focus on external causes of poverty, and give communities other kinds of incentives so that their economic growth rate will increase.

The first idea that comes to mind is reducing the influence of the Cultural Factor on trade and economic growth. However, any kind of judgment of the beliefs and values of indigenous communities, in particular the Cultural Factor, is beyond the scope of this work. Nevertheless, it is important to consider the effects of these beliefs and values on the development of public policy. Consider, for example, the case of Tibetan monks, who have lived in the same way for generations and used their time and resources to develop their minds. Also consider ecological communities whose beliefs prevent them from altering their surroundings, and who live as one with Nature. In these cases, it does not seem right to even contemplate changing the community's beliefs. However, when cultural elements are contrary to certain generally accepted principles (as in the case of the mistreatment of women) and/or compliance with traditions can adversely affect the community, then intervention is desirable.

In the next two sections, I present ideas for an assistance program aimed at increasing the indigenous population's material welfare. In Sect. 6.1, I assume that communities follow the Neoclassical model, and the goal is to move them to an Endogenous model. In Sect. 6.2, I assume that communities already follow the Endogenous model. I will analyze the empirical case of Mexican indigenous peoples, according to data collected in Sects. 3.2, 4.4 and 5.3. As we show, indigenous communities in Group 1 and some in Group 2 have the characteristics of societies that follow a Neoclassical growth model, while the other indigenous communities in Group 2 and those in Group 3 comply with the Endogenous model. The empirical dividing line between the Neoclassical and Endogenous models is ambiguous; thus, Group 2 is considered to be a border group.

[27] See Cornell and Kalt (2000), Anderson and Parker (2009), Patrinos and Skoufias (2007), Psacharopoulos and Patrinos (1994), Hall and Patrinos (2006).

[28] For a complete description of the situation of indigenous peoples, country by country, see Hall and Patrinos (2006, 2010), and Patrinos and Skoufias (2007). For the United States, see Anderson and Parker (2009).

6.1 Indigenous communities under a Neoclassical growth model

Communities in Group 1 and some in Group 2 have the characteristics described by the Neoclassical model: these societies have a near-zero growth rate (the evidence indicates that these communities live in almost the same way as they did in the 1930s, except for changes in public services, as shown in Sect. 5.3), trade is almost all with products with constant economies of scale and, apparently, investment in human capital is not profitable, mainly because these communities have not adopted major technological changes. The reason for this situation is that the Cultural Factor is very strong (large Z) in these groups, as evidenced by their high ERI. Also, the social cost of the Cultural Factor is extremely high, as this cost includes both the poverty of community members and forced migration. Thus, these communities are in the lowest economic levels of society.[29]

Generally, technological change is an appropriate incentive for a community to switch from the Neoclassical growth model to the Endogenous growth model. The main argument for investment in human capital not being profitable in the Neoclassical model is that the technology used does not imply economic specialization. Obviously, the research and development (R&D) that takes place in the world involves economic specialization, and R&D focused on technology with little or no specialization and a small scale is very scarce. However, this type of technology would be the most direct way to induce a positive growth rate in communities with the Cultural Factor; in other words, since the growth rate is defined as $\gamma = A\left(\bar{\theta} - \theta^*\right) - \rho$, then a correct incentive would be to look for an increase in A. Since we have defined $A = f\left(H/K\right)$, it would be suitable to develop labor-intensive production technology without economic specialization, which would lead to investment in human capital being profitable.

Specifically, it seems that the solution to the widespread poverty of indigenous societies is to create a business scheme where some shared skills are utilized, subject to their culture. For example, these could include Proto-industrialization schemes (each family produces a different input), intermediate technology (technology developed for small-scale work; Schumacher 1973), small-scale creativity, introduction of business leaders (indigenous or non) into the community to introduce hierarchies, like a modern "big-man," and so forth. Now, I will present two examples of R&D focused on indigenous communities.

[29] The source of forced migration is easy to understand using the Neoclassical model, if we assume that physical capital is the land used for subsistence agriculture, which is limited, and we assume a positive population growth rate. In this scenario, capital per capita will be reduced to the point where it would be impossible to even survive; thus, at this point, some people would have to leave the community. Since people who migrate are strongly influenced by the Cultural Factor (Z), they have difficulty in adapting outside of the indigenous community. Given this situation, many migrant laborers live in extreme poverty (Morett and Cosío 2004) or are homeless.

