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The Decline of Non-Military *Montepíos* in Early Mexico: A Historical, Actuarial, and Financial Approach

ABSTRACT

This article examines the historical and actuarial causes behind the decline of non-military *Montepíos* – public pension-paying institutions for civil servants in New Spain (early Mexico) – following the conclusion of the wars of independence in 1821. By combining historical, institutional and actuarial perspectives, it argues that their collapse resulted less from the fiscal and political turmoil of early independent Mexico than from their structural design flaws. These *Montepíos* operated as pay-as-you-go (PAYG), defined-benefits systems lacking mechanisms to balance contributions and payouts, leading to chronic underfunding. Through archival evidence and demographic data, this paper reveals a mismatch between short contribution periods and long deaccumulation periods, driven partly by gender and marriage patterns that extended the duration of survivor pensions. This study contributes to the understanding of how early welfare institutions in Spanish America anticipated the challenges of modern pension systems, demonstrating that institutional fragility often arises from the interaction between actuarial design and socio-demographic dynamics.

Keywords: *Montepíos*, actuarial imbalance, social assistance, New Spain, pension systems

JEL Classification: N26, N36, H55, J12, J14

Introduction

The purpose of this study is to identify the structural causes that led to the disappearance of non-military *Montepíos* in early nineteenth-century Mexico. These institutions represented one of the first public pension systems in the Americas, providing survivor benefits to the families of bureaucrats under the Spanish Crown. Their extinction, within only a few years (in the case of *Montepío de Ministros*) or decades (in the case of *Montepío de Empleados*) after independence, marks a significant moment in the non-linear evolution of social protection in Mexico. The central question addressed here is whether their demise was mainly due to macroeconomic and exogenous political shocks – such as the fiscal and institutional collapse following the wars of independence – or whether it originated in the actuarial and financial logic of their design. This article contends that these non-military *Montepíos* were structurally insolvent due to their benefit formula, demographic composition, and the absence of financial buffers or state support mechanisms.

Literature review

Research on *Montepíos* in Spain and Spanish America remains scarce and dispersed. Recent scholarship has approached the topic from three main angles: the origins of *Montepíos* within broader welfare traditions [Herráez-S. de Escariche, 1949; Rumeu-de Armas, 1944]; the study of military *Montepíos* and their institutional endurance [García-de la Rasilla, 1967; Herráiz-de Miota, 2005; Nadales, 2009; Sobrevilla-Perea, 2016]; and the link between *Montepíos* and the Bourbonic Reforms in American territories [see, in particular, Burkholder, Chandler, 1977; Arnold, 1988].¹

Chandler [1991] provided the most detailed account of the *Montepío de Ministros* and *Montepío de Empleados*, emphasising their financial deterioration and lack of actuarial foresight, although his work did not formalise the problem through an actuarial or financial model. The present study therefore extends his approach by integrating historical interpretation with actuarial reasoning to reassess the *Montepíos*' solvency and institutional legacy.

¹ The third category of literature could be further subdivided into four subgroups: (i) *Montepíos* as part of a fiscal system [Jáuregui-Frías, 1992, 1999], (ii) *Montepíos* as part of the Royal Bureaucracy [Burkholder, Chandler, 1977; Arnold, 1988]; (iii) *Montepíos* as a coercive mechanism in the viceregal marriage policy [Chandler, 1986; Sanciñena-Arsurmendi, 1999; Gálvez-Ruiz, 2019], and (iv) the inception and operation on non-military *Montepíos* with a historical, legal and social approach, without dealing with the causes of their demises [Covarrubias, 2000; Leonor-Roa, 2006, 2021; Nava-Tirado, 2022].

The evolution of social assistance in Mexico

The evolution of social assistance in Mexico cannot be understood as a straightforward, linear process.² Instead, it followed a trajectory characterised by discontinuities, coexistence of different welfare models, and institutional experimentation, with three components defining this trajectory.

The first component was the creation of a system of public and semi-autonomous welfare institutions in the late eighteenth century, such as *Montepíos*, that emerged before the secularisation of charity and the liberal reforms of the nineteenth century. These institutions were financially independent from ecclesiastical and mutual-assistance organisations, with the goal of professionalising public assistance and civil services through regulated, quasi-actuarial or formalistic mechanisms. The establishment of *Montepíos* in New Spain in the late eighteenth century represents the earliest attempt to link public service with long-term welfare obligations, and they were designed to be financially semi-autonomous from the Royal Treasury, a novel concept for the time.

The second component was the persistence of religious and pseudo-lay charitable organisations linked to religious ties, even after the rise of state-sponsored welfare initiatives. Despite liberal attempts to suppress Church-led assistance after independence, charitable associations linked with Catholic orders – such as the Ladies of Charity – continued to provide significant social aid well into the late nineteenth century. This coexistence of ecclesiastical and secular assistance mechanisms underscores the non-linear nature of welfare evolution in Mexico: secularisation did not replace charity but rather transformed it.³

The third component was the birth of the welfare state and the socialisation of healthcare in Mexico with the enactment of the Federal Law of Social Insurance in 1943.⁴ Nevertheless, by adopting Esping-Andersen's [1990] broad conceptualisation of a welfare state in terms of quality of social rights and stratification of the social citizenship, the mere approval of this federal law by the Congress, the subsequent operation of federal social insurance institutions, and the amount of money spent on these social security policies may not result in the establishment of an egalitarian welfare state in Mexico.

Together, these three components reveal that the evolution of social assistance in Mexico was not a linear transition from charity to state welfare, but rather a complex interplay between

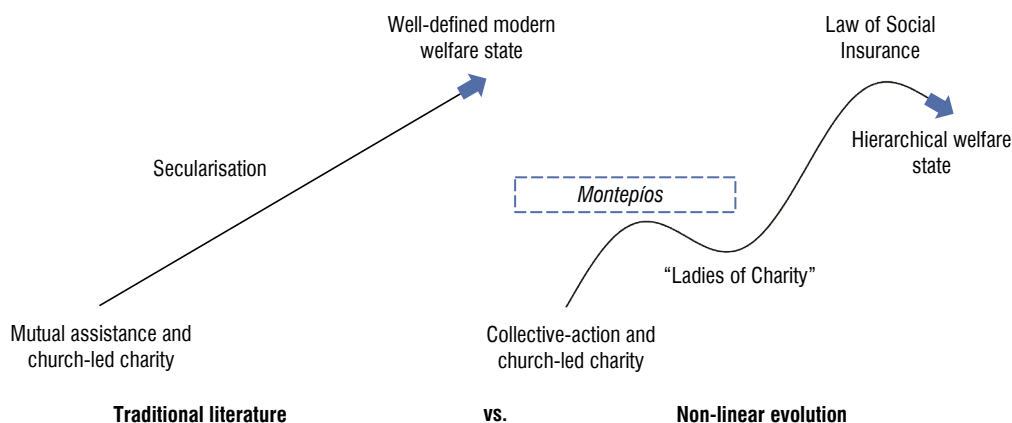
² Several authors [Pozas-Horcasitas, 1992; Fuentes, 1999; Farfán-Mendoza, 2008] tend to address a unique linear view of the historical discussion of social assistance in Mexico, in which such evolution started from collective action- and church-led charity in early Mexico (New Spain) to a gradual and forward-moving secularisation of social assistance – referred to as “modernisation” – and finalised with the formation of partially-defined modern welfare-state.

