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THE BORDÁZAR MEMORANDUM: COST CALCULATION IN SPANISH PRINTING DURING THE 18TH CENTURY

Abstract: Since the first printers settled in Castile, books were regulated as a basic necessity and their retail prices were controlled. The bestselling works were sacred prayer books. The printing monopoly in Castile was enjoyed by a Flemish workshop (Plantin). In 1732 Antonio Bordázar de Artazu, authored, printed and distributed to the authorities a Memorandum in which he tried to prove that Spanish printers were able to print books at lower prices and still maintain quality standards. This Memorandum presented a costing model, and provides an early example of the use of cost accounting to challenge a monopoly in Spain.

INTRODUCTION

Antonio Bordázar de Artazu, a renowned printer from Valencia wrote and printed a Memorandum in 1732 addressed to the King of Spain with two objectives: to demonstrate his ability to take over the printing of sacred prayer books and to show through a costing statement that these books could be printed in Spain at lower prices. The Memorandum is 24 pages long and is available at the National Library, Madrid (under the reference 2/14180).

There are three basic reasons why this Memorandum merits a depth analysis. First, the document shows an early example of the usage of cost calculations to challenge a monopoly within a

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strictly regulated market. Second, and in contrast to similar and earlier costing documents, the Memorandum entered the public domain; it was addressed and sent to the government. Third, the costing systems used in the printing industry are of particular interest and were associated with relatively sophisticated technical processes during the 18th century. This paper seeks to contribute to the growing literature on accounting in the printing industry [Daniels, 1994; Walker and Mitchell, 1998]. The fact that Bordázar was an experienced and successful printer aged 61 when he published his Memorandum, together with his solid mathematical background, makes his paper a unique source for understanding the changes that were about to occur in the printing industry during the second half of the 18th century.

STATEMENT OF PURPOSE

The objectives of the paper are to compare Bordázar's costing model with that of a benchmark workshop (Plantin) and assess the impact of Bordázar's Memorandum on the printing industry. The evidence obtained will be used to verify the utility of Bordázar's model for decision making and to analyze the document in the context of theories of change in accounting technology.

These purposes determine the structure of the paper. The first section relates the historical background and explains the printing process in 18th century Spain from a legal and technical perspective. The second section focuses on a description of the Bordázar costing model, a discussion of the findings and a comparison with the costing model of Plantin. The third section elaborates on the impact of the Memorandum when it was published. Conclusions follow. This paper seeks to contribute to the history literature on the adaptation of accounting systems in specific organizational circumstances as recommended by authorities on accounting innovation and change [McWatters, 1993] and the history of costing systems in monopolistic industries [Carmona and Donoso, 2002].

THE PRINTING BUSINESS IN SPAIN DURING THE 18TH CENTURY

Historical Background: Until the 18th century, the principal works of the classic Castilian writers such as Cervantes, Quevedo or Lope de Vega were printed on poor quality paper, using eroded or even damaged printing types. In other European countries higher quality printing was produced [García

Cuadrado, 2001]. In Spain there was no lack of demand for printed products. Illiteracy in Castile was no lower than in other European countries, and the purchasing power of its citizens was similar.

The reasons for poor quality printing in Spain were well known to contemporary printers and the relevant authorities. A regulation from 1480 regarded books as a basic necessity. As a result they were free of indirect taxation (*alcabalas*) which was the main source of income for the Crown [Albi and Garcia, 1986]. In order to make books affordable to most people, the retail price was capped and determined according to size regardless of content. Although the retail price remained stable for at least two centuries, both labor and paper costs grew constantly. As a result the quality of printed work declined.

During the 16th and 17th centuries the bestselling volumes were sacred prayer books, the sale of which was a monopoly held by the monks of El Escorial, an important monastery close to Madrid built by Phillip II in the 16th century. These monks did not have their own workshop, so printing was performed by a Flemish printer. This arrangement was not unusual due to the fact that Flanders was part of the Spanish empire until the beginning of the 18th century. In 1731, King Philip V issued a Decree stating that the sacred prayer books had to be printed in Spain. Nevertheless, the Decree did not specify the manner in which this decision was to be implemented. Bordázar wrote his Memorandum a year later in order to reveal the economic feasibility of printing prayer books in Spain.