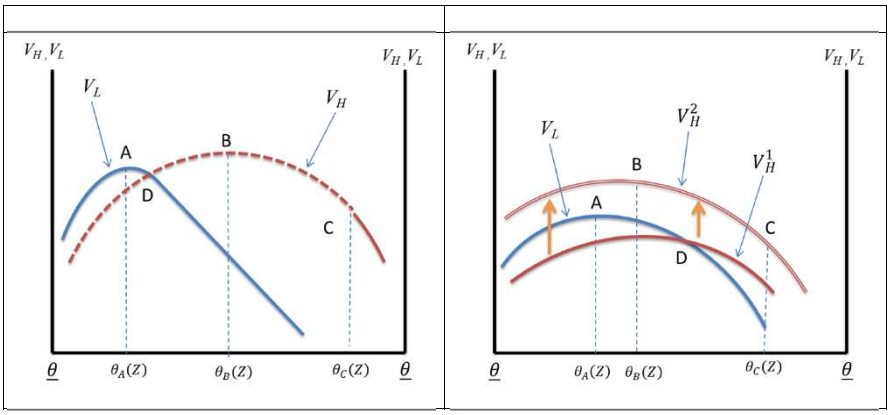

Fig. 7 Indirect utility versus discipline index. Source: Figure elaborated by the author

6.1.1 Indivisible production technology

In the two graphs in Fig. 7, the discipline index $\theta \in [\underline{\theta}, \bar{\theta}]$ is plotted (with relation to a fixed level of Z) on the horizontal axis, versus the indirect utility on the vertical axis, for both the Neoclassical model (V_L) and the Endogenous model (V_H). Both curves represent the indirect utility function, for different degrees of specialization, for a fixed weight Z.

The left graph shows the case of an indivisible production technology, in which the curve V_L represents the Neoclassical model (with no indivisibilities) and the V_H curve represents the Endogenous model, where I assume that this technology needs a minimum discipline index$\theta_C(Z)$. Therefore, the dotted sector of the curve V_H cannot be applied, precisely because of indivisibilities. In this case, under a Neoclassical model, the representative family chooses discipline $\theta_A(Z)$, represented by point A, because it is the level of discipline that provides the most utility. Note that the alternative choice is $\theta_C(Z)$, which has a very high level of discipline (large Z). Obviously, without indivisibilities, the optimum point would be B, which represents a level $\theta_B(Z)$. This is the case for the dilemma that indigenous community families face: to either work in factories and submit to factory discipline (contrary to their customs), thus increasing efficiency, or to work on a small scale (in their homes or in small groups, using technology inherited from their ancestors) following workshop discipline, with less efficiency. However, if intermediate technology is available for the indigenous people, they surely will choose this kind of technology, they will invest in human capital, and then, they will receive the material benefits of trade and economic growth.

6.1.2 Small-scale production technology

Small-scale production technology uses modern techniques to work with little or no economic specialization, such as marketing crafts, production of organic foods,

production of specific inputs and so forth. Small-scale production technology is different from Intermediate Technology in that the latter is a known production technology but without indivisibilities, while the former is a technology designed for a small scale. In the graph on the right in Fig. 7, traditional production technologies are represented by the V_L and the indivisible production technology by V_H^1 curves, with a given Z. In this scenario, the optimum would be at point A for traditional technology. Suppose there is a new production technology designed to take into account the weight of Z. If it is possible to design a small-scale technology, the new relationship between the discipline index and the indirect utility function is the V_H^2 curve; in this case, the optimum would be B, in which human capital investment would be profitable. The small-scale production technology is related to not only the use of physical capital, but also to sales techniques, advertising, services and so forth. At this point what is really important is not so much technological achievement, but rather investment in human capital. Obviously, at this point a community can begin by investing in human capital to ensure that it is sustainable, which necessarily requires technological change.

This previous analysis has been very abstract. To be more concrete, let me say the following: There is a vast literature about the relationship between culture, entrepreneurship and economic growth (Doepke and Zilibotti 2014). According to this literature, all countries or regions have entrepreneurs (some countries more than others, in accordance with their culture). In some way, the Cultural Factor that is analyzed in this paper leads to the absence of entrepreneurship. Thus, assistance programs could, as a part of their strategies, promote partnership between entrepreneurs and communities; entrepreneurs could develop new technology (e.g., small-scale production technology, marketing technology, new types of hierarchies, etc.) and indigenous communities could produce the items, with their craft abilities. The entrepreneurs might be in universities and the indigenous communities in rural areas, but the adventure of working together can produce true wonders (if also useless things). The key is that the entrepreneurs would be aware of the Cultural Factor, and they could use their intellect and their imagination to increase efficiency. The government would then need to provide assistance, money and financing to reduce the risk to indigenous communities.

