WAS COLONIALISM FISCALLY SUSTAINABLE?
AN EMPIRICAL EXAMINATION OF THE COLONIAL FINANCES OF SPANISH AMERICA

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ABSTRACT

This paper examines the long-run fiscal sustainability of the colonial finances of Spanish America. Using econometric tests of intertemporal stability and a macroeconomic budget constraint framework, the analysis revisits how the long-run fiscal dynamics of the colonial treasuries adjusted for inflation changed over time. Findings suggest that in spite of historical breakpoints associated to major financial difficulties during wartime, in general the treasuries achieved sustainable fiscal balances. However, there was a shifting pattern of fiscal sustainability between the treasuries across the colonial period.

Keywords: Fiscal sustainability, Colonialism, Cajas reales, Spanish America, Cointegration.

RESUMEN

Este trabajo examina la sostenibilidad fiscal de largo plazo de las finanzas coloniales de Hispanoamérica. Mediante pruebas econométricas de estabilidad intertemporal y un enfoque macroeconómico de restricción presupuestaria, el análisis revisita la evolución de las dinámicas fiscales ajustadas por inflación de diferentes tesorerías coloniales en el largo plazo. Los hallazgos sugieren que a pesar de puntos de quiebre históricos asociados a grandes dificultades financieras durante periodos bélicos, en general las tesorerías lograron establecer balances fiscales sostenibles. Sin embargo, existió una tendencia cambiante de sostenibilidad fiscal entre las tesorerías durante el periodo colonial.

Palabras clave: Sostenibilidad fiscal, Colonialismo, Cajas reales, Hispanoamérica, Cointegración.

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1.- Introduction

In addition to explanations related to the political and social disputes between Spaniards and 'creoles' as chief precursors of the Spanish American independence, various historians have argued that the emancipation of the colonies from Spain originated from the critical situation of the finances of the imperial regime.[2] Several studies have indicated that the financial weakness at the end of the eighteenth century was a key catalyst for the independence movements in Spanish America.[3] For instance, the Mexican historian Carlos Marichal argues:

> "It was clearly the war that finally undermined the royal administration, but the weakening of the fiscal and financial system was also a key factor (for the declaration of independence)".[4]

Quantitative research has shown that the military conflicts with Britain and France in the last years of the eighteenth century and at the onset of the nineteenth century weakened the public finance of Spain and its American colonies enormously. However, could the financial weakening have been part of a much broader fiscal process originating from previous periods which gradually accrued and culminated in the financial collapse that led to independence? Determining an ultimate combination of the causes of the Spanish American independence would be an empirical task beyond the scope of this paper. Instead of examining the fiscal performance during the last years of the Spanish 'Bourbon' regime (c.1780-1808), this paper attempts to re-evaluate

[2] See an overview in V. Uribe, 'The enigma of Latin American independence'; and in G. Paquette, 'The dissolution'.
[3] For example, in C. Archer, 'Bourbon Finances and Military Policy in New Spain'; Stein, S. J., and Stein, B. H. *Apogee of empire*; and in Johnson, L. *The Political Economy of Spanish America.*
[4] C. Marichal, *Bankruptcy of empire*, p. 254

quantitatively the long-run fiscal dynamics of the finances of the Spanish American colonies from c.1580 to c.1810.[5]

Naturally, this is not the first attempt to conduct this task. Over the years economic historians have reconstructed and analyzed the colonial treasury accounts of the Americas with relative success; however, they have not yet provided a clear picture of the 'real' long-run fiscal dynamics of the colonies. A systematic account of the inflationary episodes that affected the value of local finance together with the effects of the fiscal policies imposed by the Spanish administration have been downplayed in the cliometric literature.

The aim of this paper is twofold: First, it provides new estimates of fiscal data adjusted for inflation for the major treasuries of colonial Spanish America. And second, using this newly adjusted data, it examines the long-run fiscal sustainability of the colonial finances building upon a standard framework of public finance: the intertemporal budget constraint of the government. The analysis is motivated by previous views depicting Spain as one of the major debt 'defaulters' in history by going 'bankrupt' numerous times particularly during its colonial rule.[6] The financial struggles have been associated with a continuous rise of military costs from the wars engaged with its Atlantic rivals. Yet, by the mid-eighteenth century the Spanish royal administration was able to reorganize its finances implementing a series of wide-ranging economic reforms.[7]

A fiscal system is considered sustainable in the long-run if the 'intertemporal budget constraint' is expected to hold in present terms, meaning that debt holders expect the current debt to be offset by the sum of the expected future discounted public budget surpluses. In this historical case, the royal administration in Madrid backed their debt instruments with fiscal revenues as collateral which were dependent on the remittances from the Americas.[8] The Spanish American finances provided the certainty for the multiple loans contracted with the Crown's creditors, and were also an immediate source of revenue to finance the empire's military costs.[9]

This study is related to other works on the Spanish empire's financial sustainability. Álvarez-Nogal and Chamley assessed Spain's financial position under the Habsburg reign of Philip II (1566–1596) relying exclusively on the Spanish colonial accounts of Castile.[10] In Carlos Marichal's *Bankruptcy of empire*, various secondary sources for Spanish America from 1760 to 1810 are combined to analyze the financial situation of Spain's main colony: New Spain.

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[5] Samples vary according to the treasury employed; see details in the data section.

[6] C. Reinhart *et al*., (2003) estimate thirteen defaulting episodes in Spain before the twentieth century, seven of these occurring between 1557 and 1820.

[7] The set of reforms are known as 'Bourbon reforms'. Implemented after the ascension of Charles III in 1759, these reforms intended to modernize the administration of the Spanish public sector and to restructure the finances of Spanish American colonies by centralizing their fiscal administration, introducing new taxes, reorganizing the military, and curbing the political power of the church, among many others changes. See an analysis in Lynch (1992).

[8] The terms 'Spanish America' and 'the Americas' are used interchangeably.

[9] A similar financial mechanism was used to back Imperial debt since the mid-sixteenth century. See in E. Hamilton, 'American treasure';

[10] Also, Drelichman and Voth, 'The sustainable debts of Philip II'.

This paper contributes to previous literature by examining with an econometric perspective the fiscal dynamics in the major treasuries of Spanish America, placing historical data into a framework to test fiscal sustainability. To assess this, the analysis employs colonial treasury data from the local fiscal records also known as c*ajas reales* reconstructed in the seminal volumes by John Jay TePaske and Herbert S. Klein (1982).

Unlike previous works, this study takes into account local price developments by adjusting the referred treasury data for inflation. Using the adjusted fiscal series, the analysis exploits its statistical properties by applying a battery of time series techniques to revenue, expenditure and deficit data of nine local treasuries for the colonial period of c.1577-c.1813. The long span of annual data allows the application of this empirical methodology in order to determine structural breakpoints, and indicate the proximate causes and effects of the imperial fiscal policies during different time intervals.

The overall result varies depending on the local royal treasury and the period analyzed. The findings suggest that there were long-run equilibrium relationships between revenue and expenditure data adjusted for inflation, supporting the intertemporal budget constraint of long-run sustainability of the public finances. However, there are shifts of fiscal sustainability across regimes and regions. When the treasuries of New Spain were unsustainable during the 'Habsburg reign', Peru's treasuries experienced a sustainable fiscal pattern. During the period of 'succession and transition', New Spain's treasuries restored their sustainability unlike in Peru and Buenos Aires. And finally, in the period of the 'reformism and Napoleonic wars', the treasuries of New Spain deteriorated reaching an unsustainable position, contrary to their counterparts in Peru and Rio de la Plata.

The paper is organized as follows. The next section provides a brief overview of the historical context of the Spanish American colonial fiscal system and it reviews the recent related literature. Section 3 describes the nature, adjustments and trends of the data employed. Section 4 describes the theoretical approach and empirical strategy to assess fiscal sustainability, followed by section 5 which discusses the empirical results. Section 6 concludes.

2.- Historical context

Since the 'age of discoveries' until the mid-nineteenth century the Spanish Crown ruled vast territories in Europe, Asia, and the Americas. Its economic ascension as global power was particularly fueled in the sixteenth century with the control of the world's supply of precious metals located in the mines of the Americas. The creation of the Spanish *Council of the Indies* in 1524 besides of establishing a new economic structure for the 'New World' implied the transferring of the fiscal bureaucracy from the Spanish *metropole* to the colonies. In order to increase the 'royal' wealth expanding its domains, the Kingdom of Castile in Spain ordered the

creation of a system of *royal local treasuries* in the most important ports and regions of the conquered territories in the Americas.

The imposed colonial administrative system was initially divided in two main *viceroyalties*:[11] New Spain (covering the current territory of Mexico, Central America, and part of the United States) established in 1524, and Peru (covering most of South America except for the east of current-day Brazil) in 1542. The viceroyalty of New Granada would be established by 1714, and Rio de la Plata in 1776. This administrative structure was part of a decentralized fiscal system shaped in part by a share of revenue that had to be shipped to the Iberian Peninsula, and a share of revenue and expenditure for the local colonial economy.

The aim of establishing this new institutional framework into the colonies was to administer the extraction of surplus for the Spanish *metropole*.[12] For this, and to fund the cost of the local colonial bureaucracy, a royal fifth (20% tax) or *quinto real* was levied on the production from mining precious metals, and on agriculture.[13] Given the large deposits of silver in the mines of various territories in the region, silver extraction became one of the most lucrative activities for the local economy and for the Spanish Crown.

According to the historian Herbert Klein, the viceroyalty of Peru was unquestionably Spain's prime colony from the sixteenth to the seventeenth century due to the mercury deposits located in the Andean region that were used for large-scale production of silver. These extraordinary amounts of silver from the Peruvian mines were the main source of silver in the world often used to manufacture currency coins. However, at the end of the seventeenth century silver production declined in Peru and thereafter New Spain's silver production tripled the Peruvian production in the beginnings of the eighteenth century.[14] Consequently, after 1700 the viceroyalty of New Spain became the dominant economic zone and financial center, and Mexico City was a 'sub-metropole' for the empire which accounted for the largest silver outflows to Spain.

An important element that provided great wealth for the Crown was the fiscal burden imposed via *indirect taxation.* Upon the great dynamism of silver exports from the Americas, the Crown enjoyed the monopoly of the transatlantic commerce. The Spanish American ports were not allowed to trade with each other nor with other countries except with the Spanish ports of Andalucía. Trade tariffs, known as *almojarifazgos* were a central source of income recorded in the largest treasuries of Spanish America. By 1778, a decree of 'free trade' (only to other Spanish American ports) was enacted. This generated an increase in the shipping traffic in the customs of

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[11] 'Viceroyalty' is the English term for the Spanish 'Virreinato' meaning literally 'vice-kingdom'.

[12] It was considered 'new' because pre-colonial indigenous societies had a different economic structure and organization. See the argument in M. León-Portilla, 'Mesoamerica before 1519'.

[13] By 1723 this tax became the *diezmo minero* or 'mining tenth'.

[14] H. Klein, 'The great shift'.

the ports such as Veracruz in New Spain and Cadiz and Seville in Spain, and hence increasing the overall collection of tax revenues.[15]

Another fundamental source of indirect tax collection was the existence of state monopolies of high-value commodities such as gunpowder, salt, and tobacco, among many other goods. Sale taxes, called *alcabalas* targeted many of these increasingly demanded goods.

As figure 1 shows, these types of revenues coming from state monopolies in New Spain had the largest share in total tax collection at the end of eighteenth century accounting for more than thirty percent (31.5) of the total fiscal revenue recorded.

Figure 1
Share of fiscal revenue by entry in the cajas reales of New Spain from 1795-1799
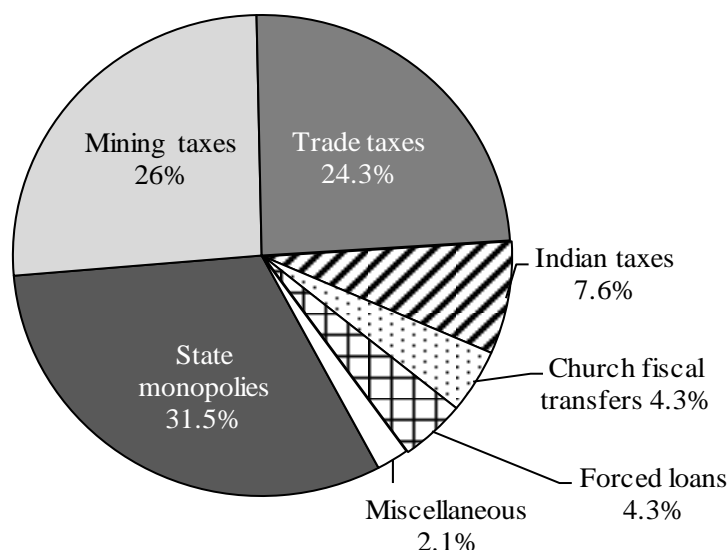
Note: Miscellaneous refers to administrative and/or other of types of income.

Source: Based on Marichal and Carmagnani (2001), p.288.

The share of the revenue branches as a percent of the total changed throughout the colonial period. This was mainly due to the lack of uniformity in the *direct* and indirect tax rates, but also because different economic activities in diverse regions generally tended to grow faster than others, and therefore, their tax incidence. But as a broad generalization, although other direct taxes such as the 'tithe' or *diezmo* (10% of personal income) and the 'indian head tax' were important fiscal components, revenues originating from mining, trade, and state monopolies were the central source of the colonial fiscal administration.[16]

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[15] See in J. Fisher, 'Commerce and imperial decline'.
[16] The 'indian head tax' was a tribute collected from the indigenous population as a symbol of their subject status. Other important branches from the income side were the sale of papal bulls (indulgencies) by the church, overlays from other treasuries, amortizations, and various private donations.

Moreover, although the clergy was in charge of collecting the 'tithe' and transfer it to the local treasury, they also accepted payments in kind. However, tax collection was made most generally in cash. Spanish royal officials began gradually to demand deposits in coins forcing the church and the general population to exchange their goods and labor for cash.[17]

On the other hand, the structure of treasury expenditure in the most important cajas was shaped by a more stable number of entries dominated by fixed costs (*gastos generales*). These expenses comprehended mainly the branches of; salaries of administrative personal; war expenses; and *situados* (intra-regional transfers). Evidently, 'war expenses' tended to rise during the European conflicts, especially during and after the *Seven Years' War* (1754-1763).