Since the end of the 15th century the printing regulation of Castile was included in the *Recopilación de las leyes de Castilla*. In addition to price capping and censorship, this regulation had the following characteristics. First, it was reactive legislation and amended whenever subversive practices or ideas (such as Protestantism) were detected. Second, the legislation was continuously breached. In fact, there was a crisis in the printing industry in 1752 when printers challenged a Digest of old regulations made by Juan Curiel, the ruling Judge of Prints during the reign of Ferdinand VI. The industry considered that the legislation had become obsolete and was disregarded by citizens and the authorities [González, 1945]. The King was asked to dismiss the Judge for having issued the Digest, the main object of which was to boost the Spanish printing industry. Amongst other rules, it forbade Spanish writers from having their works printed abroad, limited the import of books, and established a new censorship procedure (discussed later). The economic effect

of this Digest was such that some countries sent claims through their ambassadors [García Cuadrado, 2001]. However, in 1754 the Digest was confirmed by the Council of Castile. Many books that were printed abroad until then became scarce. According to García Cuadrado [2001], this was the reason why the most important printers incorporated the *Compañía de Mercaderes de Libros de la Corte* in 1758, which would later become the *Compañía de Impresores y Libreros del Reino*.

Legal Requirements: The administrative procedure required to obtain a license to print books had remained unchanged since 1558. Galley proofs had to be sent to the Council of Castile, which granted the License and later the Privilege. The Council also set the Tasa or highest retail price. These functions were later delegated to the Prints Commission. Several copies had to be sent to the Council of Castile following the printing of a commercial edition. The *librero* (who financed the edition) had to send a list of misprints attached to the galley proofs. Thus, if a forbidden statement was found in a commercial edition, the *librero* could not argue that it was a misprint [González Palencia, 1945].

The License: The Bulla *inter multiples* of Pope Alexander VI stated in 1501 that all books had to be censored before publication. In 1523, the Concile of Trento extended this obligation to all Catholic countries and, therefore, to the Spanish Empire. The license could only be bestowed by a select list of churchmen in order to control the publication and dissemination of ideas. Licensed editions could be seized by the Inquisition even after commercial printing if the content was considered *lato sensu*, adverse to the Catholic religion. If this happened the publisher did not receive any indemnity. For example, the Plantin workshop in Antwerp, which will be referred to in this paper as a benchmark, was seized and its assets were sold when it printed a heretical book in 1562 [Edler, 1934]. Plantin managed to prove that the book was printed by one of his employees without his authorization. In spite of this, he had to repurchase his assets to restart the business. There was a second seizure in 1567, when two of Plantin's partners, the van Bomberghen brothers, had to leave the country to escape religious persecution. Losing their business and jeopardizing their lives was a real concern for printers.

Furthermore, until the amendments of Charles III, it was also necessary to obtain a new license to make second editions.

This situation worsened when a third censorship of a technical nature was established for any publication about medicine or geography. The censorship was administered by specialized authorities such as the Royal Academy of History.

The Privilege: The privilege consisted of the right to reprint during a specified period, usually five years. This applied only to Castile territories. The publisher was the owner of this right until Charles III assigned the intellectual property to the writer. Until then, and in accordance with practice [Edler, 1937], the writer only received a lump sum when selling the manuscript to the printer.

One of the most long-lasting privileges -and doubtless the most harmful for the printing industry- was the exclusive distribution of prayer books in Castile awarded by Phillip II to the Jerónimos monks of El Escorial. From the beginning of this monopoly, the Jerónimos commissioned the prestigious printer Plantin of Antwerp to produce the prayer books. They distributed these books in Castile; that is, all Spain (including overseas territories) except Aragon and Navarre. The works printed by Plantin were of high standard, both in relation to the printing technique and the quality of the materials used.

The Tasa (Retail Price): The Council of Castile was the only authority allowed to set the retail price (*tasa*). The aim was to make books affordable to most customers and thus avoid speculation. The price was calculated according to the number and size of the sheets used, at a price that varied from, for example, 3.5 *maravedíes* (lowest value coin) for the first part of *Don Quixote* (1608) to six *maravedíes* (mrs.), a level at which it remained from the second half of the 17th century until its abolition 100 years later.

The *tasa* regulation seems to have been disregarded like the rest of the legislation. There are two reasons for this [López-Glazier, 1994]. First, the continuous reduction in the difference between retail prices and printing costs - until the reforms of Charles III. Second, the booksellers did not adhere to the regulations. The sale of books was in most cases, a way to support their main businesses. In relation to the *tasa*, non-compliance with the law must have been quite frequent, as can be seen from a Decree of Ferdinand VI which stated that books should not only show the amount per sheet, but the total price as well, because not all customers were skilful enough to count the number of sheets. This operation was not always straightforward

because every printed sheet produced between four and 64 pages, depending on the size of the book. The *tasa* was fixed regardless of the content of the book. The text on which the authorities approved the *tasa* had to be included at the beginning of the book in order to make it easier for the purchaser to compare the actual and the legal prices.