³ Arrom [2007] shows that even though liberal reforms sought to curtail and even shut down Catholic-led assistance organisations in the second half of the nineteenth century, Ladies of Charity remained highly active in the provision of a mixture of novel social assistance techniques and “colonial-roots” charity activities. Arrom infers cautiously that this association with deep religious roots would have been the major provider of social assistance in Mexico in the last half of the nineteenth century.

⁴ See Dion [2005] and Pozas-Horcasitas [1992].

fiscal innovation, religious continuity, and social experimentation. Figure 1 would illustrate this multi-layered trajectory, contrasting linear and non-linear narratives.

Figure 1. Non-linear evolution of social assistance in Mexico



Source: own material.

The *Montepíos*: institutional and financial design

Montepíos were pension-paying institutions for civil servants and army members, established under the Spanish Crown between 1761 and 1785. Among the five *Montepíos* that operated in New Spain,⁵ two were civilian and dedicated to providing pensions for survivors: the *Montepío de Ministros* (1770) and the *Montepío de Empleados* (1784). The first served high-ranking officials, mainly from the Audiencia of Mexico,⁶ while the second covered mid-level bureaucrats, and both were modelled after their Spanish counterparts but adapted to local administrative conditions.

They were pioneering in the Spanish Americas⁷ in separating welfare provision from religious confraternities and introducing novel aspects in the institutional design, governance rules overseen by a Board of Directors, funding model and risk-sharing scheme, benefits scheme, and rules of eligibility, among others. Moreover, this system incorporated other innovative aspects: it functioned as a mechanism of coercion within private spheres such as marriage policy and marital life, and included a portability feature that allowed employees to transfer their benefits when moving to another *Montepío*.⁸

⁵ The system of *Montepíos* in early Mexico was: *Montepío Militar* (created in 1761), which provided pensions for the survivors of the Army's members; *Montepío de Ministros* (created in 1770); *Montepío de Inválidos* (1773), which served as a disability insurance provider for injured army members due to war activities; *Montepío de Empleados* (1784), and *Montepío de Pilotos* (1785), which provided pensions for the survivors of navy officials.

⁶ Similar to the present-day Supreme Court of Justice.

⁷ Though not in Mediterranean Europe, where the original concept of *Montepío* originated.

⁸ See *Reglamento Ministros* and *Reglamento Empleados*.

Each *Montepío* operated financially and operationally independently of the others, although they shared a similar institutional architecture, such as comparable systems of corporate governance, regulation and supervision.⁹

The financial design of these *Montepíos* relied on a three-part contribution scheme: an entry fee paid by new members,¹⁰ bi-monthly salary deductions paid by the bureaucrat as a fixed ratio of contribution per each “peso” earned,¹¹ and supplementary fees associated with promotions and vacancies.¹²

Their benefits system was defined by a fixed replacement rate – one quarter of the deceased member’s salary – paid to the widow and children. However, the benefits bore no actuarial relationship to the amount contributed. This structure effectively transformed *Montepíos* into a pay-as-you-go (PAYG) scheme, where ongoing contributions funded current pensions, a system that was sustainable only in the short run, as it depended on stable demographics and a continuous inflow of new members.

Chandler [1991] documented how both *Montepíos* rapidly faced liquidity and solvency problems, with the *Montepío de Ministros* bankrupt at the end of Independence Wars (1821), and the *Montepío de Empleados* struggling for survival before disappearing in the following decades.¹³ Their downfall reflected deeper actuarial and demographic issues: plan members were often elderly upon joining, while widows and daughters – who could receive lifelong pensions if unmarried – extended the duration of liabilities far beyond the expected accumulation period. Table 1 summarises the comparative structure, funding mechanisms, and lifespan of the two *Montepíos*.

Table 1. Comparative analysis of the two civilian *Montepíos* in New Spain

Feature	<i>Montepío de Ministros</i>	<i>Montepío de Empleados</i>
Year of establishment	1770	1784
Target group	Senior officials of the <i>Audiencia</i> and high-ranking bureaucrats	Mid-level bureaucrats and administrative staff

⁹ *Montepío de Empleados* and *Montepío de Ministros* initially encompassed not only the territories of present-day Mexico, but also included the territories of Cuba, Puerto Rico, Santo Domingo and Louisiana. However, during the Independence Wars in New Spain, communications disruptions were widespread between Mexico City and these distant territories. In response to this situation, for instance, a royal order in 1813 allowed Cuba’s treasury officials to declare and determine pensions provisionally. See Chandler [1991, p. 148].

¹⁰ Equivalent to a multiple of one month of the official’s net salary (“mesada”) for *Montepío de Empleados*. For the other *Montepío*, it was half a “mesada”. The plan member could pay the entry fee in instalments.

¹¹ See *Reglamento Empleados*, Chapter III, Section XII and *Reglamento Ministros*, Chapter I, Article III.

¹² The exit fee was due to the death of an official, funded by the local treasury where the job position was vacant. The upgrading fee was due to a promotion of the plan member, funded by the member. See *Reglamento Empleados*, Chapter III, Sections I–IV.

¹³ *Montepío de Empleados* followed a more complex trajectory. It was converted into a national Mexican bureau around 1821–1822, and by 1826 “pension payments lagged as much as a year and a half” [Chandler, 1991, p. 143]. In the following decades, the institution became largely moribund, unable to sustain pension payments on a national scale. Preliminary evidence indicates that the *Montepío* continued to provide pensions regularly to the beneficiaries of deceased employees in the Mint Office; however, it ultimately ceased to exist. See also *Title of Appointment* [1822].