However, the branch of the situados gained significant importance for the creation of additional treasuries. These intra-regional transfers had the aim to be allocated to other 'deficitary' cajas (mostly in the Caribbean) in order to further develop the local economy and defend the territory from foreign invasions.

The fiscal administrative personnel in each treasury was formed by local royal treasurers, accountants (*contadores*), and supervisors (*veedores*) who were commissioned to keep the records of all financial transactions in books of their respective treasury. These local treasurers were subject of regular visits from external royal officials (*visitadores*) from Spain to check that local books were following the official guidelines and prevent any type of fraud.

Overall, there are many other entries in the categories of revenues and expenditures; however, they represented only a small share of the totals at the end of each year. Nevertheless, these entries are included in the totals computed (nominal revenues and expenditures) of the dataset employed for this analysis.

2.1.- Recent studies on the finances of the Spanish empire

New studies on the finances of the Spanish empire have emerged in the last years. Although some of them are a continuation of a rich historiographical tradition that aims to quantify the economic rise and decline of Spain from the sixteenth to the nineteenth century, many of these studies have focused on reinterpreting from a political economy perspective the way the Spanish monarchy has been portrayed by prevalent literature.

For instance, in some of these new studies the view of an imperial state continuously at war and dealing with an unsustainable fiscal position during the sixteenth century has been challenged by empirical evidence. Drelichman and Voth (2008) analyzed the debt statements of Spain with its international lenders during the Habsburg's reign (1506-1600). They showed that although Spain defaulted on its debt four times during the era of Philip II, evidence suggests that

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[17] M. Macleod, 'Aspects of the internal economy'.

these episodes were 'short-term liquidity' crises and its long-run fiscal position by the end the sixteenth century was not unsustainable.[18]

Most of the prevalent historical studies on the finance of Spanish colonialism in the Americas have relied on a 'one-sided' perspective of the transatlantic colonial exchange; a view from the *metropole* towards its colonies. However, the study of Marichal (2007) ended this historiographical drought.[19] His work focuses in detail on the finances of the transatlantic colonial exchange. He argues that the success of the Spanish Crown under the Bourbon regime by the mid-1700s was due to a limited government control together with the government's great capacity to extract tax revenue. Marichal claims that the fiscal machinery in Spanish America prospered thanks to the efficient allocation of inter-regional transfers (situados) from the rich treasuries to poor ones.[20]

Furthermore, he shows that since the Madrid central treasury depended largely on tax income from the Americas by the last quarter of the eighteenth century, the Crown 'transferred' part of its public deficits to its colonies. Due to this conflictive situation at the start of the nineteenth century, and in order to finance warfare against France and Britain, Spain over-burdened its fiscal base. A spiral of increasing military costs eventually bankrupted the central treasury house in Madrid and in the colonies.[21] He concludes:

> "In the end, all financial expedients were vain. The silver obtained from New Spain through taxes, *donativos* (donations), numerous loans […] was absorbed by military expenditures and the service on domestic and foreign debts taken by the Spanish government to pay for the international wars in which the Crown engaged almost incessantly. By 1810, the governments of both viceroyalty and monarchy were bankrupt".[22]

Conversely, Grafe and Irigoin (2012) argue that the taxation system of the Spanish Crown towards the Americas has been portrayed inaccurately by previous studies. Their discussion focused on the claim that Spanish imperial fiscal coercion has been exaggerated by the 'conventional' historical literature.[23] Their claim is that several colonial treasury districts in Spanish America had their own 'informal' control and decisions over their local budgets in terms of tax collection and expenditure allocation. Grafe and Irigoin (2006) documented that revenue

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[18] The term 'short-term liquidity' crisis has been disputed recently by Alvarez-Nogal and Chamley (2014) arguing that short-term crises were related to a tax renegotiation with lenders and not to a problem of short-term solvency.
[19] Although related works from prominent economic historians such as Lyman L. Johnson, Stanley Stein, Josep Fontana, among others, have previously analysed the colonial finances of the Spanish empire, they have not explored systematically the fiscal accounts and regional transactions of the colonies.
[20] See also in Marichal and Souto, 'Silver and the situados'.
[21] Marichal, *Bankruptcy of empire*. p. 255.
[22] *Idem,* p. 255.
[23] See a discussion between, Grafe and Irigoin, 'Bargaining for absolutism'; Marichal, 'Rethinking negotiation'; and Summerhill, 'Fiscal bargains'.

tax collection was decentralized and fragmented into a large number of tax collecting interdependent districts that managed their own local tax rates and financial instruments.[24]

Additionally, these authors claim that this fiscal 'semi-autonomy' of the colonies was granted by negotiation and not by command from the treasury of Madrid with the local elites in the Americas. This enabled the Spanish monarchy to keep official control of the territories with an 'informal rule'.[25] As a result, the colonies raised their military expenses (via *situados*) to defend themselves against potential invasions by Spain's military enemies in the Atlantic. This type of fiscal mechanism increased the wealth and power of the local colonial elites and stimulated regional economic growth. The success of this fiscal apparatus allowed its expansion by creating two additional viceroyalties (New Granada and Rio de la Plata) in order to increase the colonial fiscal base.

This semi-autonomy of the treasuries generated fiscal de-centralization, which limited the Crown's ability to impose fiscal reforms before 1700. This (de-centralized) fiscal regime came to an end with the imposition of the Bourbon reforms (after 1759). As has been argued by Arias (2013), the reforms succeeded because they proposed to negotiate fiscal centralization with local powerful elites, aligning their interests with the Crown.[26] With this, the treasury in Madrid (General Treasury) gained more control over the Spanish America fiscal administration, generating a marked increase in fiscal revenue and remittances to Spain.

However, it is not clear how damaging this was for the local treasuries in the Americas in financial terms. It is still not evident that an increase in remittances from Spanish America to Spain implied an increase in 'fiscal exaction', especially if they represented only a small share of the total revenue in nominal or real terms.[27]

Despite emerging quantitative studies on the economics of Spanish empire in the colonies of the Americas, there is still no agreement on their fiscal position; neither during the crucial years of the Spanish American insurgency or from a long-run view. To illustrate the contending interpretations, Irigoin and Grafe (2006) conclude:

> "The system of fiscal redistribution between treasury districts served its purpose […]. It funded military defence, kept the empire self-sufficient, aligned local elites' interests with those of the Crown by fostering economic growth […].[28]

On the other hand, Marichal argues:

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[24] Grafe and Irigoin, 'The Spanish empire and its legacy';
[25] Coatsworth 'Political economy'; Grafe and Irigoin, 'Stakeholder empire'.
[26] L. Arias, 'Building fiscal capacity'.
[27] For instance, Marichal (1997) argues that increases in remittances after 1790 meant a large economic 'cost' for the treasuries.
[28] Grafe and Irigoin (2006), p. 260.

"In summary, the Crown's fiscal policy weighed unequally on New Spain's population […]. At the end of the century the finances of Spanish American viceroyalties were crumbling, slowly but surely".[29]

3.- Data

Data employed in this analysis is derived from the compilation and reconstruction by John J. TePaske and Herbert S. Klein (1982) of the colonial treasury accounts (in Spanish known as *cajas reales*) of Spanish America. Their original data was collected from a 'single-entry' bookkeeping system (*cartas cuentas*) located in the *Archive of the Indies* in Seville, Spain.[30] The dataset covers the entire colonial period for four viceroyalties: New Spain, Peru (and upper Peru), New Granada, and Rio de la Plata, what today are North America (Mexico and part of the south of the United States), Central and South America (except for Brazil). In total, the coverage from the original source includes 72 cajas reales over a period of more than 250 years (1576-1823).

The present study focuses on the largest cajas of the main viceroyalties covering a period spanning from 1577 to 1813. The selection of the sample and treasuries was based on the fact that most of the analyzed cajas were considered as 'intendency capitals' that centralized tax collection from other small treasury districts. Also, other small *cajas* suffer from missing values and lack of data continuity.[31]

Therefore, as table 1 indicates I included in total annual treasury data from the following major nine treasuries; For the Viceroyalty of New Spain: Mexico City, Guadalajara, Veracruz, Acapulco, and Zacatecas; for the Viceroyalty of Peru: Lima, Potosí, Santiago; and for Rio de la Plata I include the treasury of Buenos Aires (see table 1).

Fiscal series are reported in a single currency, the *Spanish silver peso* (also called "peso de a ocho").[32] This was *de facto* legal tender in the Americas and in Europe, and therefore the standard currency used in the colonial tax accounts of the General Treasury of Madrid (Tesorería General de Madrid).

Previous quantitative research like Klein (1995), Marichal and Souto (1994), and Grafe and Irigoin (2012), among others, have analyzed partially the records of these treasuries presenting graphical evidence of nominal figures for different historical periods. Yet, no empirical attempt has been made to adjust these treasuries for price movements for the entire colonial era to provide a full systematic accounting of the long-run 'real' fiscal dynamics.

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[29] Marichal (2007), p. 249-255.

[30] A 'double-entry' bookkeeping system was ordered to be established in 1784, but it was abandoned in 1787, restoring the original 'single-entry' system.

[31] The omitted data is New Granada (today's Colombia and Venezuela). However, the present sample presented covers roughly three quarters of the entire treasury revenue of Spanish America.

[32] This was also equal to the Spanish standard of *20 reales de vellón* introduced by 1808.

Table 1
Data sample of colonial treasuries employed in this study

Viceroyalty	Treasury	Coverage
New Spain	Mexico City	1577-1813
	Guadalajara	1584-1804
	Veracruz	1590-1801
	Acapulco	1591-1809
	Zacatecas	1584-1813
Peru	Lima	1580-1813
	Potosí*	1679-1805
	Santiago	1690-1805
Rio de la Plata	Buenos Aires	1700-1809

* The 'intendancy' of Potosí became part of the Viceroyalty of Rio de la Plata in 1776.

3.1.- Inflation-adjusted treasuries

Nominal values of assets in currencies expended at different points of time do not reflect their real value if inflation is not taken into account. Although there is a vast literature documenting the long inflationary episodes in the Spanish American region during colonial times, these have not been included in the historical description of the fiscal dynamics of Spanish America.

Studies on the 'price revolution' in Europe, that is, the inflationary effects from the massive influx of bullion from Spanish America into Europe in the sixteenth century, have been well-documented by seminal literature.[33] In contrast, quantitative analyses on the effects of inflation on the colonial economy on the other side of the Atlantic (in Spanish America) are relatively scarce.[34] A possible reason impeding the proliferation of more studies on this issue is data scarcity on systematic records of regional output and prices for the Americas. Indeed, as in many regions in the world, there is practically no information on an annual basis of gross domestic output disaggregated by region before 1800.[35]

TePaske and Klein's colonial treasury data has been employed as an approximation to analyze the economic performance of the Spanish American regions.[36] Thereafter different

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[33] For instance, E. Hamilton, American *treasure*, P. Vilar, *Oro y moneda*, J. Elliott, 'The decline of Spain', D. Fischer, *The great wave*, among several others.

[34] The few are found among the empirical works of Garner (1985) and Ouweneel and Bijleveld (1989) for the case of eighteenth-century Mexico. See an overview of this historiographical lacuna in Klein and Engerman (1992).

[35] Angus Maddison's historical statistics only reported 'centennial' GDP estimates for Latin American countries before 1800, that is, one single estimate every hundred years.

[36] See for instance the works of Garner and Stefanou (1993), and Ponzio (2005).

interpretations have emerged in light of various observed 'break points' and changing trends emanated from this statistical source.

A discussion on this issue was brought up by the British historian David A. Brading who wrote a controversial essay criticizing the American scholar John H. Coatsworth on his interpretation of the treasury data for Mexico City in the eighteenth century.[37] Coatsworth argued that from 1700 to 1810, TePaske and Klein's nominal treasury revenue estimates must have been affected by the inflationary tendencies experienced during the period. He argued that in 'real' terms the total value of receipts should have fallen sharply. To demonstrate this, Coatsworth adjusted nominal figures with a maize price index which showed that original nominal figures shrank considerably when adjusting for inflation. This effect was prominent during an 'extraordinary' rise in revenue and expenditure registered at the end of the eighteenth and the first decade of the nineteenth century.

Conversely, Brading claimed that the rise in revenue and expenditure was in fact a 'real' phenomenon in terms of observed production (growth of total output), and that it was not a price effect as Coatsworth suggested. Brading argued that the silver-export boom at the end of the eighteenth century benefited the colonial Mexican economy creating additional demand for capital and labor, and thus expanding the colonial fiscal base which can explain the large peaks in the Spanish American public finances during the same period.

As mentioned, since there are no reliable records of total regional output to accurately confirm a causal multiplying effect from silver production expansion, the present estimates examine the price effect through the *purchasing power of money* of the treasuries.[38] Hence, our data takes into account Coatsworth's claim of the inflationary effects on the treasuries. However, unlike the latter, instead of analyzing one single treasury (Mexico City) and adjusting it with the cost of one single item (maize), the ensuing analysis adjusted all major treasuries available using different indices of the cost of living in the related treasuries.

For this purpose, this analysis makes use of the price information from Arroyo-Abad *et al.* (2012) of the total average costs of a consumption basket in the main colonial cities of Spanish America. A bare-bones basket is a representation of the minimum expenditure on basic consumer goods. It uses the prices of the cheapest goods of a basket that delivers a number of calories necessary for subsistence including food and non-food resources for an individual to survive.[39] Although these baskets are only a proportion of a typical 'respectable' consumer basket, in the absence of more detailed data, they provide a consistent equivalent metric of the average cost of living over time.

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[37] D. Brading, 'Facts and figments in Bourbon Mexico'; and J. Coatsworth, 'The limits of colonial absolutism'.
[38] Dobado and Marrero (2011) argue the existence of a 'mining-led growth' trend for Mexico in this period attributed to a strong correlation between the silver production and treasury receipts.
[39] See Arroyo Abad *et al*., (2012) and also in Allen *et al*., (2012) for a full detailed description on the method, quantities, and nutritional values employed in the construction of the baskets.