The printing industry in Castile before Charles III was thus a risky business and one which delivered low returns. Low returns were a consequence of the limitation of the retail price, and risk arose from the possibility of a second or third censorship that could trigger the seizure of the editions on sale. Besides, the attitude of the last kings of the Austrian dynasty and the early ones of the Bourbon dynasty towards the industry was changeable. For example, Philip IV prohibited the printing of books on matters regarded either as not necessary or "inconvenient". This could also occur when the censors considered that there were already sufficient books on a specific subject. The consequence of all this was that for more than 200 years, including the so-called "Golden Century", Spanish books were of a very low quality compared to those of other countries. They were characterized by bad paper, worn out printing types, and narrow margins.

The Printing Process in the 18th Century: In order to understand the costing system described by Bordázar, it is necessary to be acquainted with the printing process at the end of the 18th century. If the handwriting in an author's manuscript was irregular or had too many corrections, the text had to be re-written. Regular handwriting permitted a proportional distribution of duty among the typesetters. The printing process took a session (*jornada*) of four and a half days. Hence, the year had 80 sessions. The typesetters made up the moulds of the sheets or copies that had been allotted to them. It was preferable although not frequent, particularly in the case of the prayer books, that the typesetters were competent in Latin and spelling.

The prayer books were printed using two inks (red and black), and this required the reprinting of each "copy" (a double sided printed sheet). Two assistants gathered the paper and prepared the inks using nut oil, linen and turpentine for the glaze. Black was obtained from pitch, and red was a mixture of melted fish tails and wine. Plantin achieved very high accuracy both in the correlation between the two different inks and between the printed parts of each side of the paper. It should be noted that until the second half of the 18th century every sheet was

stamped in two parts, because of the large size of the *marquilla* or *marca real* paper.¹

Given the book clamps used at the time, the pressure of the type on the paper depended upon the press officer's skill. If the pressure was excessive, the paper of low quality, or the ink too liquid, then the printed text was not clean, making it difficult to read. Despite the skill of the press officer, spoilage was common. In response one of the officers of the great Spanish printer Joaquín Ibarra discovered a system to reduce imperfections and this was widely incorporated to the printing process at the end of the 18th century [Fanlo and Murillo, 1993].

According to the Bordázar Memorandum, the proportion of typesetters to printing machines was lower than 1:1. Four or five typesetters were enough for a workshop of six printing presses. The presses used were almost the same as the model designed by Gutenberg (born in 1397). In these machines, the impression on the paper was made by twisting the screw on the printer plate. The pressure of the plate on the paper depended on the force exerted by the officer. A whole side of the paper could not be printed in one impression because of the large surface to be printed. Thus, this action was carried out in two movements: once the first part had been printed the assistant moved the plate and the paper to print the other half of the same side of the copy. Thus, a double sided paper needed four stampings for every color. Bearing in mind that the prayer books required a double printing process because they needed two inks, the production of every session of four and a half days was 1,500 copies or printed sheets on both sides. The annual average production was 1,045 books containing 114 sheets.

The printer would then send the galley proof to the bookseller who was financing the edition. This proof was sent to the Prints Commission, who would deliver it to the censor. In order to avoid any pressures regarding deadlines or approvals, the bookseller was not supposed to know who the censor was. However, it was the bookseller who proposed one or several censors to the Commission. Appointment as a censor was frequently refused because of the dramatic consequences triggered by granting approval to certain books. The censorship procedure deteriorated during the 18th century, and it became usual for the license to be written in laudatory terms.

¹ The sizes *marquilla* and *marca real* papers are approximate to DIN A2.

The Digest of Juan Curiel, 1752 replaced the system outlined above. Years later there was a notorious default in the renewal censorship system [González Palencia, 1945]. The case was the publication of an almanac titled *Piscator Complutense*. To quote the terms of the report signed by Ricardo Wall, Minister of Ferdinand VI, this almanac “contained many errors, insolence and contempt, that hardly a sentence can be found that is not vile, obscene and shameless” [González Palencia, 1945, p. 152]. The *Piscatores* were hand almanacs that forecast the weather for a full year and included short poetry, epigrams and ironic allusions to famous people. They were very popular, and included titles such as *Piscator of the Ladies*, and the *Great Piscators* of Ávila or Salamanca.

The *Piscator Complutense* was written by Francisco de Valdemoros, a theology professor of the Alcalá de Henares University, and was approved by the Benedictine priest Vicente Marín. Its publication at the beginning of 1756 challenged the working of the whole censorship system as it was passed despite containing many defects. The defense of the Judge of Prints is well described by González Palencia [1945]. The ensuing scandal, in which Ferdinand VI intervened, triggered a hardening of the censorship regulations and the deportation of the author and the censor. The Judge of Prints survived the scandal as he proved that all procedures had been adhered to and that the error was due to the lack of care by the censor and his non-observance of the legislation. A new Digest was published in June 1756, five months after the scandal, and included precise instructions on the performance of the censorship task. It reinstated the censor’s anonymity and appointed 40 censors who were “obliged” to accept the appointment. The Digest also fixed the fee for censorship, which, in the opinion of the booksellers, had become too high. This fee was 2 *reales* (silver coin) or 78 *maravedies* per sheet. The Notary received 24 *reales*, the Commission of Prints received 62 *reales* for the Privilege and 32 *reales* for the License.