cont. Table 1

Feature	<i>Montepío de Ministros</i>	<i>Montepío de Empleados</i>
Legal foundation	Royal decree under viceregal initiatives ^a approved by Royal Ministers (Spain) and the president of the Council of Indies	Royal licence under local initiative with some adjustments from the King
Funding sources	Entry fee (half a month's full salary); salary deductions (2.95% for each <i>peso plata</i> earned in full salary) ^b ; supplementary fees for promotions and vacancies (exit fee: two months' full salary; upgrading fee: one month's full salary); annual fee of \$3,000 pesos for major ecclesiastical vacancies	Entry fee (one month's full salary); salary deductions (2.95% for each <i>peso plata</i> earned in basic salary) ^c ; supplementary fees from promotions and vacancies (exit fee: three months' full salary, variable upgrading fees ^d); no additional funding from ecclesiastical vacancies
Benefit formula	Fixed proportion (25%) of the deceased official's last full salary, paid to the widow, unmarried daughters and minors	
Governance structure	Board composed of one director and four ministers. Each member held one vote. Decisions were independent, though dual mandates often conflicted with no clear order of precedence. Administered by a rotating board of officials under viceregal election	Board composed of one director and six ministers. Each member held one vote. Decisions were independent, though dual mandates often conflicted with no clear order of precedence. Administered by a rotating board of officials under viceregal election
Financial model	Pay-as-you-go (PAYG), defined benefit, with limited reserves	PAYG, defined benefit, with partial accumulation during early years
State support	Occasional and insufficient aid from the Royal Treasury, not guaranteed	No direct fiscal backing; it relied on member contributions and local treasuries. One instance of exceptional financial support granted in the late 1790s
Duration	1770–1821 (bankrupt after Independence)	1784–c.a. 1840 (ceased operations gradually after a liquidity and solvency crisis)
Main causes of collapse	Severe actuarial imbalance due to ageing membership and extended pensions to widows; insolvent by 1791	Actuarial imbalance, demographic asymmetry, and lack of capitalisation; likely insolvency by 1821

^a The Viceroy of New Spain, Peru and New Granada (present-day Colombia) submitted to the King their own initiatives for their respective jurisdictions.

^b Full salary refers to the member's gross salary before deducting entry fees to *Montepíos* or *Media Annata* contributions.¹⁴ Salary deductions in the *Montepío de Ministros* were actually higher than the periodic contributions required in the *Montepío de Empleados* due to the higher contribution base.

^c Basic salary corresponds to the full salary minus, where applicable, the entry fee and the *Media Annata* contribution associated with new memberships or job promotions.

^d Upgrading fees depended on whether the job position in question was subject to the payment of *Media Annata*.

Source: own material based on *Reglamento Empleados* and *Reglamento Ministros*.

Methodology

The research methodology combines qualitative and quantitative approaches to evaluate the structural soundness of non-military *Montepíos*. The qualitative framework draws from modern pension theory, applying three analytical dimensions to historical data.

¹⁴ Within the Spanish Crown's bureaucracy, individuals appointed to certain positions were required to contribute half of their annual salary to the Royal Treasury during their first year in office. This implicit tax, known as *Media Annata*, also applied to job promotions.

Qualitative framework: a modern pension theory approach

Firstly, the funding model distinguishes between PAYG and fully funded systems. Quantitative evidence (see Figure 2 and Tables 3–4) suggests *Montepíos* operated under a PAYG structure, with no reserve accumulation beyond the early years. Secondly, the risk adjustment regime is analysed through the lens of defined benefit versus defined contribution schemes. *Montepíos* followed a defined-benefit model, where the burden of financial imbalance was absorbed by the institution rather than transferred to recipients. Thirdly, the benefit formula examines whether marginal changes in contributions led to proportional changes in benefits. In *Montepíos*, such linkage was absent, revealing a misalignment between incentives and actuarial stability.

Quantitative framework: an actuarial model

The quantitative component uses a simplified actuarial model to formalise the relationship between assets and liabilities, expressed as inequalities 1 and 2, which represent the expected present value (PV) of assets and liabilities over finite and infinite horizons. In equations 3–6, assets comprise the discounted flow of entry fees, periodic contributions, and supplementary fees, while liabilities, depicted in equations 7–9, represent the stream of pension payments to survivors, adjusted for mortality and cessation probabilities.

A formal mathematical representation of this unsoundness is shown in inequality 1:¹⁵

$$E(PV Assets)_t < E(PV Liabilities)_t \quad \forall t, \text{ where } t = \{1, 2, 3, \dots\} \quad (1)$$

where:

- $t = 0$ is the inception of *Montepío* operation
- $E()$ is the expected value of a random variable or a function of a random variable
- $E()_t$ is the expected value, given the best information available at year t
- $PV Assets$ is the present value of *Montepío* assets
- $PV Liabilities$ is the present value of *Montepío* liabilities.

Nevertheless, the formation and evolution of *Montepíos'* assets and liabilities, as shown in equation 1, consist of a group of infinite summations, and the value estimations for some components may not converge. To avoid these caveats and given the finite life of non-military *Montepíos*, equation 1 can be narrowed down. If $t = V$ is denoted as the year when non-military *Montepíos* extinguished, then the last cohort of new plan members would be those who enrolled in year V , with the inflows of contributions for the ongoing and the new plan

¹⁵ This representation of actuarial unsoundness is similar to the definition of solvency, which refers to the capacity of a firm to meet its long-term commitments.

members ceased at V . Likewise, the provision of survivor pensions stopped at V .¹⁶ Therefore, inequality 1 can be adjusted as follows:

$$E(PV Assets)_t < E(PV Liabilities)_t \quad \forall t, \text{ where } t = \{1, 2, 3, \dots, V\} \quad (2)$$

where $t = V$ is the last year of *Montepío* operation.

Formation of assets

The first component of the inequalities, 1 and 2, is related to the expected value of assets of *Montepío de Empleados*, given the best information at year t , which comprises predominantly the expected value of the three-part contribution of the plan members, among other secondary expected assets. A decomposition of the first part of equation 1 is as follows (equation 3):¹⁷

$$\begin{aligned} E(PV Assets)_t = & NR \sum_{t=1}^{\infty} \frac{\prod_{j=1}^t (1 - \bar{m}_j)(1 + \bar{e}_j) \bar{w}_{Bt}}{(1 + r)^t} + N \sum_{t=0}^{\infty} \frac{\bar{e}_t (1/12) \bar{w}_{Ft}}{(1 + r)^t} + \\ & N \sum_{t=1}^{\infty} \frac{\bar{m}_t (3/12) \bar{w}_{Ft}}{(1 + r)^t} + N \sum_{t=1}^{\infty} \frac{(4/12 \bar{u}_{1t} \bar{g}_t) + (6/12 \bar{u}_{2t} \bar{g}_t)}{(1 + r)^t} + E(OA)_t \end{aligned} \quad (3)$$

where:

- N is the number of *Montepío* plan members (individuals) at its inception ($t = 0$)
- R is a constant and refers to the fixed contribution rate¹⁸
- $\bar{m}_t$ is the average mortality rate at year t ¹⁹
- $\bar{e}_t$ is the average enrollment rate at year t ²⁰
- $\bar{w}_{Bt}$ is the average yearly basic salary of plan members at year t
- $\bar{w}_{Ft}$ is the average yearly full salary of plan members at year t

¹⁶ While the provision of *Montepíos'* pension ceased at V , it is possible that these liabilities could be recognised in the balance sheets of different state or national accounts. In that case, these liabilities would not cease after year V .