Alternatively, it could have been feasible the use of the cost of labor (i.e. wage index) as a deflator for government expenditures since these encompassed a significant share of salaries and public servant's wages. However, since the empirical analysis aims at evaluating the intertemporal primary fiscal balance which is compounded by government revenues and expenditures, the measurement of the revenue component (tax revenues and other transfer payments) would not be effectively measured with that deflator. This is because from the revenue side (in the public balance identity), branches referring to personal income taxes and other private transfers (e.g. donations) represented a minor share in the treasuries.[40]

On the other hand, tax revenues stemming from state monopolies of basic consumption commodities (staples from the consumption basket), and trade and sales taxes ('alcabalas') were significantly more important (as shown in figure 1). Therefore, a systematic indexation of the colonial fiscal aggregates based on the inclusion of the relevant movements of the average consumer price changes (from a subsistence basket) could offer a more comprehensive inflation-indexation measure of the local treasuries.[41]

Based on this, this study uses the changes in the average costs of the baskets in order to measure the inflationary effects on each colonial city related to the location of the treasury. For example, the measurement employs the average cost of a bare-bones basket of Mexico City to adjust all the treasuries in the viceroyalty of New Spain. The same was used with the average cost of a basket in Buenos Aires for the viceroyalty of Rio de la Plata; and in the treasuries of the viceroyalty of Peru (using data from the cities of Lima, Potosí, and Santiago respectively).[42]

To illustrate the effect of adjustment for inflation, and considering that the average price of a basket of goods is potentially a better metric than the price of a single item, the analysis shows that by adjusting the data with the former will yield more accurate estimates than previous exercises.

Table 2 displays the ten-year average revenue by decade of the Mexico City treasury, considered the richest of the Spanish Crown after 1700. It highlights the argument raised by Coatsworth depicting the differences of the original nominal series when applying a deflation

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[40] Except during wartime periods. Forced loans (donations) and church transfers increased their share exponentially in total government revenue during wartime.

[41] If consumer prices rise faster than wages (as in the post-1700 period), an inflation-indexation based on a measure of wage movements would entail a mismeasurement of the real value of the intertemporal public fiscal balance. This is because if that indexation (through wage indices) is applied exclusively on government expenditure and not on revenues, the fiscal identity would be deliberately biased, i.e. resulting in a larger government deficit induced by 'overvalued' expenditures (deflated with lower wage indices relative to the consumer price indices). Conversely, if the same wage indices are applied to deflate the corresponding government revenues, it would 'undervalue' their long-term evolution, affecting the 'real' public fiscal balance. See a similar accounting concern in Goldsmith (1985: 97). In general, the inflation-indexation follows the standard balance sheet approach (e.g. Blejer and Cheasty 1991) by employing the consumer price deflators accordingly (in this case, total average costs of a consumption basket) on both key variables: government nominal revenues and expenditures.

[42] It can be argued that within New Spain there were significant price differentials across its regions and therefore in its different treasuries. However, the scope of available price data allows only the adjustment of New Spain's treasuries with Mexico City prices.

procedure. In particular, it shows that in the first decade of the nineteenth century (1800-1809), on average the revenues collected were worth approximately the same in real terms of what they once had been worth collected in nominal terms in the preceding decade.

Table 2
Ten-year average of treasury revenue in Mexico City, 1700-1809
Millions of Spanish silver pesos

Period	TePaske and Klein's gross nominal revenue series (in thousands)	Coatsworth's revenue series adjusted with the average price of maize (in thousands)[a]	New series of revenue adjusted with the average cost of a bare-bones basket (in thousands)[b]
1700-1709	2,077	1,730	2,131
1710-1719	2,646	3,086	2,881
1720-1729	3,040	2,992	2,367
1730-1739	4,244	3,669	3,230
1740-1749	5,040	4,062	3,294
1750-1759	5,937	7,006	5,313
1760-1769	6,388	8,114	5,143
1770-1779	8,565	8,457	6,809
1780-1789	14,557	8,207	7,449
1790-1799	27,287	18,950	13,968
1800-1809	51,736	27,652	21,978

Notes:
[a] Coatsworth reported its maize index for Mexico City with 1700 as reference year. His source of maize prices is a combination of data by Rabell (1986), and Florescano (1969). However, the full price series employed for deflation was not reported.
[b] Adjusted with the ten-year average of the index of the average cost of a bare-bones basket in Mexico City (1700=100).

Source: Coatsworth's revenue series is from Los orígenes del atraso (1990). p. 39. Table II.1.

As mentioned, it was expected that discrepancies would arise when employing a more comprehensive price index to adjust the referred data. For instance, looking at the revenue series adjusted with the new index, during that decade (1800-1809) the average revenues collected were worth slightly less than the estimate of Coatsworth, which was less than half of their nominal value.

However, although there are marked differences in terms of levels before 1800, real figures adjusted with the new index yielded a similar trend to the ones that Coatsworth estimated (for Mexico City). This is due to the fact that maize price data employed by Coatsworth (maize was the major commodity in the consumption basket of the Spanish American population) is captured in the weights of the consumer baskets of the present indices (of the average cost of bare-

bones baskets). Nevertheless, these findings show a clear indication that the purchasing power of 'treasury money' went down in eighteenth-century Mexico.

Figure 2
Evolution of inflation and gross nominal revenue in Mexico City, 1577-1813
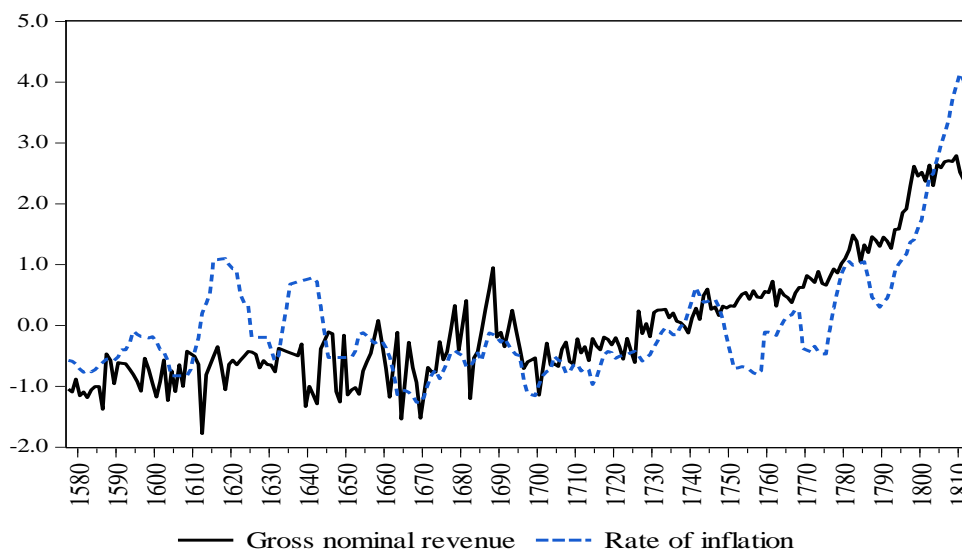
Note: Graph plotted as normalized data.
Equation estimated in OLS is: $\Delta[price]_t = \alpha + \beta \, [(log)revenue]_t + years + \mu_t$
OLS refers to an ordinary least squares regression. The rate of inflation ($\Delta[price]$) was calculated as the change of a five-year moving average of the index of the average cost of bare-bones baskets. Gross nominal expenditure is in logarithmic terms.

Source: In text and Appendix.

Moreover, figure 2 shows the significance of including these price developments into the analysis of colonial finances. Since inflation can be viewed as an indirect type of taxation for money holders, tax revenues and the rate of inflation moved together indicating the effect of printing additional currency (via seigniorage).[43] This income stemming from coinage (known as *amonedación*) was recorded on the revenue side; therefore, inflation fluctuated depending on the changes of money in circulation. Although for statistical robustness purposes it is necessary to control for other trend determinants, figure 2 shows a rough depiction of this long-term relationship across the colonial period for the case of Mexico City.

According to the pioneering work of Richard Garner (1985) who provided records of maize prices for Mexico City, there was a steep rise in overall prices from the mid-sixteenth century onwards. This inflationary period ended around the 1650s. Thereafter and until the first

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[43] This macroeconomic assumption holds under a closed economy scenario, otherwise an unmatched growth of money supply would be reflected on a balance of payments deficit. However, the former depiction is consistent with the Spanish American economy since trade was limited for most of the colonial period (Trade monopoly was lifted after the free trade decree in 1778).

decades of the 1700s there was a period of modest deflation.[44] However, after 1750, prices rose again. These price trends are confirmed by Arroyo-Abad *et al.* (2012) who assembled price data not only on maize prices for Mexico City but on the average prices of other goods and for other major colonial cities (see source details in appendix).

Figure 3 reports five indices (1700=100) drawn from the data on the average cost of the 'bare-bones' basket for each city. Although price volatility was a common denominator in the majority of the Spanish American cities, Lima and Santiago experienced relative stability compared to the price trends of Mexico City, Potosí and Buenos Aires that were characterized by higher price volatility during the entire colonial period. Another salient feature from these price records is the exorbitant price increase in Mexico and Buenos Aires at the end of the eighteenth century. These price hikes were well-established facts in the historical literature.[45] Price levels at the end of the century tripled 1700 levels and even more in the case of Buenos Aires. However, the origins of these increases are still under-explored in existent studies. For instance, Coatsworth (1982) claimed that an increase in silver available in Mexico City implied an expansion of New Spain's monetary base and therefore generated higher inflation.[46]

Conversely, the historian Eric Van Young (1992) has argued that the Bourbon reforms, despite their usual depiction in the literature as positive changes that accelerated productivity growth in New Spain after 1750, never reached the agricultural sector. According to this view the sector stagnated, generating a meager supply of agricultural goods creating inflationary pressures as a result of demand in a growing population.

Notwithstanding the structural origins of these price changes (supply or demand shock), to properly measure the real levels of fiscal revenues, expenditures, and deficit, it is necessary to incorporate the movements of prices in each local treasury in order to adjust them as conventionally utilized in public finance accounting (see e.g. Tanzi *et al*., 1993).[47] This is because inflation affects revenue and expenditure via multiple channels. One of the most important is the *Olivera-Tanzi effect* which occurs in periods of high inflation. Under this scenario, there is a reduction in the purchasing power of the consumer, a decline in firms' profits, and as a result, a reduction in government revenue collection.[48]

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[44] R. Garner, 'Price trends in eighteenth-century Mexico'
[45] See in S. Amaral, 'El descubrimiento de la financiación inflacionaria' for the case of Buenos Aires, and E. van Young, 'La crisis del orden colonial' for Mexico City.
[46] Similarly, for the case of Buenos Aires, Amaral (1988) argues the spike in the rate of inflation was associated to the large amounts of silver circulating at the end of the eighteenth century.
[47] See 'operational measures' in V. Tanzi *et al*., 'Effects of inflation on measurement of fiscal deficits'.
[48] J. Escolano, 'A practical guide to public debt dynamics', p. 18.

Figure 3
Price indices by colonial city, 1577-1813
Index of the average costs of a bare-bones basket, 1700=100
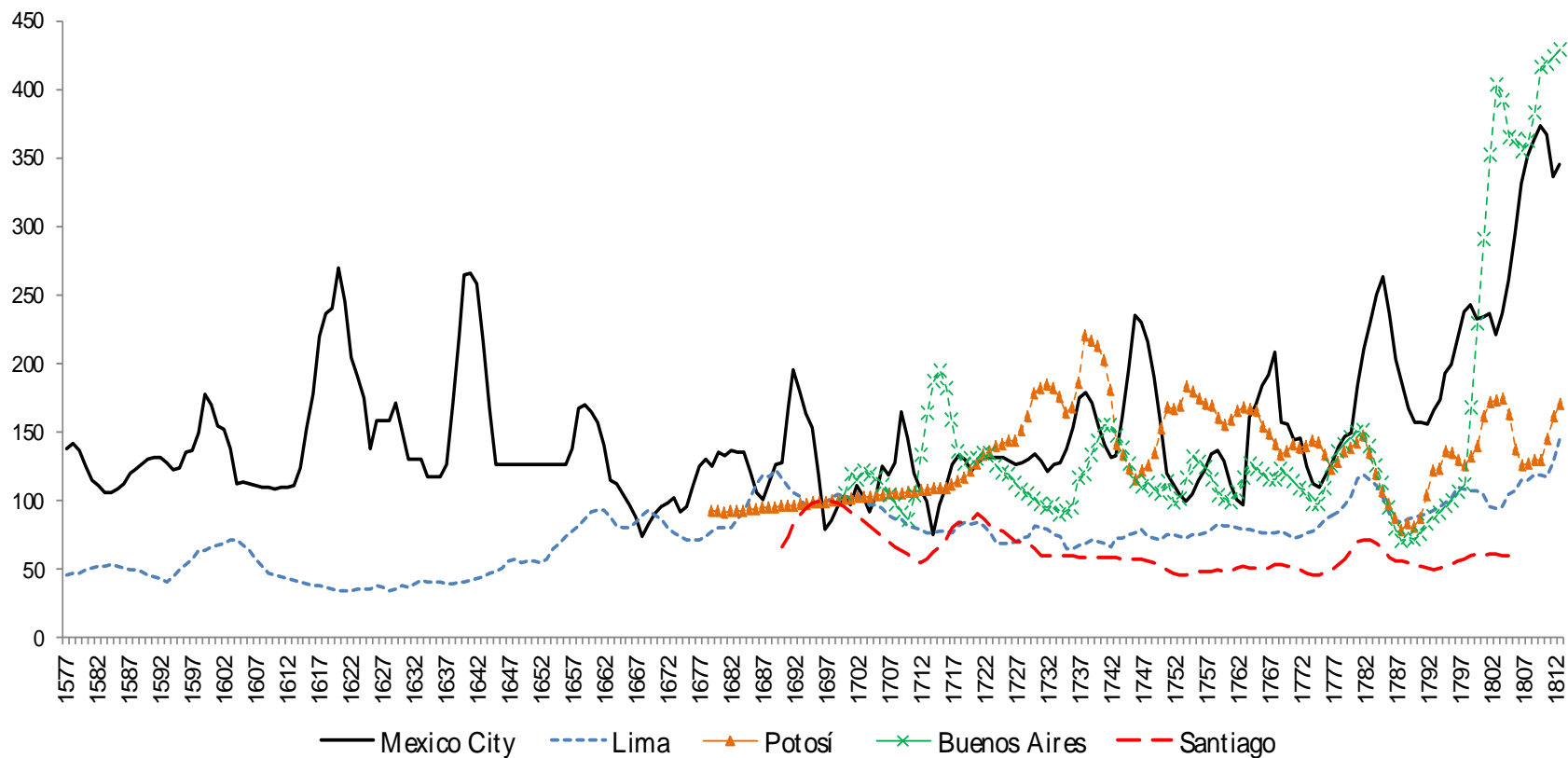
Note: Author's elaboration based on Arroyo-Abad et al. (2012). Data are five-year moving averages. The average cost was re-converted from silver grams to Spanish silver pesos. Data for Mexico City for the period 1655 to 1798 refers to data of the Mexican central region of 'El Bajío'. Price data for Potosí from 1682 to 1719 was interpolated.
Source: See text and Appendix.