The publishing process ended once the approval of the Commission had been granted. Texts concerning the License, the *tasa* and the Privilege had to appear at the beginning of the book. The whole edition could then be printed. Some copies had to be sent to the Commission.

BORDÁZAR’S COSTING MODEL

The Bordázar Memorandum, 1732 is cleanly printed on pa-

per of excellent quality. The frontispiece includes an engraving signed by Tomás Planas and several samples of the typefaces available for printing for prayer books. Bordázár explains that the technical quality of the edition and engravings was aimed at showing the standard at which the Spanish workshops could perform.

The Memorandum is structured as follows:

1. An open letter in which Bordázár explains that his Memorandum is a consequence of the Royal Decree of 1731, where the King decided that the sacred prayer books had to be printed in Spain, although there were no instructions on the implementation of this Decree. In this letter Bordázár says that Spanish printers could undertake the task at a lower cost while maintaining quality standards. This is not the first open letter he had written. He had published at least one other related to the convenience of unifying weights and measures in all the territories of Spain. This part of the Memorandum consists of two pages including the frontispiece.
2. The Memorandum itself, detailing categories of raw materials and techniques of printing (paper, type settings, engravings, tables, scores, materials and instruments). This part is 7½ pages long.
3. A feasibility study (*Conveniencia*), in which Bordázár proposes the creation of a workshop with six printing machines to carry out the orders coming from *El Escorial*. This part is 10½ pages long.

The Royal Decree of 1731 did not eliminate the printing monopoly, but compelled the Jeronimos to bargain with printers and priests (purchasers). By the time of Bordázár's death in 1744 these negotiations had not been concluded. The first contract between the Jerónimos and the *Compañía de Impresores del Reino* (Company of Printers of the Kingdom), was actually signed 20 years later, during the reign of Charles III. The Company, whose shareholders included the main booksellers, took on the task of printing the books to a similar quality and price as offered by Plantin.

The systematic reluctance to change shown by the owners of the monopolistic Privilege and on their behalf, the Prior of *El Escorial*, Eugenio de la Llave, can be explained by comparing the huge difference between the prices proposed in the Memorandum and those at which the books were being sold, which was twice as high. If the monks accepted to change their supplier and the prayer books were finally printed at the price sug-

gested by Bordázar the reason for maintaining the traditional gross margin on sales of 50%, would disappear, since there were neither copyrights nor any relevant distribution costs to pay, and net profits were not allowed.

This high margin was a strong incentive for both the King and the customers to negotiate with *El Escorial*, but the *Jerónimos* would probably refuse to change, as in the past. This could explain Bordázar's proposal to determine a margin for the sellers. According to his proposal, the retail price (what he calls "extrinsic value"), had to be calculated by raising the printing costs ("intrinsic value") by 25%. He believed this could be acceptable even though it meant a reduction of the *Jerónimos'* gross margin by 75%, providing the price at which they purchased the books abroad was similar to the one determined by the model. Bordázar [1732, p. 12] explains this 25% as follows: "25% is to be added to the intrinsic value of these books; 15% in order to compensate for the delay in recovering the capital employed.² Extending their highest selling delay to six years [the cost] equals to 5% a year."

The printed batch of prayer books was sold out in six years. Therefore the printing costs would have to be financed for an average of three years. Based on an annual rate of 5%, the total cost is 15%. Thus, the cost of financing this stock is included in a higher retail price. I will elaborate on this later. Without any further explanation, Bordázar allots an additional mark-up of 10% for "administration wages, corrections, and any other expenses". The lack of provision for profits is discussed later.

The most interesting part of the Memorandum is the feasibility study (*Conveniencia*), which contains a description of the printing costs. It should be born in mind that Bordázar was already printing prayer books for the Benedictine monks of Valencia. These books had a specification similar to other prayer books as regards the variety of inks, the printing quality and paper, as well as the absence of misprints in the Latin texts. Bordázar states three types of costs in his business: (i) paper, (ii) engravings and (iii) impression. He does not mention any other cost of the workshop apart the wages of the master and two porters, the lease of the shop and fuel.

²Note how Bordázar does not include 'interest' in this cost, because this would be inconsistent with the rules of the Concile of Letran. On the other hand, compensation for the "loss of profits" even when lending money was accepted by the Catholic Church since the times of the *doctor angellicus*.

Paper: The paper was made in several standard sizes. In fact, one of the aims of the *tasa* was to avoid the publication of books on low quality paper. Bordázar describes four sizes. These are shown in Table 1 with equivalents in centimeters.