¹⁷ This functional form of the asset side is based on *Reglamento Empleados*, Chapter III, Sections I–IV. The functional form of the asset formation for *Montepío de Ministros* has minor differences.

¹⁸ The contribution rate is a constant rate for each *peso* earned by the plan member. According to *Reglamento Empleados*, the salary deductions are 8 silver *maravedís* per *peso fuerte*. *Peso fuerte* was not typically used as currency in New Spain. Instead, “ocho reales de plata” was used, commonly referred to as *peso*. According to Marichal, Topik, Frank [2017], Chapter 1, p. 9, one *peso fuerte* and *ocho reales de plata* was identical in value and equal to 272 *maravedís*. Thus, the contribution rate is equal to 8/272, or equivalently 1/34, which is approximately 2.94% per *peso plata* or *ocho reales de plata*.

¹⁹ It can be argued that $\bar{m}_1$ (at $t = 1$) is close to zero. However, $\bar{m}_t$ tended to go up in the subsequent years ($t \neq 0$) reaching a steady-state value as $t \rightarrow \infty$. We assume that this steady-state value is equal to $\bar{m}$ in equation 5.

²⁰ $\bar{e}_0 = 1$, since, at the inception of non-military *Montepíos*, all plan members must contribute to the entry fee in accordance with their respective New Spain's *Reglamentos*. However, this specific value is only used in the second component of equation related to the entry fee. This fee was paid in six instalments in the first year of being a plan member. See *Reglamento Empleados*, Chapter III, Section I.

- $\bar{g}_t$ is the average annual wage differential ($\Delta \bar{w}_F$) between the plan member's previous average full salary and the actual upgraded average full salary²¹
- $\bar{u}_{1t}$ is the proportion of plan members who obtain a promotion, and their job posts are subject to the payment of *Media Annata*
- $\bar{u}_{2t}$ is the proportion of plan members who obtain a promotion, and their job posts are not subject to the payment of *Media Annata*
- r is the annual rate of opportunity cost of \$1 *peso* of contributions²²
- $E(OA)_t$ is the expected value of other *Montepío* assets, given the best information available at year t .

The first summation is the present value of the flow of expected periodic contributions based on the contribution rate (R) as a multiple of the average basic salary ($\bar{w}_{Bt}$). Although R is fixed, the number of plan members is variable each year due to their intrinsic demographics, starting with N plan members at $t = 0$, with new plan members entering the pension plan (based on the average annual enrolment rate ($\bar{e}_t$) at each year) and exiting the pension plan (based on the average annual mortality rate ($\bar{m}_t$)) in subsequent years.

The second summation is the present value of the flow of entry fees based on $\bar{e}_t$. Contrary to other components, this summation starts on $t = 0$, as, at the inception of the *Montepío*, plan members must contribute one *mesada* to pay the entry fees.

The third and fourth summations are related to supplementary fees due to vacancies. In that respect, the third one is the present value of the inflows of exit fees, paid by the local treasuries, due to the death of plan members. The key variable is $\bar{m}_t$, and the amount paid for each deceased official is equivalent to three *mesadas*. The fourth is the present value of the inflows of upgrading fees due to job promotions for the members. The amount paid depends on whether the job post was subject to the *Media Annata* contribution (four *mesadas* if the job is subject to *Media Annata*, six *mesadas* if otherwise).

The last element is the expected value of other assets, not related to the three-part contributions.²³

²¹ It can be assumed that $\bar{g}_t = \Delta \bar{w}_F = (\bar{w}_{Ft} - \bar{w}_{Ft-1})$.

²² Chandler [1991, pp. 152–153] implicitly assumed an annual discount rate of 5%, derived from the interest rate imposed on *Montepíos*' borrowings (opportunity cost) and loan requests made to *Montepíos* by credit applicants during its operation. See, for instance, various volumes and files ("exp") of AGN's Series 075, such as: vol. 1, exp. 9, 10 and 15; vol. 10, exp. 5; vol. 11, exp. 1, 6, 10, 11, 17, 18 and 19; vol. 12, exp. 1; vol. 14, exp. 36 and 46. This rate coincides with other sources, including Dehouve [1993, p. 22]. TePaske [1998, p. 94] shows that in the late eighteenth century and the first two decades of the nineteenth century, New Spain's government issued debt with an annual fixed rate of 4% or 5%, backed by the inflows of the tobacco state monopoly or the customs unit. This government debt aimed to fund the systemic annual public deficits. At least during the late 1700s and the first two decades of 1800s, the annual discount rate is assumed to be 5% and constant over this period. However, during Mexico's state formation following its independence, it is likely that the opportunity cost of money increased due to the financial crises of federal and central governments and the underdeveloped domestic market for public debt. Marichal [2015, pp. 202–203] stated that active interest rates during the 1820–1850 period in Mexico ranged from 12% to 40% for short-term commercial loans and from 30% to 200% for government loans. Thus, the estimated yield curve would be flat from the inception of non-military *Montepíos* to 1821, and then it could vary according to a non-flat yield curve. This study assumes a flat yield curve in this section for simplicity.

²³ In this last term, the upper limit would be the market value of loans lent by the *Montepío*, and the lower limit would be the fair value of the collaterals, i.e. real assets as mortgages.

The previous equation 3 can be simplified as follows (equation 4):

$$\begin{aligned}
 E(PV Assets)_t = & NR * \lim_{T \rightarrow \infty} \left(\sum_{t=1}^T \frac{\prod_{j=1}^t (1 - \bar{m}_j)(1 + \bar{e}_j) \bar{w}_{Bt}}{(1+r)^t} \right) + \\
 & \frac{N}{12} * \lim_{T \rightarrow \infty} \left(\sum_{t=0}^T \frac{\bar{e}_t \bar{w}_{Ft}}{(1+r)^t} \right) + \frac{N}{4} * \lim_{T \rightarrow \infty} \left(\sum_{t=1}^T \frac{\bar{m}_t \bar{w}_{Ft}}{(1+r)^t} \right) + \\
 & \frac{N}{12} * \lim_{T \rightarrow \infty} \left(\sum_{t=1}^T \frac{(4\bar{u}_{1t}\bar{g}_t) + (6\bar{u}_{2t}\bar{g}_t)}{(1+r)^t} \right) + E(OA)_t
 \end{aligned} \quad (4)$$