6.2 The case of the endogenous model

Communities that demonstrate the characteristics of an Endogenous model of economic growth, like the indigenous communities in Group 3 and some of those in Group 2, are willing to invest in physical and human capital, so that programs would need to focus more on exogenous issues. As we can see in section 4.4, in these communities, an important part of the EAP works in specialized jobs; these communities also mainly produce agricultural goods for export, and the sale of crafts has a degree of vertical integration. However, as we can see in Sect. 5.3, these communities still face serious poverty. Therefore, there appear to be external factors that hinder economic development.

7 Conclusions

The evidence suggests a relationship between the historical circumstances experienced by indigenous peoples, their current economic behavior and their poverty. Historically, indigenous peoples have endured colonialism, defending their land for a very long time and usually losing their original possessions. In response, they constructed their own sets of institutions and culture, including a very strong attachment to their land, non-dominant social groups and a social preference for working in small family businesses (on their lands or in workshops). However, these institutions and culture are no longer economically viable, so indigenous peoples generally live in some of the poorest regions in their countries.

The present paper suggests the following hypothesis to link the historical and current behavior of indigenous communities: During the Colonial period, indigenous societies needed to produce a large amount of public goods, mainly for their defense, so they created and implemented a strategy of social and economic egalitarianism among their members. Thus, indigenous societies implemented egalitarian norms, and the production of public goods became more efficient. In the end, the egalitarian norms became rooted in indigenous culture and were incorporated into beliefs, values, rituals and so forth.

There are two main egalitarian norms: communal resources and preference for workshop discipline to factory discipline (or, simply, for working on a small scale). The first norm has been widely studied, especially since Hardin published his paper "The Tragedy of the Commons" in 1968. This second norm is precisely what I am considering as the Cultural Factor, associated with the self-employment culture and small-scale work.

This paper presents empirical evidence to support the existence of egalitarian norms among the Mexican indigenous population. To do so, the paper analyzes self-employment factors among and within indigenous communities, including ERI, which is a measure of the influence of tradition within societies. The result is that the higher the ERI of a community, the higher its self-employment rate.

The paper also analyzes the effects of the Cultural Factor on the economic behavior of indigenous societies, mainly in terms of trade and economic growth. The paper examines trade in terms of the inter-industry trade model developed by Krugman (1979), with the addition of the Cultural Factor to the model. The result is a trade model that contemplates cultural differences. However, societies that engage in trade (both those with and without the Cultural Factor) do not experience many of the material benefits of trade, although they increase their utility. The empirical evidence analyzed shows that Mexican indigenous communities mainly export both agricultural products and crafts, which are products with constant economic scale.

The second model shows that the economic growth of a society with the Cultural Factor is limited. In fact, it is possible to explain the sources of economic growth using either a Neoclassical or an Endogenous economic growth model. A Neoclassical growth model can explain the economic behavior of the poorest indigenous communities, in which the Cultural Factor has significant weight. However, an Endogenous growth model that considers both physical and human capital can explain the economic behavior of less impoverished indigenous societies. As in the

previous case, empirical evidence indicates that higher ERI leads to lower material welfare. In fact, I also present evidence that the economic lifestyle of some indigenous peoples in Mexico has not changed between the 1930s and today.

Section 6 suggests some incentives for indigenous communities to abandon traits that confine them to a Neoclassical model, so that they may move toward an Endogenous model. Once indigenous communities are in an economic situation that can be explained by an Endogenous economic growth model, the economic authorities can use social programs to achieve positive rates of economic growth. Several social programs have been used with success, as they do not address endogenous variables that can reduce efficiency, like the Cultural Factor.

As mentioned above, Sects. 4.4 and 5.3 of the paper address empirical evidence for trade and economic growth models. In these sections, the largest indigenous communities were divided into three groups, depending on the influence of traditions within society, measured by the ERI. Group 1 consists of communities that closely follow their traditions, including the Cultural Factor. This Group has the highest level of self-employment among the three groups analyzed, and it has a low utilization of economies of scale, insignificant trade and a high share of subsistence agriculture, all of which lead to low material welfare. Group 2 has a lower level of self-employment and a more important share of workers engaged in commercial agriculture than Group 1 does. The level of material welfare is also higher for Group 2 than for Group 1. Finally, Group 3 comprises the least traditional communities. This group has an important trade in agricultural products and crafts, and it has a significant share of workers under factory discipline, all leading to its level of material welfare being the highest of the three groups.