TABLE 1
Paper and Sizes in Centimeters and *Dedos*

	Dimensions in centimeters			Dimensions in <i>dedos</i>	
	Width	Length	Surface	Width x Length	Surface
Marquilla	36.5	51.87	1893.255	19x27	513
Marca real estrecha	46.11	50.91	2347.4601	24x26.5	636
Marca real ancha	46.11	54.75	2524.5225	24x28.5	684
Marca real mayor	46.11	60.51	2790.1161	24x31.5	756

Source: Based on the data provided by Bordázar [1732].

Printing Costs: The material on printing costs is amongst the most interesting in the Memorandum. The way in which the costs of some fungible items and the wages of the press officers are incorporated in the costing model is clearly superior to that of Plantin. At the beginning of his Memorandum, Bordázar allots costs per sheet for paper, engravings and impression. The cost of paper in the model is the market price. At the time it appears that there were enough paper mills to ensure that price and quality matched those abroad. The engravings were created by artists and craftsmen who could be contracted freely. Both paper and engravings were purchased, and thus, no calculation was needed to determine their cost. The printing cost was calculated by Bordázar based on his own experience, and according to the method that is now described. His estimations would appear arbitrary but he gave explanations. Thus, he presents a table explaining the cost of each activity included in the printing process (see Table 2).

The Memorandum contains a number of negligible arithmetic errors, as for example when determining the price of preparing the *Diario en octavo*. These errors do not impact on the general accuracy of the model. They do reflect the rapid preparation of the Memorandum and the lack of subsequent scrutiny and checking.

The column “Impression” in Table 3 shows the costs of printing every size of paper calculated by Bordázar. Bordázar provides prices but does not explain how he determined them. But as shown in Table 3, a simple calculation shows that the price of paper is in direct proportion to its surface area.

TABLE 2
Activities of the Printing Process

Styles of types (Amounts in rs.)	Settings	Printing	Cutting	Inks & Types	Total wages
Grancanon & Peticano	12	60	4	70	146
Misal & Parangona	14	60	4	70	148
Texto	16	60	6	70	152
Atanasia	20	60	6	70	156
Lecturas y cicerón	24	65	8	70	167
Entredos	32	65	8	70	175
Breviario	45	70	8	70	193
Glosilla	60	75	10	70	215
Total wages					1352
Simple average					169

Source: Based on the data provided by Bordázar [1732].

TABLE 3
Printing Cost and Paper Surface
Prices in maravedies (34mrs. = 1 real)

	Surface	Surface %	Paper	Paper %	Impression	Impression %
Marquilla	1893.255	67.86%	2.17	61.91%	5	67.80%
Marca estrecha	2347.4601	84.13%	2.50	71.43%	6.2	84.07%
Marca ancha	2524.5225	90.48%	2.67	76.20%	6.7	90.85%
Marca mayor	2790.1161	100.00%	3.50	100.00%	7.375	100.00%

Source: Based on the data provided by Bordázar [1732].

R^2 coefficient between "Surface" and "Impression" is 99.98%. The same coefficient between "Paper" and "Impression" is lower (83.58%). This finding will be discussed later. The crew (workforce or labor) estimated by Bordázar for a workshop of six machines is shown in Table 4.

TABLE 4
Crew

	For each machine	Total workshop
Master		1
Assistant to the master		1
Paper and ink porters		2
Officers of prints	1	6
Print assistants	1	6
Official typesetters	0.75 to 0.83	4 to 5

Source: Based on the data provided by Bordázar [1732].

Bordázar estimates that the wage of a workman who is directly involved with the presses is 10.331 *reales* a year for the master, 6.199 *reales* for the assistant, and 2.066 *reales* for porters. Subtracting the costs that Bordázar assigns to ink and printing types, lease of the shop and fuel, the remainder of the impression costs was to be used to pay the wages of the rest of the crew. Bordázar reserves the difference between the actual wages and those he used for his calculations to reward productivity.

Engravings: Engravings were the third cost component. Engravings were commissioned from specialists. The engravings were frequently renewed, even if those of prior publications were still available. The reason for this is that the novelty of the engravings and their appropriateness to the taste of the period was frequently used by the printers as a sign of prestige [López-Glacier, 1994]. The price of the engravings depended on the book size, and the smallest were proportionally more expensive. Table 5 shows Bordázar's calculations of all costs depending on the type of book.