If $\bar{w}_{Bt}$ and $\bar{w}_{Ft}$ do not change over time (or vary at a constant (average) annual rate (i)), and we assume that the enrolment rate ($\bar{e}$) and the mortality rate ($\bar{m}$) are constant over the analysed period,²⁴ then equation 4 can be simplified as follows (equation 5):

$$\begin{aligned}
 E(PV Assets)_t = & \frac{NR\bar{w}_B}{r-i} * \lim_{T \rightarrow \infty} \left(\sum_{t=1}^T (1 - \bar{m})^t (1 + \bar{e})^t \right) + \frac{1}{12} \bar{w}_F N + \frac{N\bar{w}_F}{12(r-i)} * \lim_{T \rightarrow \infty} \left(\sum_{t=1}^T \bar{e} \right) + \\
 & \frac{N\bar{w}_F}{4(r-i)} * \lim_{T \rightarrow \infty} \left(\sum_{t=1}^T \bar{m} \right) + \frac{N}{12} * \lim_{T \rightarrow \infty} \left(\sum_{t=1}^T \frac{(4\bar{u}_{1t}\bar{g}_t) + (6\bar{u}_{2t}\bar{g}_t)}{(1+r)^t} \right) + E(OA)_t
 \end{aligned} \quad (5)$$

where $\bar{m}$ and $\bar{e}$ are constant $\forall t \neq 0$.

As mentioned earlier, the formation of assets and liabilities in equation 3 (and its variants) consists of the sum of some infinite amounts that do not converge. Given that non-military *Montepíos* operated a finite life ($t_{MAX} = V$), and taking the same assumptions as the infinite period, the model could be narrowed down and reformulated as equation 6:

$$\begin{aligned}
 E(PV Assets)_t = & NR\bar{w}_B \sum_{t=1}^V \frac{(1+i)^{t-1} (1 - \bar{m})^t (1 + \bar{e})^t}{(1+r)^t} + \frac{N\bar{w}_F}{12} + \frac{N\bar{e}\bar{w}_F}{12} \sum_{t=0}^V \frac{(1+i)^t}{(1+r)^t} + \\
 & \frac{N\bar{m}\bar{w}_F}{4} \sum_{t=1}^V \frac{(1+i)^t}{(1+r)^t} + \frac{N}{12} \sum_{t=1}^V \frac{(4\bar{u}_{1t}\bar{g}_t) + (6\bar{u}_{2t}\bar{g}_t)}{(1+r)^t} + E(OA)_t
 \end{aligned} \quad (6)$$

Formation of liabilities

The second component of the inequality equations (1 and 2) is related to the expected value of liabilities of the non-military *Montepío*, given the best information at year t , which predominantly comprises the expected value of pension commitments to the recipients of the

²⁴ With a relevant exception, the value of the enrolment rate in $t=0$ is 1.

plan members, among other expected liabilities. A functional form of the liabilities' formation, given the long-term inequality equation 1, is as follows (equation 7):²⁵

$$E(PV Liabilities)_t = z\bar{w}_{D_1}P_1 \sum_{i=1}^{\infty} \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} + z\bar{w}_{D_2}P_2 \frac{1}{(1+r)} \sum_{i=1}^{\infty} \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} + \\ z\bar{w}_{D_3}P_3 \frac{1}{(1+r)^2} \sum_{i=1}^{\infty} \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} + \dots + z\bar{w}_{D_t}P_t \frac{1}{(1+r)^{t-1}} \sum_{i=1}^{\infty} \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} + \dots + E(OL)_t \quad (7)$$

where:

- P_t is the number of newly created *Montepío* pensions at the beginning of year t ²⁶
- z is a constant and refers to the replacement rate of the last salary of the deceased plan member²⁷
- $\bar{w}_{D_t}$ is the average yearly full salary²⁸ of plan members at year t , when their death occurred²⁹
- δ_j is the probability of ceasing the pension commitments at period j ,³⁰ where $0 \leq \delta_j \leq 1$
- r is the annual rate of opportunity cost of \$1 *peso* of contributions³¹
- $E(OL)_t$ is the expected value of other *Montepío* liabilities, given the best information available at year t .

Cohorts of new pensioners (recipients) each year (P_t) are identified by the year of death of the plan member. Each cohort t evolves over time and shares with the other cohorts a decreasing tendency of the number of pensions. In every year for each cohort, some recipients were

²⁵ Unlike the assets' formation, no relevant differences were identified in the functional form of the liabilities' formation between *Montepíos de Ministros* and *Montepío de Empleados*. The decomposition of the liabilities is based on both *Reglamento Empleados*, Chapter II, Section I and *Reglamento Ministros*, Chapter II, Article I.

²⁶ P_t is the number of new pensions to be paid by the *Montepío* at each year. For each plan member, there is only one pension, regardless of who are the recipients of their pension (i.e. the widow, offspring, or mother of the plan member), and the number of recipients *per* family. Thus, a one-by-one correspondence occurs between the plan member and his survivor pension.

²⁷ The replacement rate is a constant proportion of the last salary of the plan member. The value of z is $\frac{1}{4}$ for both non-military *Montepíos*. See *Reglamento Empleados*, Chapter II, Section I and *Reglamento Ministros*, Chapter II, Article I.

²⁸ This wage is the average full salary at each year, used in the equations of the present value of *Montepío* assets ($\bar{w}_{F_t}$), but in the liabilities expression it is used to estimate the last average salary of the plan members (cohort) who passed away that year. See, for instance, *Reglamento Empleados*, Chapter II, Section I.

²⁹ It is reasonable to assume that δ_j is almost zero at $j = 1$ for every cohort of pensioners. Further, it is a fact that a survivor pension is eventually over once the recipients are not eligible due to death, marriage, or age limit. That is why it is assumed that δ_j tends to go up over time and converge eventually to 1. A sensible and somewhat logical assumption is that given that δ_j changes over time, this yearly change pattern is the same, regardless of the cohort of pensioners. Thus, δ_j does not depend on P_t . That is to say, the initial value of δ_j is the same for every cohort of new pensioners.

³⁰ The variable δ_j should be decomposed in several components. The interplay of different variables, such as the probability of the widow's death (widow's mortality rate), the probability of having eligible children, the age profile of the recipients, and the probability of certain events (e.g. marriage, taking holy vows or joining the Army), has a direct impact on the final value of δ_j . This final value can be preliminary characterised as a Markov decision process. See Puterman [2005].