3.2.- The long-run dynamics of the 'cajas reales' in constant terms

The ensuing analysis adjusts the nominal treasury figures with the new price indices in order to provide better measures of 'real' revenue and expenditure for each treasury. Figure 4 displays the major trend that Klein (1995) labeled as the 'Great Shift'. Up until the end of the seventeenth century the viceroyalty of Peru (Lima) was the most important colony in Spanish America; thereafter it was overtaken by New Spain (Mexico City). In real revenue terms, Mexico and Lima were the major treasuries in the continent, followed by the treasuries of Potosí, Buenos Aires, and Santiago.

The figure shows increasing real revenue in Lima in this period surpassing the revenues of Mexico City. This depiction differs from the widespread interpretation regarding the seventeenth century as a period of economic crisis in the Americas.[49] Although figure 5 shows that Lima ran modest budget deficits in the middle of the seventeenth century, it would rather be difficult to consider this as a 'fiscal crisis'.

In fact, as figure 5 shows, in the last quarter of the century Lima recorded succeeding primary surpluses. It was up until the start of the eighteenth century when the treasury in Lima (and also Mexico City) followed a 'conservative' policy characterized by fiscal discipline that resulted in overall balanced budgets. The Spanish Wars of Succession (1701-1715), represented a financial challenge for the Spanish Crown, and thus resorted in the use of remittances from the *Indies* to finance military costs, which was reflected in the budgets of the major Spanish American treasuries.

Moreover, large relative differences arise when comparing nominal to real revenue (in terms of levels). If there were no inflation adjustments, the magnitudes of revenue records in Lima would be undervalued for almost the whole seventeenth century. These trends are shown in the figures 1A and 1B of Appendix.

On the other hand, comparing the nominal and real revenues series of Mexico City (see figure 1B in appendix) yields a similar trend until the last quarter of the eighteenth century, precisely during and after the Bourbon reforms (1760s). As mentioned, the large nominal revenues recorded during this period (until 1760-1813) shrank gradually reaching less than half of their nominal value when inflation is taken into account (table 2). Therefore, if these adjustments are not considered for Mexico City, revenue records during the Bourbon reforms are largely overvalued.

From a long-term view, however, Mexico City ran relatively minor deficits during the whole colonial period. As figure 5 depicts, there were only a few episodes of deficit recorded under the Habsburg regime at the end the sixteenth century. For this major treasury having primary surpluses was a rule rather than the exception.

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[49] For instance, see K. Andrien, 'Crisis and decline'; and TePaske and Klein 'Seventeenth-century crisis'.

Figure 4
Treasury revenue adjusted for inflation in selected treasuries, 1577-1700 and 1701-1813
Millions of Spanish silver pesos of 1700

a. 1577-1700

b. 1701-1813
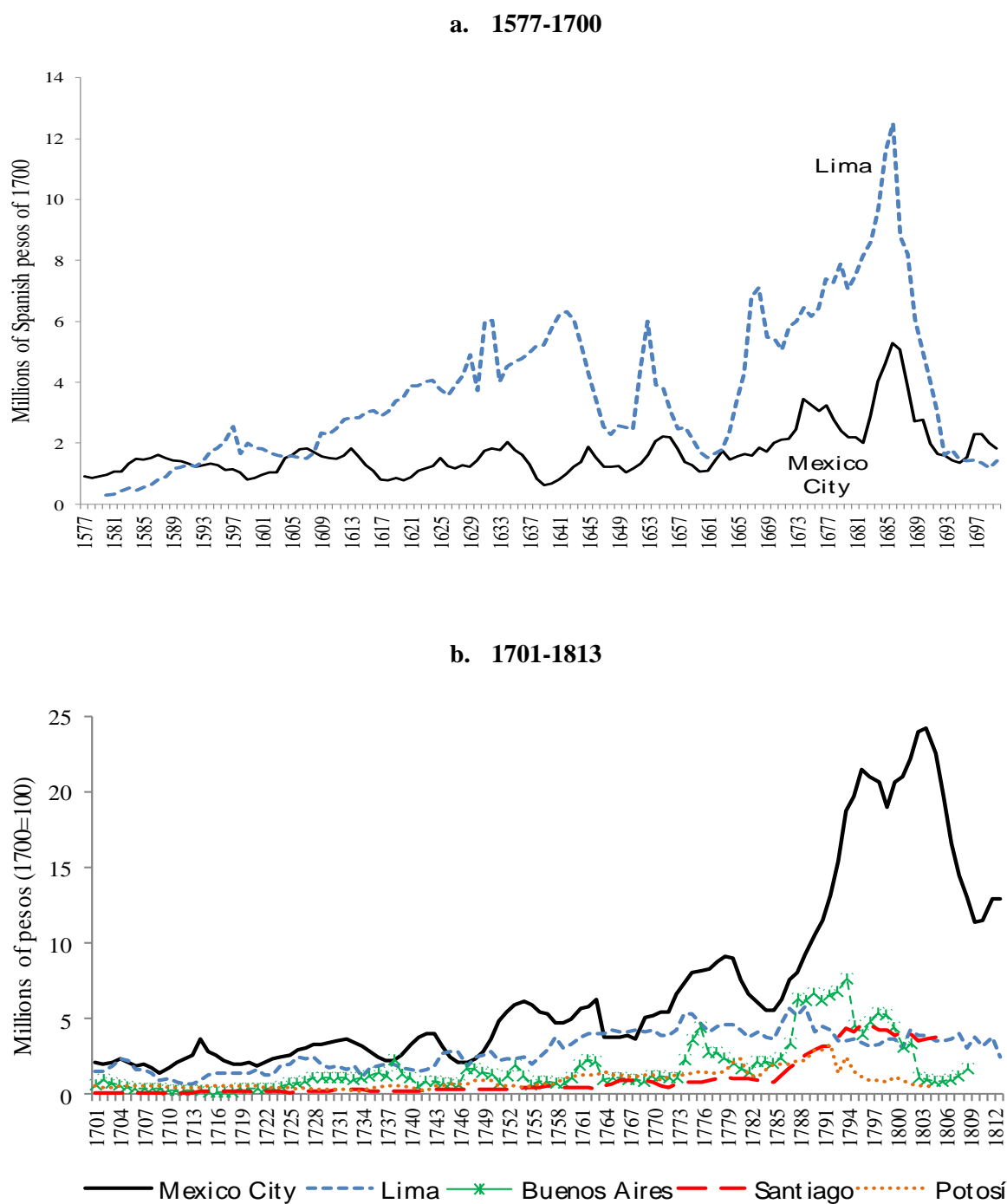
Note: Data adjusted for inflation using the index of the average costs of a bare-bones basket. Figures are computed in five-year moving averages.

Source: See text.

Figure 5
Primary budget balance adjusted for inflation in Mexico City and Lima, 1577-1700 and 1701-1813
Millions of Spanish silver pesos of 1700

a. 1577-1700

b. 1701-1813
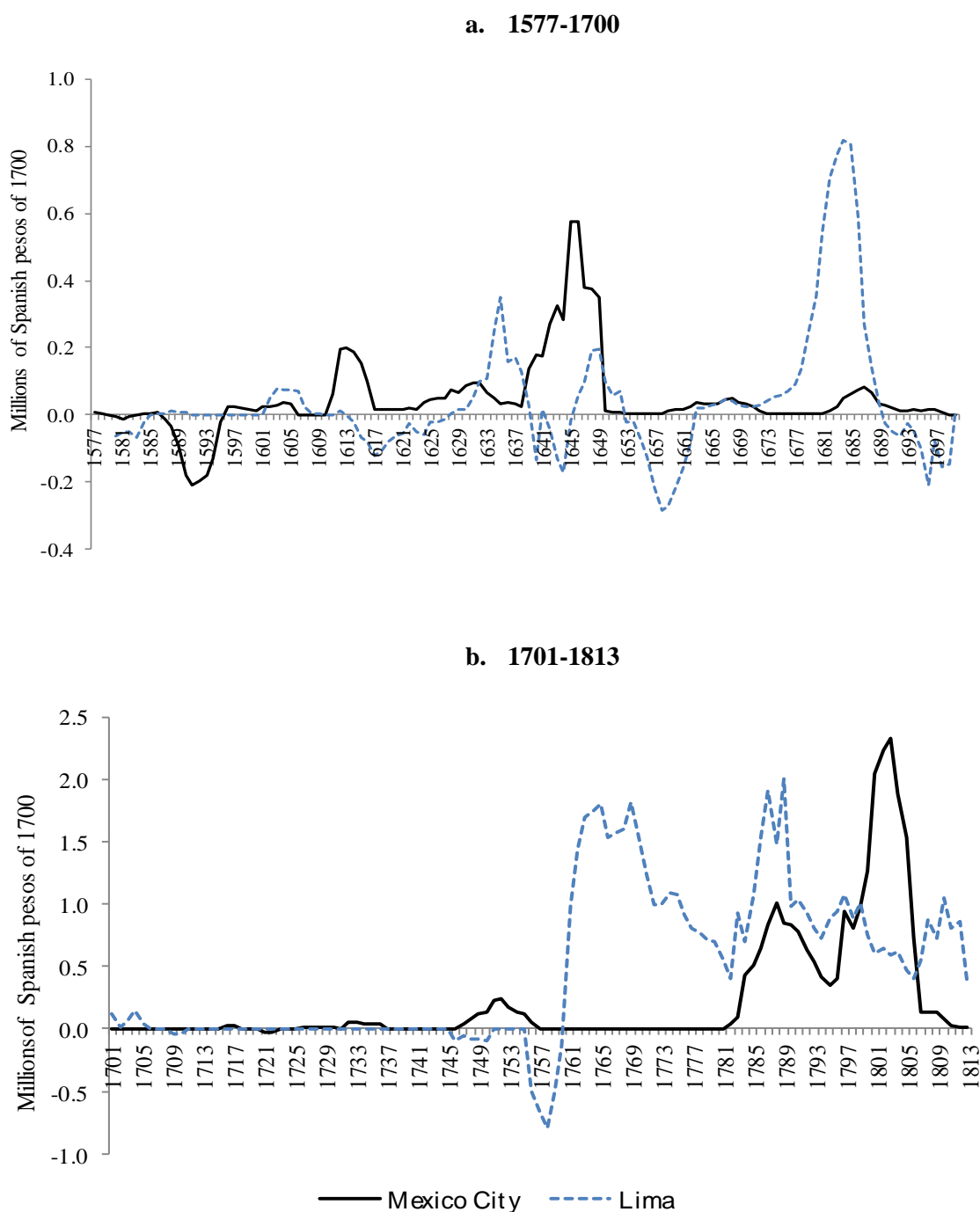
Note: The primary budget balance by definition is the total annual revenue minus the total annual expenditure before interest payments. Data adjusted for inflation using the index of the average costs of a bare-bones basket. Figures are computed in five-year moving averages.

Source: See text.

Still, the large primary surpluses at the end of the eighteenth century eroded during the 'Napoleonic wars' (1803-1814). A rise of military expenses coupled with a decline in local revenue stemming from the prevailing political uncertainty brought Mexico City's treasury to a difficult financial position in those years.[50] The fiscal bonanza accomplished throughout the Bourbon reforms was washed-out by the year 1813 when Mexico City's treasury recorded a near to 'zero-balance budget' (figure 5 part b). As some studies have indicated, the creation of new treasuries was possible because of the intra-regional fiscal transfers.[51] Parts of the surpluses from the treasury of Lima (and Upper Peru) were allocated as subsidies to the treasuries of Santiago and Buenos Aires. The importance of the creation of more treasuries was fundamental in order to expand the empire's fiscal base in South America.

Although their real revenue amounts never reached to the levels of Mexico City or Peru (as figure 4.b shows), their fiscal budgets (revenues and expenditures) were necessary for the development of the local economy. However, the downside of the inter-regional network for treasury financing was that when the revenue of a large treasury declined, it tended to affect the main treasury of the viceroyalty. For example, when silver mining declined in Potosí at the end of the seventeenth century, revenue collapsed in this treasury generating a secular decline in the tax collection of Lima's treasury.

In addition, the prominence of other major treasuries within New Spain (other than Mexico City) such as Guadalajara, Acapulco, Zacatecas, and Veracruz cannot be overlooked. These treasuries were of fundamental significance for the Spanish American fiscal administration and the Crown (figure 3.B in Appendix). Most of the collection of the port duties came from Acapulco and Veracruz, the main entry ports of New Spain. Whereas the port of Acapulco had the trade route of the Pacific Ocean that carried goods from the Philippines and Peru, Veracruz had an indispensable role in tariff collection (*almojarifazgos*) from the transatlantic commerce.[52] This made the treasury of Veracruz, the most important in revenue collection in the continent after Mexico City.

4.- Testing fiscal sustainability: theory and empirics

The empirical issue of fiscal sustainability from a long historical perspective has received increased attention. The persistence of fiscal deficits in the United States and in various European countries has raised concerns on their government's ability to cope with these deficits in the long-

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[50] See a detailed explanation of the revenue collapse in Mexico City in the work of J. TePaske, 'La crisis financiera', and in L. Jáuregui, 'La caída de los ingresos'.
[51] Marichal and Souto, 'Silver and the situados'.
[52] See in K. Bjork, 'The link that kept the Philippines Spanish'.

run, and as a consequence several fiscal studies employing a combination of historical indicators and modern financial theory have emerged in recent years.[53]

Yet, the historical case of the Spanish American economies is to some extent different from the modern fiscal mechanisms that rule in present-day economies. The colonial treasuries in Spanish America were subordinated economic units of the royal government in Spain. Thus, an interpretation based solely on their fiscal performance is warranted considering that the modifications (increases or reductions) of tax rates and expenditure decisions were semi-autonomous. Although the local treasuries were fiscal subjects of the central authority in Madrid, they were allowed to control revenues and allocate expenses according to the local requirements.[54] Still, officially they could not issue debt.[55] Most of the financial liabilities were subject to the Spanish Crown and not to the local treasury.