We can conclude that indigenous communities share the cultural factor *it is preferable to work on a small scale*, which can be seen in their high rates of self-employment. Also, communities with a high degree of traditionalism (that closely follow the Cultural Factor) have less trade and lower economic growth than less traditional communities, and thus, they exhibit lower material welfare, as can be clearly seen in Sect. 5.3. However, as shown in Sects. 5 and 6, it is possible for a community to have the Cultural Factor and still experience positive economic growth, because the Cultural Factor is part of the utility function for indigenous peoples, which implies that it is part of their welfare. However, for this to occur, technological change is necessary, as I show in Sect. 6.

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Mathematical Appendix

From the neoclassical to the endogenous production function

Let $Y = F\left[K, H, \left(\bar{\theta} - \theta\right)\right]$ be a production function with constant returns to scale on K and H, thus:

$$F\left[K, H, \left(\bar{\theta} - \theta\right)\right] = f\left(\frac{H}{K}, \left(\bar{\theta} - \theta\right)\right)K$$

Now, if investment in human capital is profitable, then the representative family will invest in both types of capital, i.e., $\dot{H} + \dot{K} = f\left(\frac{H}{K}, \left(\bar{\theta} - \theta\right)\right)K - c$. As can be appreciated, both types of assets may be interpreted as perfect substitutes, which implies that the profit rates for human and physical capital must be equal. As both the profit rates are the marginal productivity, thus:

$$f\left(\frac{H}{K}, \left(\bar{\theta} - \theta\right)\right) = f'\left(\frac{H}{K}, \left(\bar{\theta} - \theta\right)\right) + f'\left(\frac{H}{K}, \left(\bar{\theta} - \theta\right)\right)\frac{H}{K}$$

Since the function is homothetic, all solutions will have the same ratio rate $\left(H/K\right)$ and we can use this function as a constant, such as $A\left(\bar{\theta} - \theta\right) = f\left(H/K, \left(\bar{\theta} - \theta\right)\right)$ (Acemoglu 2009, Sect. 11.2; Barro and Sala-i-Martin 2004, Sect. 4.2). If we substitute the above equation into the production function, we have $Y = A\left(\bar{\theta} - \theta\right)K$, which it is the production function for the Endogenous model.

Maximization program

$$\max_{c,\left(\bar{\theta}-\theta\right)} H = \mathrm{e}^{-\rho t}\left[u(c) + Zg\left(\bar{\theta} - \theta\right)\right] + \lambda\left[F\left[K, R, \left(\bar{\theta} - \theta\right)\right] - c\right] \tag{A1}$$

FOC:

$$\frac{\partial H}{\partial c} = \mathrm{e}^{-\rho t}u' - \lambda = 0 \tag{A2}$$

$$\frac{\partial H}{\partial\left(\bar{\theta} - \theta\right)} = -\mathrm{e}^{-\rho t}g' + \lambda F'_{\left(\bar{\theta}-\theta\right)} = 0 \tag{A3}$$

$$\frac{\partial H}{\partial K} = \dot{\lambda} = -\lambda F'_K \tag{A4}$$

If we derive FOC with respect to time, we obtain the equations in Tables 9 and 10.

In the Exogenous model, $\gamma_K > 0 \rightarrow V_H > V_L$

The solutions of the Neoclassical and Endogenous models are as follows:

$c_H^* = c\left[K(t), H(t), \bar{\theta}, Z, \rho, A\right]$	$c_L^* = c\left[K_0, H_0, \bar{\theta}, Z, \rho, A\right]$
$\theta_H^* = \theta\left[K(t), H(t), \bar{\theta}, Z, \rho, A\right]$	$\theta_L^* = \theta\left[K_0, H_0, \bar{\theta}, Z, \rho, A\right]$

If in $t = 0$, $K(0) = K_0$ and $H(0) = H_0$, then $V_H(0) = V_L(0)$. As by hypothesis $\gamma_K > 0$ then, for $t > 0$, $K(t) > K_0$ and $H(t) > H_0$, thus $c_H^* > c_L^*$. In this case, families have more resources, and they can choose the discipline index that maximizes their utility function, then $V_H > V_L$.

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