³¹ It is implicitly assumed an annual discount rate of 5%. Also, for simplicity, the term structure is assumed constant over time.

no longer eligible, with the pension ceasing. Thus, the probability of ceasing a pension commitment (δ_j) tended to go up over time, with the $\lim_{j \rightarrow \infty} (\delta_j) = 1$. Given this pattern, equation 7 can be expressed as follows:

$$\begin{aligned}
 E(PV Liabilities)_t = & z\bar{w}_{D_1}P_1 * \lim_{I \rightarrow \infty} \left(\sum_{i=1}^I \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} \right) + z\bar{w}_{D_2}P_2 \frac{1}{(1+r)} * \\
 & \lim_{I \rightarrow \infty} \left(\sum_{i=1}^I \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} \right) + z\bar{w}_{D_3}P_3 \frac{1}{(1+r)^2} * \lim_{I \rightarrow \infty} \left(\sum_{i=1}^I \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} \right) + \dots \\
 & + z\bar{w}_{D_t}P_t \frac{1}{(1+r)^{t-1}} * \lim_{I \rightarrow \infty} \left(\sum_{i=1}^I \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} \right) + \dots + E(OL)_t
 \end{aligned} \tag{8}$$

Mathematically, the upper limit of the expression $\sum_{i=1}^{\infty} \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i}$, when $\delta_j = 0 \ \forall j$, is

$1/r$, and the lower limit is 0, when $\delta_j = 1 \ \forall j$. Although these extreme values do not apply, in practice, for the ongoing actuarial model, given that $0 \leq \delta_j \leq 1$ and δ_j tends to increase over j , these extreme values give us the maximum range in which this expression, and therefore part of the liabilities' formation, would theoretically vary.

The liabilities' formation in equation 8 consisted of the sum of infinite cohorts of new pensioners. Nevertheless, it can be narrowed down given that non-military *Montepíos* survived a finite life (denoted by $t = V$, where V is the year when *Montepíos* ceased to exist). Thus, the last cohort of pensioners would be P_V , and *Montepíos* ceased any pension at V , regardless of the survival of eligible pensioners in the last and previous cohorts. Therefore, equations 7 and 8 can be adjusted, given inequality equation 2, as follows (equation 9):

$$\begin{aligned}
 E(PV Liabilities)_t = & z\bar{w}_{D_1}P_1 \sum_{i=1}^V \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} + z\bar{w}_{D_2}P_2 \frac{1}{(1+r)} \sum_{i=1}^{V-1} \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} + \dots \\
 & + z\bar{w}_{D_t}P_t \frac{1}{(1+r)^{t-1}} \sum_{i=1}^{V-(t-1)} \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} + \dots + z\bar{w}_{D_V}P_V \frac{1}{(1+r)^{V-1}} \sum_{i=1}^{V-(V-1)} \frac{\prod_{j=1}^i (1 - \delta_j)}{(1+r)^i} + \\
 & E(OL)_t
 \end{aligned} \tag{9}$$

Last but not least, the estimation of the $E(PV Assets)_t$ and $E(PV Liabilities)_t$ is for each t , given the best information available at year t . The temporal variations of the estimation of these expected values will mainly depend on the variation over time in the expected values for the demographic and labour variables, shown in equations 4–6 and 7–9.

The model, which enables testing the solvency condition $PV(Assets) \geq PV(Liabilities)$, is conceptual and illustrative, intended to formalise the solvency condition rather than produce numerical forecasts. However, preliminary evidence – see the next section – suggests persistent violations of this inequality, pre-confirming the structural insolvency of *Montepíos*.

Preliminary results

Financial design

Preliminary findings indicate that the non-military *Montepíos* were financially unsustainable almost from their inception. The low bi-monthly salary deductions – 2.95% of the plan member's salary – compared to modern international standards,³² the absence of an effective minimum contribution period,³³ the restrictive investment regime governing surplus funds,³⁴ and some poor investment decisions by the Boards of Directors,³⁵ among other actuarial issues, resulted in a gradual but inevitable depletion of *Montepío* financial assets.

Demographic patterns

Demographic evidence from the 1790 Census of Mexico City³⁶ reveals significant age and gender asymmetries: men tended to marry later, often between their mid-twenties and forties, whereas women married at much younger ages and rarely remarried after widowhood. Men, in contrast, were more likely to remarry and did not generally remain widowers for long, and women were approximately three times more likely to become widowed than men.

³² Similar to other military and non-military *Montepíos* in the Spanish territories.

³³ To be eligible for a survivor's pension, a plan member had to contribute regularly, in due form, and for at least one year (through continuous bi-monthly payments) after enrolment in the pension plan. In retrospect, this minimum contribution period was exceedingly short and contributed, among other factors, to the actuarial imbalances of the system. More critically, supervisors often failed to enforce even this minimal one-year requirement, granting pensions to ineligible beneficiaries [Chandler, 1991].

³⁴ In cases of surplus, funds could be allocated to investments or lending opportunities. The *Reglamento Empleados* and *Reglamento Ministros* explicitly prohibited channelling funds to charitable activities that did not generate interest. Both regulations also required that collateral be worth at least three times the value of the loan. If loans failed to meet these standards yet were still approved by the Board, the members involved were held personally liable for any resulting losses. Accordingly, the non-military *Montepíos* maintained a highly restrictive lending policy, and few applicants met these strict requirements [Chandler, 1991, p. 55].

³⁵ Civil *Montepíos* did not have an effective mechanism to supervise and recoup their investments in the incipient capital markets. See Chandler [1991, pp. 69–70].

³⁶ Although the 1790 Census was conducted in various provinces and localities, the population data from Mexico City were selected as a good proxy for the demographics of non-military *Montepío* plan members, since the city had the largest concentration of bureaucrats in New Spain. A secondary reason for selecting Mexico City was its status as the capital of the Viceroyalty and the major urban centre, with a high proportion of so-called Spaniards and Europeans. *Montepíos* also functioned as instruments of enforcement over marriage policies within the royal bureaucracy, reflecting the caste-based social structure of the time. However, as noted by Chandler [1991], Arrom [1993], and Gonzalbo-Aizpuru [2005, 2018], the caste system in early Mexico proved largely ineffective as a mechanism of enforcement.

This pattern led to long-lasting pension commitments, as widows and unmarried daughters could receive lifelong pensions. Table 2 summarises key demographic indicators from the 1790 Census in Mexico City, highlighting the gendered dimensions of the actuarial problem.³⁷

Table 2. Population of Mexico City in 1790 by gender and civil status

	Men			Women		
Age brackets	Single (%)	Married (%)	Widower (%)	Single (%)	Married (%)	Widow (%)
<7	100	0	0	100	0	0
[7–16)	98	1	1	95	3	2
[16–25)	57	40	3	45	47	8
[25–40)	20	73	7	19	56	25
[40–50)	20	66	14	17	36	47
≥50	20	55	25	17	25	59
Total	56	38	6	49	33	18

Source: own material based on data from the 1790 Census and Commons [1995, p. 48].