However, fiscal centralization was persistently challenged by the local authorities in Spanish America throughout the colonial period. Accordingly, the fiscal authority in Madrid possessed a constrained capacity to directly enforce taxes and withhold Spanish American revenues as remittances for the crown's treasury. Instead, there were sequential rounds of negotiation with the local treasuries regarding the fiscal mechanisms and financial commitments. In these negotiations, the exchange of fiscal exemptions and other economic privileges were commonly at stake.[56]

In general, the fiscal policy of Spanish America was semi-autonomous because running a deficit or a surplus was a bilateral 'negotiated' decision. Although the local treasuries operated on cash-based transfers they had their own budget constraints depending on the amount of expected revenues and expenditures to execute on the local economy but also subjected to prior arrangements with the central fiscal authority in Madrid.

The inability to issue official debt and other financial instruments at the local treasury-level is an important limitation to properly portray the colonial treasuries as representative modern fiscal entities. However, given the semi-autonomy fiscal status to allocate their own gross revenues and expenditures, the local colonial authorities faced in practice an intertemporal budget constraint, a framework that dictated fundamentally the local fiscal dynamics.

4.1.- The intertemporal budget constraint

A well-developed body of literature on the issue of fiscal sustainability has adopted the framework of the intertemporal budget constraint of the government.[57] In theory, any value for the budget

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[53] See for e.g. Sargent and Velde (1995), Dempster (2006), and Lusinyan and Thornton (2009) for empirical exercises on a historical case-studies; see also a similar approach on the public debt in the work Drelichman and Voth, 'Debt sustainability in historical perspective'.

[54] See the argument in depth in R. Grafe and A. Irigoin, 'A stakeholder empire'.

[55] The extraordinary funds so-called *donativos* acted as debt instruments during wars, however, within the cajas' bookkeeping system they usually did not enter as such. See Marichal (1990) for details.

[56] L. Arias, 'Building fiscal capacity in colonial Mexico'.

[57] See a complete overview in Chalk and Hemming, 'Assessing fiscal sustainability'.

deficit would be possible if the government could raise its liabilities without limit. However, in practice this situation is impossible since the government is restricted by the present value of its budget constraint, and because of this, it faces the problem of balancing its budget across time, meaning that the discounted value of the public debt must go to zero in the long-run (Blanchard *et al.*, 1990). That is, a sustainable fiscal policy is a position in which the public debt does not exceed the present value of all future primary surpluses.

The standard derivation of the intertemporal budget constraint (hereafter IBC) starts with a version of public sector income statement, that is, a one-period budget constraint which describes the evolution of public debt as follows:

$$B_{t+1} = (1+r)B_t - PB_{t+1} \tag{1}$$

where B_t is the stock of the government net debt, r is the interest rate, PB_t is the primary balance of the public sector which equals revenues minus expenditures excluding interest expenditure.

Solving the budget constraint recursively forward by n:

$$B_{t+1} = (1+r)^{-n} B_{t+n} + \sum_{i=1}^{n} (1+r)^{-i} PB_{t+i} \tag{2}$$

Taking the limit as *n* tends to infinity:

$$B_{t+1} = \lim_{n \to \infty} (1+r)^{-n} B_{t+n} + \sum_{i=1}^{\infty} (1+r)^{-i} PB_{t+i} \tag{3}$$

Therefore, the IBC holds if and only if the present value of the government debt in infinity is assumed to be zero:

$$\lim_{n \to \infty} (1+r)^{-n} B_{t+n} = 0 \tag{4}$$

By substituting the above into equation (3) we obtain:

$$B_t = \sum_{i=1}^{\infty} (1+r)^{-i} PB_{t+i} \tag{5}$$

According to this restriction (also called *no-ponzi* game condition), the IBC implies that the current value of the public debt is equal to the present value of the expected future budget

surpluses. In other words, a fiscal policy in place is sustainable if the sum of all discounted future primary surpluses is enough to offset the market value of public debt.[58]

4.2.- Empirical methodology

In order to disentangle the long-term statistical trends of the cajas reales across time, this analysis establishes a periodization based on the political regimes and the wars engaged by Spain during the colonial period. Thus, the full sample was split into three sub-periods: starting from a period of the 'Habsburg reign' that in the dataset covers 1577-1698; it is then followed by a period of 'succession and transition' from 1699-1759; and lastly a third sub-period that spans from 1760 to 1813 characterized by 'reformism and the Napoleonic wars'. As mentioned the sample coverage of different cajas varies, therefore, the starting sub-period was set according to the range of the statistical series.

As mentioned above, in practice the concept of fiscal sustainability implies that a fiscal policy can be maintained in the long-run without resort to a sudden adjustment. To evaluate this, many studies have analyzed whether the financial data are consistent with the 'transversality' condition by examining the stationarity properties of the budget deficit excluding interest payments of the public debt.[59] Seminal empirical research has suggested the exploration of the statistical properties of long-span data to determine if the government debt follows a stationary process. An approximation for this is to analyze fiscal data to establish if there are 'cointegration relationships' between government revenues and expenditures.[60]

According to this assumption, if a fiscal deficit is stationary, the IBC holds and no adjustment to the debt process would be necessary. This condition is also seen in empirical studies as a case of 'strong sustainability'. On the other hand, if a budget deficit is non-stationary, still there are cases where the IBC could hold as in the case where government revenues and expenditures are *cointegrated*, however in that case, the ability to pay the debt is compromised.

Accordingly, a sudden change in the budgetary process is expected in order for the government to keep the public debt viable. This situation is referred to as "weak sustainability" (Hakkio and Rush, 1991; Quintos, 1995). To test the IBC it is necessary to determine whether the series of real revenues R and real expenditures E are non-stationary I(1) variables (and integrated in the same order, usually first order) and that the first differences are stationary variables I(0).[61]

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[58] Wilcox, 'The sustainability of government's deficits'.

[59] 'Transversality' means that the present value of a variable converges to zero as the planning horizon recedes towards infinity.

[60] See for instance, J. Hamilton, 'On the limitations of government borrowing' and H. Bohn, 'The behavior of US public debt and deficits'.

[61] Notation I(1) refers to a variable integrated in its first order. And I(0) refers to a stationary variable.

In order to assess the long-run sustainability of the IBC, I estimate the following cointegration regression:

$$R_t = \alpha_t + \beta_t E_t + u_t \tag{6}$$

Where R_t is the logarithm of real revenues, and E_t is the logarithm of real expenditures. If the null hypothesis of no cointegration is rejected, then it would imply that the variables are cointegrated (alternative hypothesis). For that to hold, the residuals series of u_t must be stationary and should not display a 'unit root'. α_t is an intercept to capture the initial level of the deviation. Binary variables (dummies) were included to capture the effects of time-trends in the data. As Hakkio and Rush (1991) established, $\beta \geq 1$ would imply that all government expenditure will be financed by primary revenue, and thus, the public debt will not be growing without bound. On the contrary, if these variables are not cointegrated the gap between them will grow indefinitely, and fiscal policy would not be sustainable. I can summarize these features with the following assumptions:

a. When there is no cointegration, the fiscal deficit is not sustainable.
b. When there is cointegration with $\beta \geq 1$, the deficit is sustainable.
c. When there is cointegration with $\beta < 1$, the deficit may not be sustainable.

4.3.- Estimations

The standard method to test for cointegration consists of two steps: first, the stationarity properties of the time series are studied by using stationarity or 'unit root' tests. Second, if it is established that the series are non-stationary $I(1)$, the tests of cointegration (Johansen' test and, single equation tests) are applied to the time series variables.

Stationarity

Conventional regression models for non-stationary variables yield spurious results. For this reason, exploring the stationarity of time series variables is crucial to determine the existence of a 'true' (non-spurious) long-run relationship. The stationarity properties of the series (full sample) of real revenues, real and expenditures (E) are examined using the tests Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS). Table 3 report unit root tests results for the series in levels and in first differences.

Table 3
Stationarity tests to revenue and expenditure: New Spain
Full sample, series adjusted for inflation

Caja / test		ADF		PP		KPSS	
		Intercept	Intercept & trend	Intercept	Intercept & trend	Intercept	Intercept & trend
Mexico City	*Revenue*	-1.44	-2.63	-1.22	-2.30	1.16***	0.30***
	Δ *Revenue*	-5.23***	-5.25**	-8.33***	-8.33***	0.07	0.03
	Expenditure	-1.19	-2.95	-1.45	-2.29	1.19***	0.30***
	Δ *Expenditure*	-3.80***	-3.80***	-8.69***	-8.70***	0.08	0.02
Guadalajara	*Revenue*	-2.81	-4.96***	-2.27	-4.98**	1.42***	0.24***
	Δ *Revenue*	-11.25***	-11.24***	-8.08***	-8.02***	0.11	0.04
	Expenditure	-2.61	-3.23*	-2.61*	-3.23*	0.64*	0.06*
	Δ *Expenditure*	-7.97***	-7.98***	-7.97***	-7.98***	0.06***	0.04***
Veracruz	*Revenue*	-2.93*	-5.10**	-2.52	-5.01**	1.42***	0.23***
	Δ *Revenue*	-11.77***	-11.75***	-21.46***	-21.40***	0.07	0.11
	Expenditure	2.87*	-5.13*	-2.39	-4.97**	1.42***	0.24***
	Δ *Expenditure*	11.99***	-11.96***	22.78***	-22.93***	0.08	0.07
Acapulco	*Revenue*	-5.05***	-5.15***	-5.16***	-5.28***	0.39*	0.11*
	Δ *Revenue*	-15.32***	-15.30***	-16.13***	-16.11***	0.04	0.03
	Expenditure	-5.16***	-5.24***	-5.45***	-5.57***	0.38*	0.07
	Δ *Expenditure*	-12.51***	-12.67***	-16.05***	-16.04***	0.06	0.03
Zacatecas	*Revenue*	-1.84	-1.91	-1.39	-1.41	0.22*	0.21**
	Δ *Revenue*	-9.85***	-10.40***	-14.95***	-15.23***	0.03	0.04
	Expenditure	0.01	-1.01	-2.44	-4.62	0.23*	0.32*
	Δ *Expenditure*	-13.63***	-13.66***	-18.45***	-18.86***	0.08	0.06

Note: For ADF and PP tests the symbols ***, ** and * indicate respectively statistical significance at 1%, 5%, and 10% of the rejection that the series has a 'unit root'. The KPSS test has the opposite null, meaning the rejection of the null hypothesis that the series is stationary. Maximum lag-lengths were chosen using the Schwarz information criterion for ADF tests. For PP and KPSS tests the Newey-West bandwidth was used.

Table 4
Stationarity tests on revenue and expenditure: Peru and Rio de la Plata
Full sample, series adjusted for inflation

Caja / test		ADF		PP		KPSS	
		Intercept	Intercept & trend	Intercept	Intercept & trend	Intercept	Intercept & trend
Lima	*Revenue*	-2.74*	-2.67	-3.04*	-2.98	0.14	0.14
	Δ *Revenue*	-13.98***	-13.98***	14.01***	-14.00***	0.06	0.03
	Expenditure	-2.76*	-2.77	-3.07	-3.07	0.16	0.16
	Δ *Expenditure*	-13.62***	-13.62***	-13.62***	-13.61***	0.07	0.03
Potosí	*Revenue*	-5.20**	-5.37**	-3.43**	-3.79**	0.19	0.19
	Δ *Revenue*	-8.52***	-8.69***	-8.39***	-8.54***	0.26	0.11
	Expenditure	-5.63***	-5.64***	-3.58**	-4.03***	0.19	0.20
	Δ *Expenditure*	-7.95***	-8.13***	7.77***	-7.93***	0.27	0.12
Santiago	*Revenue*	0.35	-2.24	0.14	-1.34	0.82***	0.23***
	Δ *Revenue*	-4.08***	-4.38***	-7.38***	-7.94***	0.24	0.05
	Expenditure	0.50	-1.41	0.80	-0.92	0.99***	0.23***
	Δ *Expenditure*	-8.26***	-8.43***	-8.27***	-8.36***	0.32	0.04
Buenos Aires (Rio de la Plata)	*Revenue*	-2.03	-2.50	-2.15	-2.70	0.72*	0.07
	Δ *Revenue*	-9.72***	-9.68***	-9.72***	-9.68***	0.05	0.05
	Expenditure	2.35	-2.85	-2.40	-2.93	0.66*	0.07
	Δ *Expenditure*	-10.23***	-10.19***	-10.26***	-10.22***	0.05	0.05

Note: For ADF and PP tests the symbols ***, ** and * indicate respectively statistical significance at 1%, 5%, and 10% of the rejection that the series has a 'unit root'. The KPSS test has the opposite null, meaning the rejection of the null hypothesis that the series is stationary. Maximum lag-lengths were chosen using the Schwarz information criterion for ADF tests. For the PP and KPSS tests the Newey-West bandwidth was used.

Results are fairly consistent using different tests. They show that revenue and expenditure in levels of all selected treasuries followed 'unit root' processes [or I(1)], then become stationary [$I(0)$] in first differences. For the case of New Spain, these results are clear for the treasuries of Mexico City, Veracruz, Zacatecas and Guadalajara. However, the fiscal series of the treasury of Acapulco are already stationary in level terms. This implies that this treasury (Acapulco) originally (thus, in levels) did not have a clear trend-like behavior; its standard parameters such as the mean and variance did not change significantly over time.

For the viceroyalty of Peru and Rio de la Plata, Table 4 equally displays the feature of New Spain's treasuries. The exception is the real revenues and real expenditures in the treasury of Potosí which test shows evidence that these are stationary in their original form (levels).

The significance of finding stationary variables in levels presents an even stronger case of supporting evidence that the series (real revenues and real expenditures) are cointegrated without further empirical examination. However, most of the other treasuries are $I(1)$ (first-order integration), which means that they followed a common trend.