TABLE 5
Engravings

Type of Book		Total prices in <i>maravedtes</i> (mrs.)					
Book Title	Size	Sheets	Engravings	Paper	Impression	Engravings	TOTAL
Epístolas	Marquilla	124	12	268.7	620	144	1032.7
Misal	Marquilla	218	12	472.3	1090	144	1706.3
Breviario	Octavo m.m.	220	16	770	1622.5	96	2488.5
Breviario	Dozavo m.a.	160	16	426.7	1072	80	1578.7
Diurno	Octavo m.m.	43	10	150.5	317.1	60	527.6
Semana Santa	Dozavo m.a.	34	12	90.7	227.8	36	354.5
Oficio N ^o Señora	32avo m.e.	4.5	11	11.3	27.8	22	61.1

Source: Based on the data provided by Bordázar [1732].

Since the average production of every print session was 1,500 sheets, based on a simple average of 114.78 sheets per book, the annual production was probably 1,045 books by press. Bordázar proposed that the prayer books should be printed in only one workshop using six presses that could meet total demand.

The Memorandum includes a table comparing Bordázar's prices with those of Plantin. This revealed the high margins that either the printer or the *Jerónimos* were benefiting from. By

heading the column that contains the prices of the monopoly with “Price at which they are sold in *San Gerónimo* those of Antwerp” instead of using an innocuous descriptor (name of the printer, current tariff, etc.), Bordázar emphasizes the extent to which printing was being done abroad (see Table 6).

TABLE 6
Retail Prices

TITLE	Cost according to Bordázar	Price at which they were sold in San Gerónimo of Antwerp
Epístolas	1032.7	2720
Misal	1706.3	3306
Breviario	2488.5	6964
Breviario	1578.7	3212
Diurno	527.6	1072
Semana Santa	354.5	726
Oficio N ^a Señora	61.1	212
AVERAGE	1,107.06	2,601.71

Source: Bordázar [1732].

Bordázar does not mention the existence of profits, and neither does he show much interest in accuracy because the aim of his Memorandum was to challenge a monopoly that was selling books far beyond their cost, and creating wealth in foreign countries.

DISCUSSION OF THE COSTING MODEL

The model described by Bordázar was relatively unsophisticated compared to modern management accounting. Neither was it an early example of scientific management in the terms described by Wells [1982]. This is because the object of the document was more limited in scope, i.e. to determine a retail price in order to challenge a highly profitable monopoly. Nevertheless, there are several findings to discuss.

Publication: The Memorandum presents a costing model used in an early industrial process. This is not particularly remarkable, but the difference to other costing models is that this was printed, published and sent to the government in order to support a regulatory change and trigger the end of a monopoly. The literature on costing history indicates that published costing methods before the 19th century were rare. The memorandum

provides evidence of the existence of costing models in the early 18th century.

Indirect Imputation of Costs: As shown in Table 3 above, there is an extremely high R^2 correlation between paper surface and printing cost. That is, there is a statistical relationship between these costs, showing that Bordázár applied a cost per square inch when determining the printing cost to every book. The costing model of Plantin can be used as a benchmark. This costing model was later described by Edler [1937]. It consists of separate accounts for every rough material such as paper and wages. Plantin's model opens an account for every project (i.e. every book printed), thus managing stocks of work in progress and stocks of books ready for sale. Nevertheless, Plantin's model treats ink, glue, thread and other materials as a general cost that was not booked in the account of each project. These costs were considered as general expenses of the workshop and were not identified separately. The difference with the model of Bordázár is twofold. First, Bordázár makes a separation between the wages of the workers directly involved with printing and those who were not. Then, he determines a printing cost per square inch by adding the cost of fungible items to the wages of the workers dividing the total by the paper surface printed. Plantin's model does have the advantage of opening a new account for every project, although these accounts did not include all costs. Bordázár did not advance a theoretical development of the imputation of costs to the process and he did not show great concern for scientific accuracy.

Profits: The determination of profits was recommended in the first handbook on accounting published in Spain [Solórzano, 1590], although the method suggested (*hacer avanço*) consists of obtaining the difference between amounts received from customers and paid to suppliers. Solórzano does not suggest that profits should be calculated periodically. When Bordázár wrote his Memorandum, the calculation of profits on an annual basis was established practice [Enciso, 1957; Jócáno, 1793]. Yamey [2000] suggests that the determination of profits on an annual basis is triggered by the instability of businesses, i.e., whenever there was a period of stability in trade and margins, merchants did not need to know regularly the profits they were achieving. Bordázár did not elaborate on profit determination; his model was not aimed towards management decision-making.