Actuarial imbalances and stakeholders reactions

In 1784, Martín José de Alegría, the then protector of *Montepío de Ministros* – acting as advocate and intermediary between the Board and beneficiaries – was among the first officials to identify the emerging actuarial mismatch, estimating that the ratio of survivor pensions to active plan members would soon approach one-to-one, or even higher, anticipating the eventual collapse of the funds.³⁸

Table 3. Estimated income, liabilities, and annual and cumulative financial balances of *Montepío de Empleados* (in pesos)

Year	Annual income	Annual outlay	Annual balance	Cumulative balance
1784	68 872	3385	65 487	65 487
1785	77 988	7310	70 678	136 165
1786	53 209	9935	43 274	179 439
1787	67 287	21 024	46 263	225 702
1788	68 802	26 080	42 722	268 424
1789	65 000	30 188	34 812	303 236
1790	69 164	39 595	29 569	332 805
1791	66 985	44 081	22 904	355 709
1792	70 458	49 613	20 845	376 554
1794	70 146	74 862	–4716	371 838

Source: own material based on Chandler [1991, p. 129] with some adjustments.

³⁷ The 1790 Census is preserved in Mexico's General Archive (Archivo General de la Nación, AGN). However, Commons [1995] presents its main findings in a more accessible and convenient form.

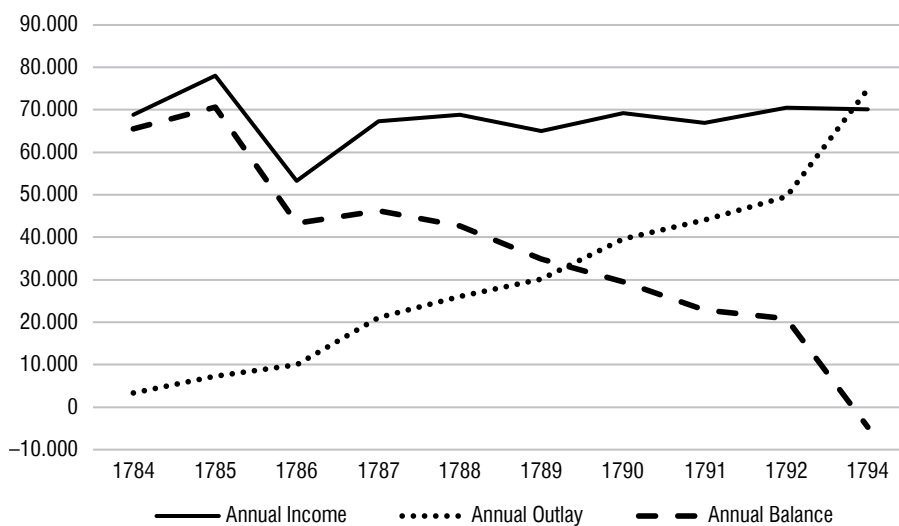
³⁸ Chandler [1991, pp. 152–156].

Archival evidence and Chandler's [1991] reconstructed data, complemented by adjustments introduced in this study, confirm that *Montepío* assets grew at a significantly slower rate than liabilities, producing an inevitable actuarial deficit (see Figure 2 and Tables 3–4). For instance, the *Montepío de Empleados* recorded an average annual asset growth of only 0.18% during its first ten years of operation, while liabilities increased at an average annual rate of 36.29% over the same period. By its tenth anniversary, the institution faced its first major liquidity crisis, although it still maintained a positive cumulative balance.

This pattern was not unique. The *Montepío de Ministros* began to experience liquidity problems after roughly a decade of operation, and by 1791 – twenty-one years after its creation – it was showing clear signs of irreversible insolvency.

Taken together, the data in Figure 2 and Tables 3–4 illustrate the widening imbalance between assets and liabilities, revealing that the collapse of non-military *Montepíos* was not accidental but a predictable result of structural actuarial unsoundness and inadequate capitalisation mechanisms.

Figure 2. Estimated annual income, annual liabilities, and annual financial balances of *Montepío de Empleados* (in pesos)



Source: own material based on Chandler [1991, p. 129].

Table 4. Estimated cumulative financial balances of *Montepío de Ministros* (in pesos)

Year	Cumulative balance
1779	99 089
1782	n.a. ^a
1784	n.a.
1785	n.a.
1791	-17 945

cont. Table 4

Year	Cumulative balance
1792	–18 093
1793	–20 923
1794	–25 455
1795	–45 351
1796	–53 719
1797	–72 444
1798	n.a.
1799	–107 080
1800	–124 475
1808	–134 469

^a n.a.: Not available.

Source: own material based on Chandler [1991, p. 130], with minor adjustments.

In sum, contributions were insufficient to meet rising pension payments, while external funding was virtually non-existent. Local treasuries occasionally covered shortfalls, but these transfers were neither systematic nor sufficient. While Military *Montepíos* faced severe financial distress in the late eighteenth century – prompting a special royal intervention in 1779 that included massive endowments and other extraordinary measures – non-military *Montepíos* received no comparable support. At the time, many administrators regarded the military bailout as an exceptional case, justified only by the Crown's direct interest in the armed forces.

Non-military *Montepíos*, perceived as fiscally sound during their early years, did not benefit from similar assistance. Nevertheless, by 1782 and 1794 the *Montepío de Ministros* and *Montepío de Empleados*, respectively, began to face liquidity problems. As Chandler [1991, p. 155] observed, their only chance of long-term survival would have been a massive initial endowment granted before pension liabilities began to outpace accumulated income. However, only partial and delayed financial support was provided before the wars of independence, proving insufficient to prevent insolvency.

Facing these growing financial pressures, members of the boards of both non-military *Montepíos* – along with royal officials and even plan participants – proposed various emergency reforms. Most of these initiatives sought to reduce pension expenditure or tighten eligibility, but they achieved limited or no practical effect. A summary of these measures is presented below:

Table 5. Summary of proposed measures to ameliorate financial issues

Year	Proposal/Reform	Outcome
1789	A Royal Order decreed that members marrying after age 60 would forfeit survivor pension rights for their dependents	Unclear enforcement
1798	The <i>Montepío de Ministros</i> Board proposed reducing survivor pensions for financial reasons	Rejected by the Royal Crown
1799	The Council of the Indies suggested cutting pensions when only one recipient remained	Not approved by the Crown

Year	Proposal/Reform	Outcome
1799	The <i>Montepío de Ministros</i> Board halved pensions for two long-term female pensioners	Implemented locally
1799	The <i>Montepío de Empleados</i> Board proposed a means test for widows and adult daughters with independent income	Rejected by Viceroy Azanza
1801	The <i>Montepío de Ministros</i> proposed to end pensions for married sons under age 25, specifically with reference to a particular cadet	Vetoed by viceregal authorities as contrary to <i>Reglamento Ministros</i>
1809	A Royal Order established that widows who renounced a pension to remarry could later draw only one pension if widowed again, provided there were no dependent offspring	Implemented with a limited scope

Source: own material based on archival data (AGN) and Chandler [1991].