Cointegration

Exploring the statistical properties of times series variables have been a widely used tool to make inferences about their short and long-run performance. The IBC theory (as various theoretical propositions) implies the existence of equilibrium relationships in the levels of times-series variables. The concept of *cointegration* has been often used in applications to long-term financial data with the aim to establish if they follow a common *stochastic* drift.[62]

The economic interpretation of cointegration is that times-series variables $I(1)$ with a long-run equilibrium relationship cannot drift 'too far' apart from the equilibrium because economic forces will act to restore it. In this case, if fiscal policy and all budgetary local decisions on revenues and expenditures were sustainable (consistent with the IBC) then the fiscal series of the colonial treasuries should be cointegrated. Conversely, if there is no evidence of cointegration that may imply that the financial sustainability of the treasuries was at risk of default and/or highly exposed to a sudden fiscal adjustment. As mentioned in previous sections, seminal studies are still contending quantitatively whether this was a feature in the economies of colonial Spanish America.

Since most of the unit root (stationarity) tests of table 3 and 4 confirm the stationarity property of the variables and follow the same order of integration $I(1)$, the ensuing analysis

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[62] A formal definition of the term 'cointegration' refers to the case when a linear combination of two or more series in their first order of integration $I(1)$ results in a stationary $I(0)$ relationship. See a cliometric perspective in Greasley and Oxley (2011).

employs two cointegration tests conventionally used within the time-series econometric literature: the 'Johansen's test', and a 'single equation test'.[63]

4.4.-Interpreting cointegration tests

The cointegration tests in tables 5 and 6 show mixed results that are conditional to the specifics of the caja and the sample analysed. For instance, for the case of the caja of Mexico City, the full sample (1577-1813) analysis shows the existence of a cointegration relationship (significance of 'trace' value and 'maximum eigenvalue'). Its β coefficients (in both tests Johansen's and single equation) are near to 1 (0.99 and 0.98 respectively).

The relationship changes by analysing the sub-period 1577-1698. In this, there is no evidence of cointegration in either test and the β coefficient drops significantly (to 0.78 and 0.90 respectively). In the following period (1699-1759), cointegration is restored and β equals unity (1.03 and 1.01). However, in the last sub-period (1760-1813), despite of reaching unity, there is no evidence of the existence of cointegration. Similarly, other treasuries within New Spain experienced a comparable trend (except of the caja of Acapulco); evidence of a cointegration relationship is found in the full sample, and the sub-period 1699-1759, but also 'no-cointegration' for the last sub-period (after 1760), the period of reforms and the Napoleonic wars.

On the other hand, following this statistical analysis, the trends of the treasuries in Peru (and Rio de la Plata) are relatively different from New Spain. For example, looking at the full sample of the caja of Lima, there is no evidence of cointegration.

Yet, there is evidence of this during the first and last sub-period. In other major treasuries such as Potosí, the evidence is quite mixed; although there is evidence of it in the full sample, in the first sub-period it is not statistically significant. Whereas there is evidence of cointegration and β near unity, the 'single equation' test fails to confirm it.

Furthermore, regarding the treasury of Santiago the analysis shows unclear evidence of cointegration when looking at the full sample. However, when looking at the period of 1690-1759 it is possible to detect evidence of it with β on unity (1.01 and 1.05). Lastly, the treasury of Buenos Aires shows also that in the full sample cointegration is weak, still, there is a strong case for it during the last sub-period (1760-1809) with a *b* on unity (1.19 and 1.02).

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[63] Johansen's procedure employs two test likelihood ratio (LR) test statistics: the maximal 'eigenvalue' and 'trace' value to test the presence or absence of long-run equilibria between the variables as stated in equation 6. This implies finding whether there is a 'cointegration vector' (excluding the constant term) close to [1 -1] (See Johansen, *et al*., 2000). Once having normalized the cointegration vector on (1,-1), the condition ensuring sustainability is read as: $\beta \leq 1$. The 'single equation' test, also called 'Engle & Granger', consists in using the residual-based equation of an ordinary least square's regression from equation 6. The β coefficient from it will be statistically valid by rejecting the non-stationarity of the residuals obtained from that regression, implying the existence of a cointegration relationship.

Table 5
Cointegration tests: New Spain
Revenue and expenditure series in logarithms adjusted for inflation

Caja	Period	Johansen maximum likelihood test					Single equation test	
		Trace (Ho: r=0 ; Hi: r>0)		λ max (Ho: r=0 ; Hi: r=1)		β	Stationarity (residuals)	β
		Eigenvalue	trace value	λ max eigenvalue				
Mexico City	Full sample	0.066	17.50***	15.86***		0.99 (0.02)	-4.02***	0.98 (0.05)
	1577-1698	0.080	16.99*	13.26		0.78 (0.07)	-2.89	0.90 (0.01)
	1699-1759	0.146	14.79***	9.65***		1.03 (0.01)	-4.29***	1.01 (0.00)
	1760-1813	0.136	10.30	7.90		1.04 (0.02)	-3.18*	1.02 (0.00)
Guadalajara	Full sample	0.019	13.16**	8.88**		0.96 (0.03)	-3.53*	0.93 (0.00)
	1584-1698	0.042	7.24	4.75		0.91 (0.08)	-2.65	0.89 (0.01)
	1699-1759	0.257	35.32**	18.14**		1.06 (0.01)	-3.02*	1.00 (0.00)
	1760-1804	0.148	10.28	7.25		1.32 (0.12)	-1.57	1.00 (0.00)
Veracruz	Full sample	0.075	19.22**	16.26*		0.95 (0.00)	-3.05*	0.96 (0.00)
	1590-1698	0.086	11.35	9.39		0.94 (0.01)	-2.38	0.95 (0.00)
	1699-1759	0.205	25.24*	14.03*		1.03 (0.00)	-1.89	1.01 (0.00)
	1760-1801	0.065	2.92	2.86		0.82 (0.11)	-1.28	0.99 (0.00)
Acapulco	Full sample	1.118	39.87*	27.11*		1.23 (0.05)	-2.24	0.97 (0.00)
	1591-1698	0.089	17.85**	9.67*		0.36 (0.19)	-4.36***	0.96 (0.00)
	1699-1759	0.241	21.96*	16.89*		1.49 (0.13)	-2.95*	0.94 (0.02)
	1760-1809	0.089	6.33	4.68		0.78 (0.10)	0.11	0.97 (0.01)
Zacatecas	Full sample	0.092	28.93**	21.89**		1.02 (0.01)	-2.31*	1.00 (0.00)
	1584-1698	0.237	33.04*	29.83***		0.97 (0.00)	-3.29**	0.98 (0.00)
	1699-1759	0.161	16.91*	10.77*		0.86 (0.05)	-3.52**	0.96 (0.01)
	1760-1813	0.149	10.01	8.76		1.10 (0.03)	-0.48	1.01 (0.01)

Note: Parentheses on β for Johansen's and 'single equation' tests indicate their standard errors. Symbols ***, ** and * indicate respectively statistical significance at 1%, 5%, and 10% of the rejection of the existence of at least one cointegration equation. The Johansen test results are based on a lag length of three (p=3) for the VAR in levels (p=3), i.e. Using lags 1 and 4. The length was chosen using the Akaike information criteria. Estimations were obtained assuming a linear deterministic trend, and an intercept in the cointegration equations. The critical values (tau-statistic) for the residuals of single equation test are from MacKinnon (1996). Symbols ***, ** and * indicate respectively statistical significance at 1%, 5%, and 10% of the rejection the null hypothesis of no cointegration.

Table 6
Cointegration tests: Peru and Rio de la Plata
Revenue and expenditure series in logarithms adjusted for inflation

Caja	Period	Johansen maximum likelihood test				Single equation test	
		Trace (Ho: r=0 ; Hi: r>0)		λ max (Ho: r=0 ; Hi: r=1)	β	Stationarity (residuals)	β
		Eigenvalue	trace value	λ max eigenvalue			
Lima	Full sample	0.058	26.43	13.91	0.59 (0.44)	-2.55	1.04(0.01)
	1580-1698	0.131	21.02**	16.03**	1.04 (0.01)	-4.26***	1.03 (0.00)
	1699-1759	0.169	14.73	11.30	0.81 (0.05)	-3.51*	0.93 (0.01)
	1760-1813	0.234	18.59**	14.41*	0.86 (0.19)	-3.11*	0.62 (0.08)
Potosí	Full sample	0.105	20.07***	13.59**	1.01 (0.05)	-2.97*	0.90 (0.01)
	1679-1759	0.283	31.25**	25.32**	1.95 (0.21)	-1.55	0.87 (0.02)
	1760-1805	0.223	13.28*	11.61*	0.98 (0.04)	-3.88**	0.92 (0.02)
Santiago	Full sample	0.055	7.04	6.39	1.28 (0.07)	-1.89	1.24 (0.01)
	1690-1759	0.294	26.18***	22.69***	1.01 (0.01)	-4.59***	1.05 (0.00)
	1760-1805	0.219	13.48	11.39	1.65 (0.09)	-1.70	1.49 (0.05)
Buenos Aires (Rio de la Plata)	Full sample	0.121	16.41*	13.54*	1.21 (0.06)	-2.74	1.09 (0.02)
	1700-1759	0.156	10.17	9.38	0.88 (0.06)	-0.01	1.96 (0.03)
	1760-1809	0.243	19.89***	13.95***	1.19 (0.08)	-3.21**	1.02 (0.03)

Note: Parentheses on β for Johansen's and 'single equation' tests indicate their standard errors. Symbols ***, ** and * indicate respectively statistical significance at 1%, 5%, and 10% of the rejection of the existence of at least one cointegration equation. The Johansen test results are based on a lag length of three (p=3) for the VAR in levels (p=3), i.e. using lags 1 and 4. The length was chosen using the Akaike information criteria. Estimations were obtained assuming a linear deterministic trend, and an intercept in the cointegration equations. The critical values (tau-statistic) for the residuals of single equation test are from MacKinnon (1996). Symbols ***, ** and * indicate respectively statistical significance at 1%, 5%, and 10% of the rejection the null hypothesis of no cointegration.

Structural break

Although splitting the full sample into sub-samples is an approach to examine a structural change in the series, there are more accurate ways to detect a structural break that may have generated that change. Indeed, a criticism on the robustness of cointegration tests is the existence of structural breaks in the equilibrium relationships. A structural break appears when an unexpected shift is detected in time series variables.

However, the problem is often that the 'break date' is unknown and also there are (unknown) breaks in the variance.[64] Thus, the use of the 'Gregory-Hansen test' has become more useful in time-series analysis because it tests for one 'unknown' structural break. Since many high-frequency series have usually multiple structural breaks, Bai and Perron (2003) developed a test to determine multiple breaks in the data indicating the precise year.

Table 7
Tests for multiple structural breaks in long-run equations
Full samples

Caja	Total of structural breaks	Year(s) of structural break	F-statistic (scaled) [a]	Critical value [b]
Mexico City	1	1779	33.55	14.03
Guadalajara	2	1617, 1653	27.79	12.95
Veracruz	2	1621, 1652	18.97	12.95
Acapulco	0	-	-	-
Zacatecas	0	-	-	-
Lima	1	1761	48.55	11.47
Potosí	1	1707	153.77	11.47
Santiago	2	1708, 1781	128.9	14.85
Buenos Aires	3	1716, 1737, 1754	41.07	15.29

Note: Test refers to the Bai-Perron test of L+1 vs. L sequentially determined breaks. Estimation was made with trimming at 0.15, with five breaks as maximum, and with a significance level of 0.05. Test statistics employed HAC covariances (Quadratic-Spectral kernel, and Andrews bandwidth).
[a] reports the scaled F-stat of the last breakpoint year found.
[b] indicates the critical value of Bai-Perron (2003).

Table 7 shows an application of this to the treasury data. Although it displays the existence of structural breaks for most of the treasuries, the treasury of Mexico City, one of the most important ones, only reports one structural breakpoint (none for the case of Acapulco and Zacatecas). To some extent this empirical finding is surprising given the collapse of real revenues 'graphically' detected (figure 5b) at the start of the nineteenth century (circa 1804) in Mexico City, which would have led us to assume *a priori* the existence of a sudden change in the mean and/or

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[64] Various empirical studies set a predetermined 'break date' for structural change through a simple 'Chow test', however, that test is unable to detect endogenously the exact breakpoint.

variance in that year. However, the structural change started by 1779, precisely in the midst of the Bourbon reforms.

One the other hand, various structural breaks are reported in Santiago and Buenos Aires during the eighteenth century. It has been documented for the case of Buenos Aires that its treasury experienced a notable unstable fiscal performance before its adherence to the Viceroyalty of Rio de la Plata in 1776. After that, its fiscal revenues stabilized relying mostly on the inter-regional transfers from surpluses of other treasuries.[65] Certainly, this pre-1776 fiscal instability in Buenos Aires is revealed statistically in table 7 with three structural breakpoints.

5.- Empirical findings and discussion

After estimating long-run equilibrium relationships of the colonial fiscal series through various time-series techniques, a vital question emerges when recapitulating the usefulness of this econometric approach: what can these statistical tests reveal that previous quantitative historical works have not? First, the present data adjustments are one of the first attempts to adjust the colonial treasuries of Spanish America for price movements in a systematic way. Since inflation distorts taxpayers' income and thus, revenue collection, this adjustment is necessary as taxation and finance in colonial times were not pegged to inflation rates (tax indexation).[66] The analysis has shown that in the absence of this adjustment the fiscal trends of the local treasuries over different periods can be misrepresented.

This is not to say that the inflation-adjustment procedure impacted the condition of long-term fiscal sustainability. The price adjustment was applied equally to nominal revenues and expenditures, thus, deflating by the same factor (prices) evidently does not alter the differences between the series. The price adjustment merely reveals (on each separated series of revenue and expenditure) in relative terms with other treasuries, the effects of local inflation and deflation on the fiscal budgets. These adjustments were aimed to quantify the real fiscal stance of the treasuries from a long-term view and measure the magnitude in which high inflation caused the erosion (*Olivera-Tanzi effect*) of the value of money.

Second, a long-term historical analysis involving relationships of time-series variables should always verify that these relationships are not spurious. Thus, exploring their statistical properties (such as non-stationarity, cointegration, and structural breaks) can be a useful tool to have a better understanding of their long term-dynamics. Statistically speaking, the econometric analysis established the existence of long term equilibrium relationships of the fiscal data of the treasury budgets of Spanish America. Although there were marked changes across time and space

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[65] For e.g. Cuesta (2009), and Halperín (1982)
[66] Except in colonial North America. See for e.g. the case of the Commonwealth of Massachusetts in R. Shiller, 'The invention of inflation-indexed bonds'.