According to Tallón [1992] and Donoso Anes [1998],

Sebastián de Jócano wrote the first Spanish exposition of a management accounting system in 1793 [Jócano, 1793]. This was for use in the production of official newspapers (the *Mercurio* and the *Gazeta*), where profits were calculated on a yearly basis (*alcance*). In some respects Bordázár's model is far more sophisticated, and was published several decades earlier. Jócano's model was similar to the systems followed in other public companies [Carmona et al, 1998]. Bordázár does not calculate nor even mention profits, but this does not detract from the significance of his model. It has to be considered, that the Fifth Concile of Letran had defined usury at the beginning of the 16th century as the profit obtained in exchange of a fungible thing without any labor, danger or risk. Pope Benedict XIV wrote a letter to the Italian bishops in 1745 where he defined usury as the intention to receive more than was lent, disregarding the balance between what was given and what was recovered. Within the bounds of these definitions, making profits when selling sacred prayer books seems unacceptable, particularly when considering the lack of any risk, danger or sales effort. In any case, the wages of the owner and the savings due to productivity would reward capital invested and management ability. Profits were not regarded as a priority in the costing models of other monopolistic industries [Carmona et al, 1998]. Bordázár does not present any formal statement comparing turnover and expenses, but the data provided by his model have been used to build Table 7, which compares turnover and expenses.

Depreciation: Bordázár does not include any amount for the depreciation of printing machines. This practice was not unusual at the time. Whenever a fixed asset had to be repaired, the cost was simply booked as an expense of the period. According to Garner [1954] this was a sound practice among the printers of the period. Daniels [1994] considers that the depreciation of long term assets by the printers Walker Evans & Coswell (WE&C) in the USA in 1874 represents an early case.³

Subactivity Costs: Bordázár says that during the periods in which some of the six machines were not busy with the production of sacred prayer books, they could be used for printing other books. Although he does not expand on this, he was effec-

³ One of Plantin's presses, which can be seen today in the Plantin Museum in Antwerp, is still used occasionally for special editions.

TABLE 7
Income and Expenses

Item	Nature ⁴	Amounts in maravedies		Amounts in euros		
		Per book (1045 /year)	Per press p.a.	Per book (1045 /year)	Pre press p.a.	Per work- shop p.a. (6 machines)
Sales		1,107	1,156,815	113.10	168,970.97	1,013,825.80
Paper	PAP	313	327,085	45.78	47,775.89	286,655.35
Engraving	GRA	83	86,735	12.12	12,669.00	76,014.04
Inks and types	IMPR	182	190,190	26.58	27,780.23	166,681.38
Print officers and assistants ⁵	IMPR	264	275,880	38.56	40,296.60	241,779.60
Rest of crew ⁶	IMPR	238	248,710	34.76	36,327.99	217,967.97
Lease and fuel	IMPR	27	28,215	3.94	4,121.24	24,727.46
Difference (profits)		0	0	0	0	0

The cost of paper (312.9 mrs.) and engravings (83.1 mrs) is the simple average of the seven types of books (312.9 mrs).

Source: Based on the data provided by Bordázár [1732].

tively proposing the absorption of fixed costs. Bordázár seemed to know from his own experience about the existence of subactivity costs.

Distinction between Direct and Indirect Labor Costs: Since the model considers an average wage cost of 171.5 *reales*, I will assume this amount in spite of the small error (see Table 2). Bordázár then multiplies the said amount by 1,500 copies (sheets) of marquilla paper for every 4.5 days' session, amounting to 220rs. and 20mrs. Subtracting from this amount the direct labor costs for every copy, Bordázár obtains an "excess of wages" of 49rs. and three mrs. for every session. Assuming full utilization of the six printing machines of the workshop, Bordázár obtains the annual amount of 49rs. 3mrs. x 80 sessions x 6 machines = 23.562rs, which he calls *residuo de los salarios* (remainder of the wages). This was basically used to pay for the leases and the wages of the rest of the crew. There is a small error here, since Bordázár calculates 23.662 *reales* instead of 23.562. (Using the same criterion as above, I will use his figure in spite of the mistake). This *residuo de los salarios* should absorb the fixed costs of the workshop, which Bordázár [1732, p. 17] calculates as follows:

⁴Nature refers to the three categories suggested by Bordázár: Paper (PAP), Engravings (GRA), and Printing (IMPR).

⁵Could be considered as direct workforce.

⁶Could be considered as indirect workforce.

<i>Residuo de los salarios</i>	23.662 rs.
Lease of the workshop and fuel:	<u>3.000 rs.</u>
	<u>20.662 rs.</u>

Absorption:

Master	5 parts/10	10.331 rs.
Assistant	3 parts/10	6.199 rs.
Paper porter	1 part/10	2.066 rs.
Ink porter	1 part/10	2.066 rs.

This shows that the average printing costs used by Bordázar at the beginning of the Memorandum was obtained by adding direct and indirect labor costs. The reliability of the printing costs per unit of surface shown by Bordázar depends upon the wages on which he had based his model. These wages can be compared to those of other studies of the same industry and period [Enciso, 1957], and there are no significant differences. As for the size of the crew, there is no way of knowing if it was adequately dimensioned. Considering that 80% of the printing costs were wages of the direct workforce (typesetters, print officers and their assistants) there was little margin for error.⁷

Determination of the Retail Price Based on Multiples: The current system used in the printing industry for calculating the retail price⁵ is multiple on cost. Bordázar did the same when he deter-

⁷Walker and Mitchell [1998] indicate that most workshops in Britain hired fewer than 20 hands at the end of the 19th century. The workshop described by Bordázar was of a similar size.