In practice, these proposed reforms reveal the institutional paralysis of the non-military *Montepíos* during their final two decades before the Independence Wars. Efforts to curtail pension obligations – through age restrictions, means testing, or partial benefit reductions – were either vetoed by the Crown or inconsistently enforced. In that regard, the study of non-military *Montepíos* is a good example of what Gonzalbo-Aizpuru [2013, p. 16] argues: New Spain's institutions were in a permanent conflict between order and disorder, in which disorder was not an exception, but the rule. By the early nineteenth century, both *Montepíos* had exhausted their reserves, leaving them unable to honour pension commitments on a sustainable basis.

Unlike *Monte de Piedad*, which diversified its financial base through lending activities, *Montepíos* lacked mechanisms for capitalisation, risk sharing or profitable lending activities for the initial surpluses in *Montepío de Empleados*. The absence of effective and long-run external support made them vulnerable to even minor demographic shocks.

In sum, the centralised Royal Treasury limited its responsibility to fund survivor pensions, shifting almost all fiduciary and legal responsibilities onto eligible bureaucrats and the local treasuries.

Conclusions and future research

The extinction of non-military *Montepíos* in early and mid-nineteenth-century Mexico illustrates how well-intentioned welfare innovations can fail due to structural design flaws and lack of enforcement of their internal rules. These institutions collapsed due to their actuarial assumptions being inconsistent with demographic realities and lacking external fiscal support. While macroeconomic instability accelerated their downfall, the root cause was endogenous. The study highlights that institutional survival depends not only on macroeconomic stability but also on adaptive institutional design (e.g. *Monte de Piedad*) and the political bargaining power of the military stakeholders in times of institutional instability (e.g. Military *Montepíos*).

Unlike Chandler [1991], this article presents a mathematical formulation of the actuarial imbalances of *Montepíos* and identifies key demographic, labour, financial and institutional

variables and parameters. One avenue of further research will be to collect or estimate these variables and parameters of the actuarial model, shown in the Methodology section, using archival and secondary data to test the solvency inequalities quantitatively.

Another promising avenue for future research is to explore why military *Montepíos* survived longer, at least on paper, than their civilian counterparts. A plausible explanation is that military militias in post-independence Mexico retained significant political influence, which may have secured continued fiscal or institutional support for their pension funds.³⁹ Understanding this asymmetry between military and civil pension schemes could shed light on the broader relationship between political power and the endurance of welfare institutions in transitional states.

Finally, comparative analysis with the *Monte de Piedad* – a charitable financial institution established around the same time as the *Montepíos*, with the primary objective of lending money at modest interest rates secured by pledged assets – could further clarify why some welfare institutions persisted while others disappeared. The *Monte de Piedad* not only withstood the political and economic instability of nineteenth-century independent Mexico but also remains fully operational today, albeit with several structural adjustments. Its longevity can be largely attributed to its consistent financial support compared with the pension-paying *Montepíos*, as well as its adaptive institutional design and the political will to adapt its business model in response to changing circumstances.⁴⁰ Thus, institutional and actuarial fragility, rather than macroeconomic turbulence, best explains the early collapse of non-military *Montepíos*.

While the preceding analysis focuses on the historical trajectory of civilian *Montepíos*, their experience also offers insights for contemporary pension systems.

Implications for contemporary pension systems

The experience of the non-military *Montepíos* offers several lessons for contemporary pension systems facing demographic transition and fiscal pressures.

Firstly, low contribution rates undermine the accumulation of sufficient actuarial reserves to cover long-term liabilities. The *Montepíos* operated with contribution rates that proved

³⁹ Vázquez [1984, 2009] stated that the viceregal equilibrium was disrupted after Mexico's independence. Internal conflicts among different factions, along with other external factors, weakened miners and craftsmen while strengthening warlords and foreign creditors. These influential groups utilised their growing power in the political and institutional arena. See also Tenenbaum [1986].

⁴⁰ See Romero-Ibarra [2021] and Cabrera-Siles, Escandón [1993]. The former illustrates how *Monte de Piedad* implemented different business models to cope with its emergency financial status, which involved the creation of a savings bank, the diversification of financial services as a private bank by offering not only pawnbroking services but also mortgage-backed loans, and the issuance of fiat money guaranteed by *Monte de Piedad* assets, among other funding sources. The agency also had to deal with expropriation measures, the compulsory lending of loans to several public institutions, the obligatory exchange of minted coins stored by *Monte de Piedad* for government-issued fiat money, and a bank run that was ultimately mitigated by two commercial banks.

insufficient once pension obligations expanded, while a similar concern has arisen in modern contributory pension systems. In Mexico, for example, the relatively low mandatory contribution rate in the compulsory retirement savings system recently prompted legislative reforms aimed at gradually increasing contribution levels to strengthen long-term sustainability. The historical record of the *Montepíos* reinforces the principle that inadequate contribution rates, even if politically necessary, compromise intertemporal solvency.

Secondly, an overly restrictive investment regime can limit returns and weaken the long-term performance of pension funds. The *Montepíos* faced strict lending and collateral requirements that constrained investment opportunities and reduced potential yields, and while safeguarding retirement savings is essential, a balanced investment framework – one that allows for risk-adjusted returns within prudent regulatory boundaries – is critical for enhancing fund performance over the long term. Excessive conservatism in asset allocation may generate stability in the short term but reduce sustainability in the long run.

Thirdly, weak enforcement of internal rules poses serious risks to financial viability. In non-military *Montepíos*, supervisors frequently relaxed eligibility requirements, particularly the minimum contribution period, out of short-term sympathy for individual beneficiaries. These discretionary decisions, though socially understandable, gradually eroded the actuarial foundations of the system, with the historical case illustrating how short-term incentives faced by fund administrators can produce persistent negative effects on long-term sustainability. Contemporary pension systems are not immune to similar pressure, especially in politically sensitive contexts.

More broadly, PAYG systems tend to face structural sustainability challenges in ageing societies, where, as populations age, the contribution base shrinks while the beneficiary base expands, placing pressure on dependency ratios. Had civilian *Montepíos* survived into the present demographic context, the effects would likely have been mixed. Increased life expectancy among contributors might have extended contribution periods; however, longer life expectancy among widows and unmarried daughters – the primary beneficiaries – would also have prolonged payout periods, potentially amplifying financial strain. This demographic duality underscores the importance of integrating longevity projections and dependency dynamics into pension design.

Ultimately, the historical trajectory of the *Montepíos* offers a cautionary case study: actuarial imbalance, demographic transition, and political selectivity – if unaddressed – can undermine even well-intentioned social insurance mechanisms. Historical evidence thus complements contemporary actuarial analysis by illustrating how institutional fragility can emerge gradually yet predictably when these elements become misaligned. In this sense, non-military *Montepíos* should not be viewed merely as historical anomalies, but as early laboratories of pension design whose failures illuminate enduring structural tensions in modern social insurance systems.

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