(change in trend and structural breaks) that yielded mixed results on the overall coefficients, the robustness of this was statistically significant.

Moreover, the issue of uncovering cointegration relationships in the full sample but failing to find them in different sub-periods is very much relevant to understand fiscal sustainability. In general, these findings reveal different signs of deterioration or improvement of fiscal position in the colonial treasuries across time. In particular, it indicates that when 'no cointegration' was found in a certain sub-period, expenditures and revenues were not following an equilibrium path, thus, the resulting difference between them (primary balance) was not stationary. This suggests that the budget deficit grew without bound reaching an unsustainable fiscal position. On the other hand, when cointegration was found in a sub-period, the colonial treasury operated under its own intertemporal budget constraints.

The following table summarizes the overall findings according to the periodization and the cointegration tests employed:

Table 8
Results of intertemporal budget constraints across regimes

Caja	Habsburg reign (c.1577 to 1699)	Succession and transition (c.1700 to 1760)	Bourbon reforms and Napoleonic wars (after 1760)
Mexico City	Unsustainable	Sustainable	Unsustainable
Guadalajara	Unsustainable	Sustainable	Unsustainable
Veracruz	Unsustainable	Sustainable	Unsustainable
Acapulco	Sustainable	Sustainable	Unsustainable
Zacatecas	Sustainable	Sustainable	Unsustainable
Lima	Sustainable	Unsustainable	Sustainable
Potosí	-	Sustainable	Sustainable
Santiago	-	Sustainable	Unsustainable
Buenos Aires	-	Unsustainable	Sustainable

Note: Results based on tables 5 and 6.

Most of the existing quantitative studies have focused on the last sub-period because it has been presumed that the Bourbon reforms greatly improved the efficiency of the Spanish American fiscal administration by increasing the fiscal revenues and raising the remittances to Spain. Indeed, the present estimates in real terms showed that total revenues in the main treasuries increased greatly during this period. However, real expenditures also rose immensely in different treasuries during that period, making the overall evaluation of fiscal sustainability highly differentiated across the treasuries.

Whereas most of the treasuries of New Spain during the Bourbon reforms (after 1760) experienced an unsustainable fiscal behavior, other treasuries like in Peru and Rio de la Plata were sustainable. Surprisingly, in spite of the inflationary trends in Buenos Aires, real primary balances in its treasury experienced a sustainable pattern. On the other hand, during the period of 'succession and transition' (circa 1700 to 1760), this fiscal pattern was different. Whereas New Spain's treasuries were fiscally sustainable, unsustainable behavior was observed in the treasuries of Lima and Buenos Aires. Although revenue growth and fiscal balances in New Spain's treasuries were not extraordinary, their finances were viable during this period. The period of the Habsburg reign (circa 1577-1699) is also a phase of shifting fiscal performance across the treasuries. Whereas the treasury of Lima, Spain's prime treasury in this period was sustainable, the major treasuries of New Spain (except Acapulco and Zacatecas) were not.

The findings of different shifts in fiscal sustainability between treasuries and across centuries in Spanish America suggest the following: The 'Great Shift' that according to Herbert Klein started in the eighteenth century was actually reversed after 1760 with the start of the Bourbon reforms. Marichal and Souto (1994) have suggested that after 1760 intra-regional transfers within Spanish America were the channel with which small treasuries were sustained by large treasuries, distorting the fiscal budgets (mainly Mexico City). Indeed, although newly founded treasuries (such as Buenos Aires) were aided and sustained with this, the present empirical findings suggest that the shifting fiscal performance is part of a more complex fiscal development that predates the period of the Bourbon reforms.

This analysis indicates that the so-called 'decadence' of the Spanish empire in the Americas at the onset of the nineteenth century cannot be linked solely to the fiscal performance of New Spain's treasuries as commonly portrayed in the literature. Although Mexico City's treasury plunged into an unsustainable position in the last years of the colonial period, other key high-revenue treasuries were not. The empire's fiscal sustainability cannot be evaluated separately from the developments of other viceroyalties and from other periods in time because as was shown in this study, there was a clear shifting of fiscal performance across the Spanish American treasuries. Whether this was a fiscal policy choice from Madrid aimed purposely to manage in this manner the Spanish American budgets, or merely a circumstantial fiscal dynamic developed at the local level in Spanish America remains a political economy question.

The quantitative puzzle analyzed here, on whether the colonial fiscal system in Spanish America was sustainable, unfolds statistically in the various tests presented how their magnitude varied according to a particular treasury and the period analyzed. Furthermore, it can be said that the *price revolution* experienced in Europe in the sixteenth century was also an historical feature in Spanish America in subsequent periods which had a significant effect on the value of the purchasing power of money in the local treasuries.

6.- Conclusions

After his famous journeys to colonial Latin America, the illustrious Prussian explorer Alexander von Humboldt published in 1809 the *Political Essay on the Kingdom of New Spain*. His work provided the first conjectural estimates of the treasury revenue in New Spain which revealed the vast wealth and fiscal capacity of the colonies in Spanish America. In this he indicated the following:

> "The territorial tax levied, […] indicates with precision, the progress of industry only if we compare the periods in the intervals of which the price of commodities has undergone no sensible variation".[67]

Various historical studies on the treasury accounts in Spanish America have usually overlooked this feature, thereby neglecting a fundamental financial problem: the changing value of money across time. Seminal historical literature has constantly emphasized the great efficiency of the colonial fiscal administration to collect taxes which yielded large surpluses in various treasuries throughout the colonial period. Yet, all units registered in existent studies are amounts reported in nominal terms. And although the Spanish Crown deliberately ordered the debasement of silver, this paper shows evidence that what really pushed down the value of 'treasury money' was the high rate of inflation in the local colonial economies of the Americas.

The analysis produced quantitative evidence that when this is not taken into account, the colonial finances of the largest caja for the Spanish empire, Mexico City, can be misrepresented for the period of 1760-1813. Also, for Peru when inflation is not considered, total revenues and expenditures in Lima's caja are undervalued for most of the seventeenth century.

These findings are relevant not only to understand the long-run fiscal position of the colonial treasuries, but also for re-examining singular historical events at the end of the colonial rule. For instance, when the Spanish Crown resorted in issuing treasury bills (*vales reales*) in the Americas in order to cover Spain's deficits, it generated an increase in the money supply that may have affected the overall price level in the colonies and thus, the real value of all financial instruments and the value of the public finance in the colonies.

Moreover, this paper introduced the framework of fiscal sustainability into the historical literature of the Spanish American finances. It applied a series of statistical tests to establish the existence of long-term relationships between the fiscal series of the colonial treasuries according to the IBC theory. The results are statistically significant but mixed.

There was a shifting process of fiscal sustainability across regimes. While the treasuries of New Spain were unsustainable during the 'Habsburg reign', Peru's treasuries experienced a sustainable fiscal pattern. During the period of 'succession and transition', New Spain's treasuries

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[67] Originally published in French as *Essai politique sur le royaume de la Nouvelle Espagne*. Sentence taken from the 1822 Spanish version, *Ensayo Político del reino de la Nueva España*. Book IV, chapter X. p. 459.

restored their sustainability in contrast to Peru and Buenos Aires. And finally, in the period of the 'reformism and Napoleonic wars', the treasuries of New Spain deteriorated vastly reaching to an unsustainable position, contrary to their counterparts in Peru and Rio de la Plata.

The analysis has an important limitation that is worth emphasizing because it may lead to the improvement of this empirical perspective and also to stimulate future research avenues. Aside from the inevitable generalization of various political economy aspects that this econometric approach entails, from an empirical-finance perspective it is necessary to construct better long-term measures of fiscal sustainability. Computing systematic measures across regimes of the ratio of the present value of primary surpluses (in the local colonial treasuries and in Madrid) to the value of all debt payments would yield a more accurate measure on whether the Spanish Crown (as a broad fiscal unit) was on the path to reach its financial obligations.

Furthermore, a complementary element to the latter would be the inclusion of continuous data on real output by region. In spite of the overall fiscal extraction portrayed by the literature, the analysis in this paper has shown that various colonial treasuries recorded large fiscal revenues, and particularly expenditures. This may have impacted the local economic activity which also might have expanded the fiscal budgetary constraints. New regional data on gross output would allow the proper estimation of the standard fiscal ratios (all variables could then be defined in terms of ratios to Gross Domestic Product).

An extension of this would allow us to unveil how the intertemporal budget constraints in the local treasuries were related (or not) to the growth of their colonial economies, but more importantly whether the financial liabilities of the empire were warranted on the grounds of the economic growth of Spanish America.

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Appendix

As mentioned along the document, the fiscal series of the colonial treasury accounts are from TePaske and Klein (1982). Since that all original information is reported in gross nominal terms, the original series were adjusted with price indices (deflators) of the colonial cities using information from Arroyo-Abad *et al.* (2012) in order to obtain fiscal measures in 'real terms'. From the latter source, the average cost of a bare-bones basket was taken for each colonial city, and setting an index with 1700 as reference year (1700=100).

According to the source, the average cost of these baskets include items such as foodstuff that covered around 70 percent of which 40 percent are maize and wheat, and the rest where other utility goods (30 percent) such as textiles, soap, candles and fuel [See detailed weighting description in the appendix of Arroyo-Abad *et al.* (2012)].

Exchange rate conversion

All treasury data from TePaske and Klein is reported in 'Spanish silver pesos' (pesos de a ocho de 272 maravedís; or *real de ocho*) also called 'Spanish dollar'. However, the price data from Arroyo-Abad *et al.* (2012) particularly the average cost of the bare-bones baskets was originally reported in 'grams of silver'. Thus, in this study, their data was converted into Spanish pesos in order to set all data in the same unit of account. Although the silver value of the peso was held fairly constant across the colonial period in Spanish America, there were a few episodes of debasement affecting the exchange rate. These changes were introduced based on the data from Burzio (1958) following the conversion of table 1.A:
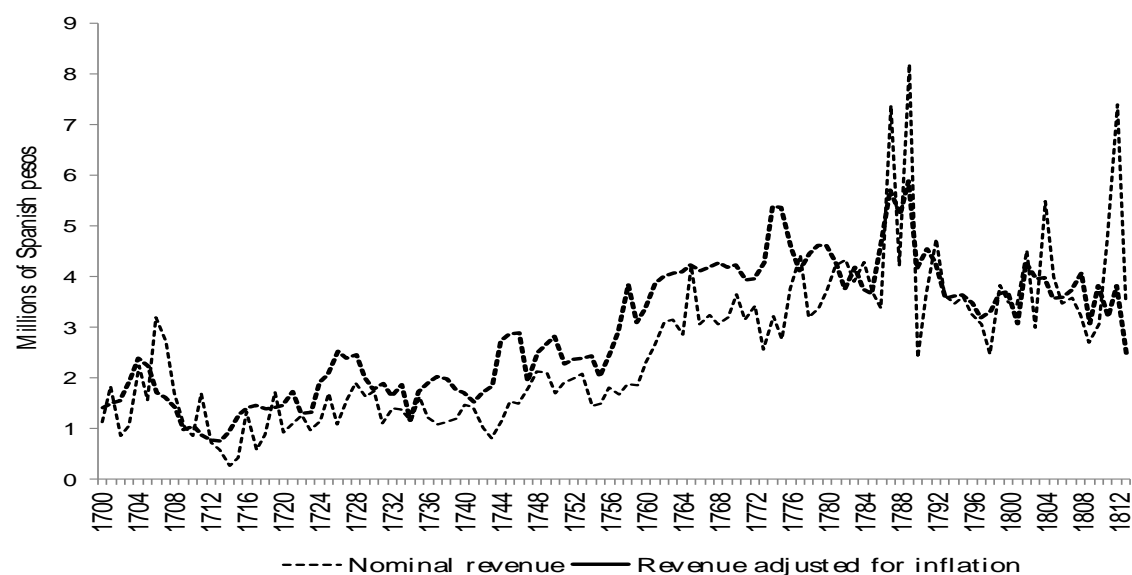
Table 1.A
Conversion Spanish peso-silver grams

Period	Spanish peso per grams of silver
1577-1626	21.561
1627	22.561
1628	23.561
1629	24.561
1630-1728	25.561
1729-1771	24.908
1772-1786	24.433
1787-1813	24.245

Figure 2.A
Nominal vs real revenue and primary balance: Lima

a)   1580-1699

b) 1700-1813

c) Spread nominal to real on primary balance (full sample)
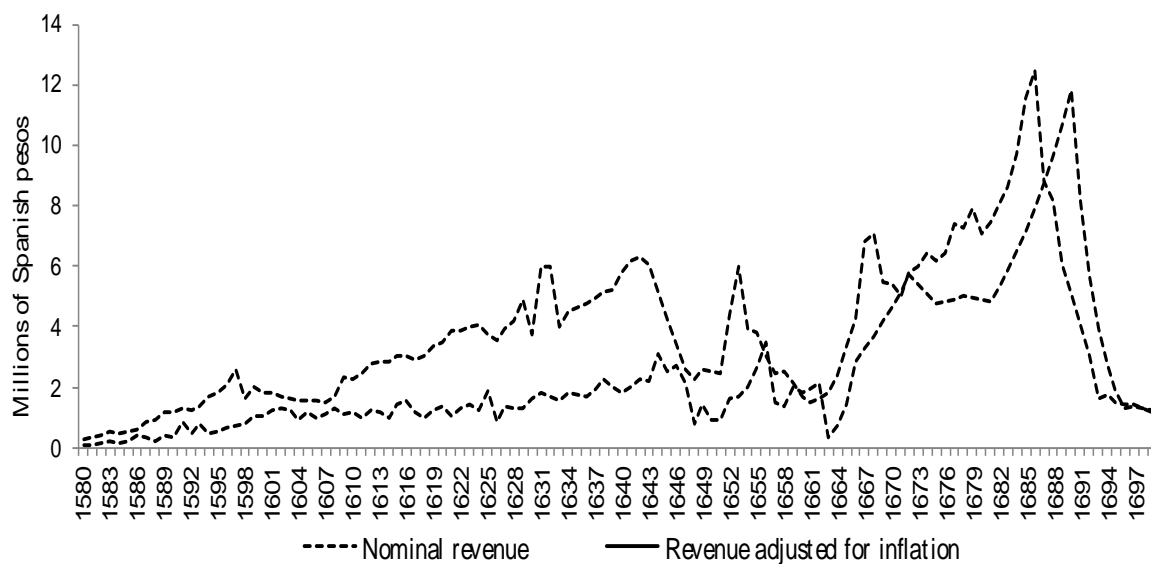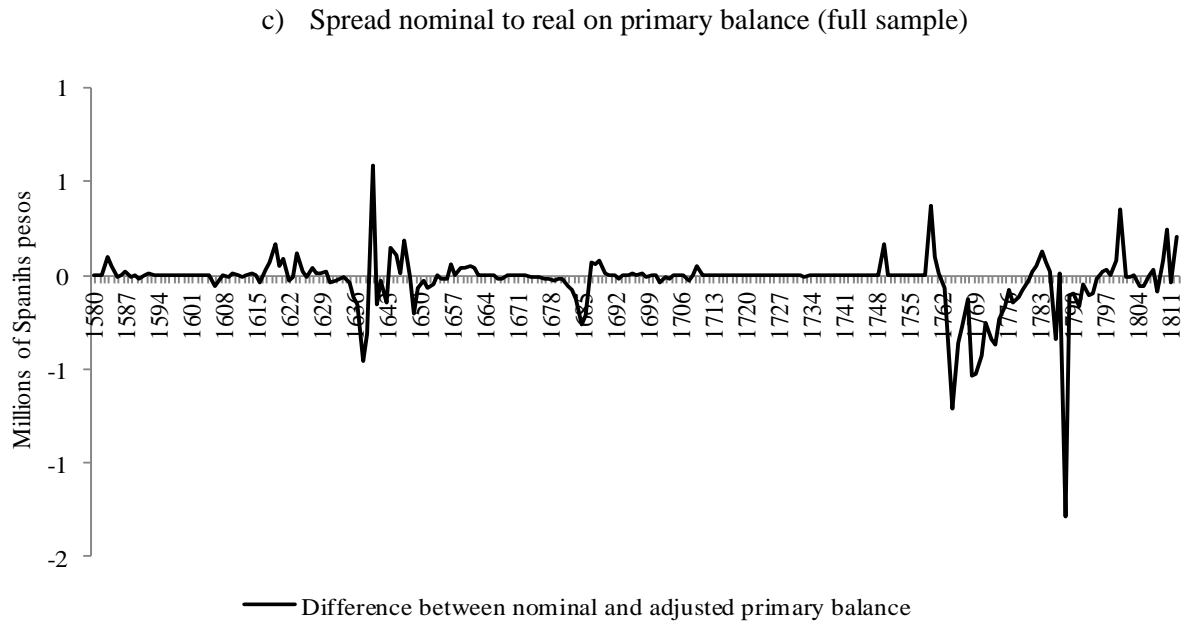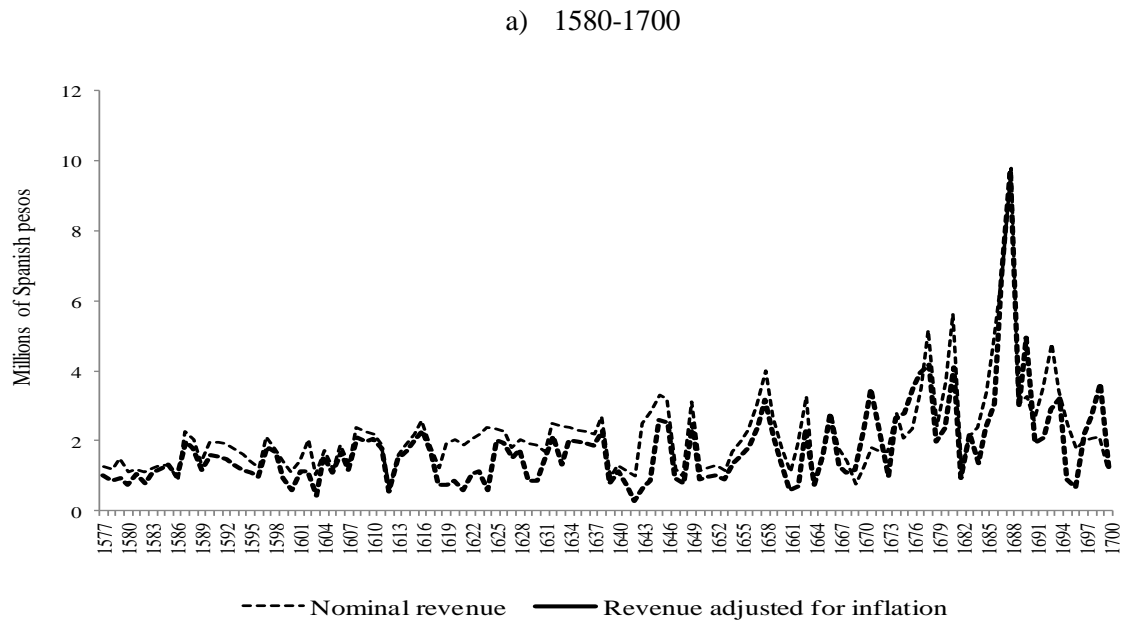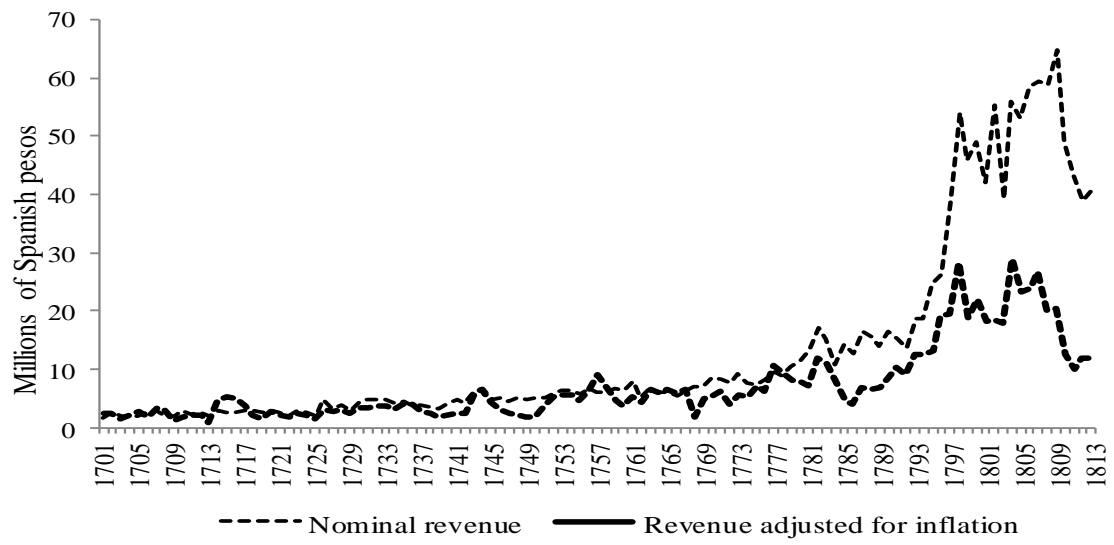

Figure 2.B
Nominal vs real revenue and primary balance: Mexico City

a) 1580-1700

b) 1701-1813

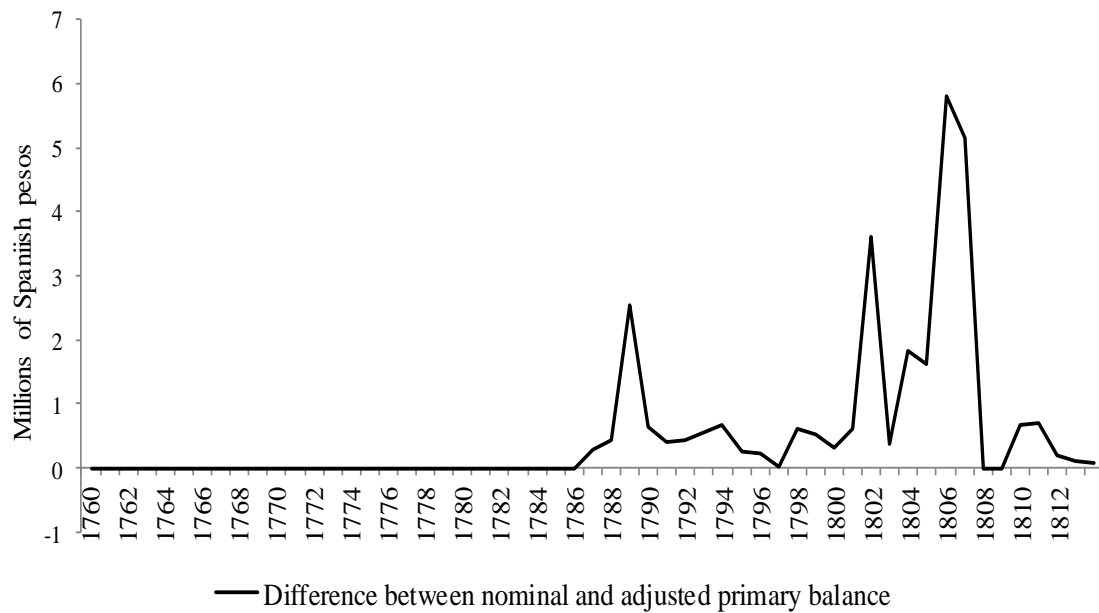c) Spread nominal to real on primary balance after 1760 (during Bourbon reforms)

Figure 3.A
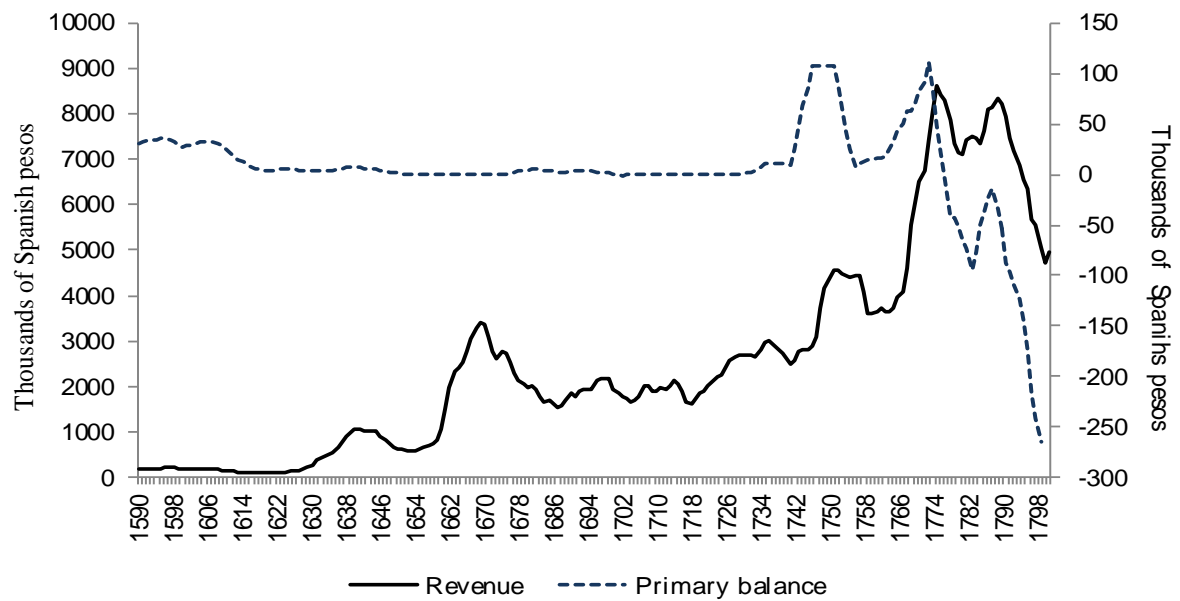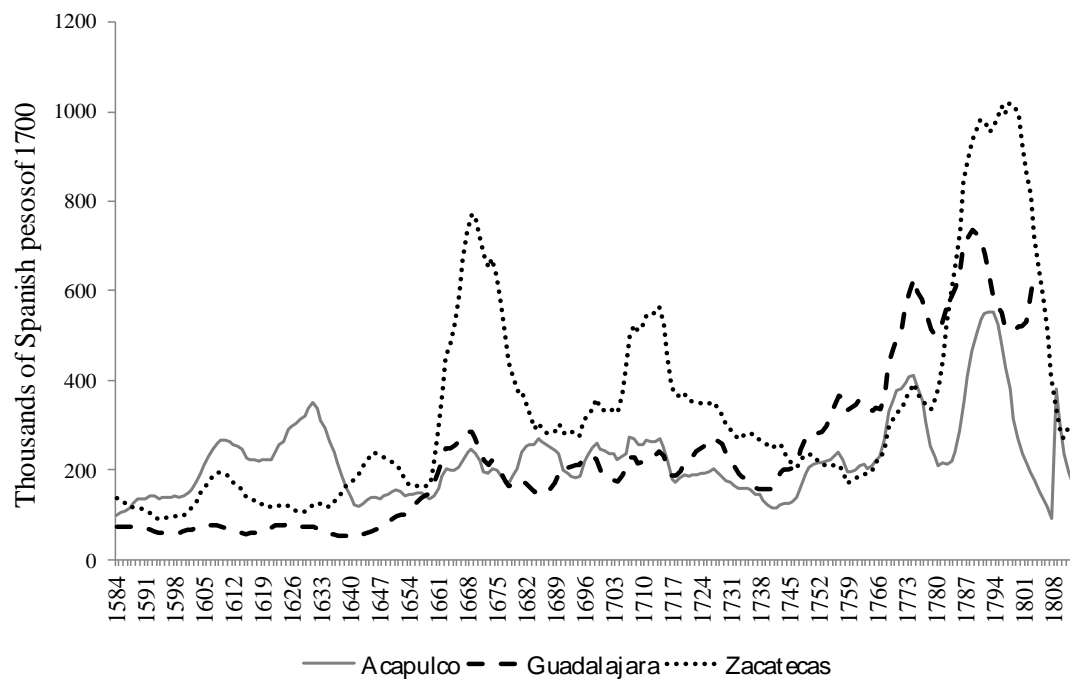**Real revenue and primary balance of the treasury of Veracruz, 1590-1801**

Figure 3.B
Real revenues in the treasuries of Acapulco, Guadalajara, and Zacatecas

Note: Data adjusted by inflation using the index of the average cost of bare-bones baskets. Figures are computed in five-year moving averages.