⁸The calculation methods for fixing the retail price have changed of course, as has printing technology. But the main elements of the system used by Bordázar are still identifiable. See for example, the criterion proposed by Néret [1951] in order to fix the retail price based on the publication cost of French books with official prices:

$$\text{Retail price} = \frac{\text{printing cost}}{(1-\text{avg. discount}) \times (1-\text{amortization rate} - \text{author proceeds})}$$

The amortization rate is a figure between 0.45 for bestsellers and 0.65 for those of slower sales. This formulation is similar to that described by Bordázar, considering the lack of the copyrights and amortization rate, inasmuch as the Jerónimos of El Escorial purchased the entire edition and financed the stock.

Alfonso Mangada prefers the following formula:

$$\text{Multiple on cost} = \frac{1}{(1-tb + gg) [(1-tb + gg)g] - d}$$

Where:

tb	profit on sale
g	distribution expenses
d	copyrights
gg	general expenses on net sale.

mined the “extrinsic cost” or retail price by increasing the “intrinsic cost” by 25%. As explained above, this percentage was determined by estimating the total costs that would be incurred before the batch of books was sold out. This system is similar to the one used by WE&C in the early 19th century as described by Daniels [2001].

Application of Interest: Considering that the finished books had to be stored for several years until the whole production was sold out, Bordázar suggests increasing the retail prices by 5% p.a. in order to include the financial cost.

Productivity: As mentioned above, Bordázar reserved some amounts to reward productivity. He does not elaborate on this, nor does he explain how these rewards would be calculated, but this can be considered as an early example of “human accountability” in the terms described by Hoskin and Macve [1988].

Objective of the Model: According to Flingstein [1993], the use of accounting practices become pronounced only during the finance control phase. Although Bordázar’s Memorandum presents a costing model, it was not aimed towards improving financial control. In fact, it was rather focused on determining retail prices in order to trigger the end of the monopoly in the manufacturing and sale of books. This finding accords with the discussion of Flingstein’s theory on control conceptions which suggests that there is no direct link between emerging accounting practices and specific conceptions of control.

Change in Accounting Technology: Bordázar’s Memorandum matches the elaboration of change in accounting technology made by Edwards et al. [1995] and Boyns [1996]. The change agent of accounting technology was in this case the proprietor of an existing and successful printing office.

IMPACT OF BORDÁZAR’S MEMORANDUM ON THE PRINTING INDUSTRY

A few decades after the appearance of the Bordázar Memorandum in 1732 important developments took place in the Spanish printing industry. In 1763, barely three years after being crowned King of Spain, Charles III changed book and printing legislation. The *tasa* was abolished except for schoolbooks and catechisms. The Decree explains this decision by arguing that

“free trade is the mother of abundance”. This resulted in an immediate improvement in the quality of materials and favored the return of Spanish printers who had migrated in search of better opportunities abroad. A new set of favorable regulations was approved one year later when the obligation to gain a new license for second editions was eliminated. Further, the censorship system was relaxed and censors no longer remunerated. In consequence of the pressure exerted by the King on his confessor, who also enjoyed the supreme command of the Inquisition, censors determined not to confiscate any publication without first hearing views of the bookseller.

The *Compañía de Impresores del Reino* (Printers Company of the Kingdom) was constituted at the beginning of the 1760s, and the contract with *El Escorial* was signed in 1764. Up to eight shares in this company could be bought annually for 1,500 *reales* each. The result of the first contract was disappointing: the time agreed for the first delivery was defaulted and the *Compañía* incurred additional costs due to the delay, which swallowed up all the profits. Thereafter, the *Compañía* had to ask for discounts when purchasing vermilion and antimony from the royal monopolies. The company was not profitable until it built its own workshop in 1787. Later, this workshop became royal property, and carried out the printing of all the Spanish official papers (*Boletín Oficial del Estado*). The legislation permitted the Company to print publications other than prayer books. In order to avoid unfair concurrence, this authorization did not include the right to print popular, high selling books.

No evidence has been found of any influence of Bordázar's proposals on these events. Too much time elapsed between the Memorandum (1732) and the amendments of Charles III (1763) or the contract between the *Compañía* and *El Escorial* in 1764. Thus, it is unlikely that a direct influence could have existed. The Memorandum shows that the main issues of printing cost calculation, such as cost identification, indirect allocation of costs, determination of prices through multiples on cost, and the application of interest, were already known and used in early 18th century Spain. Besides, this paper suggests, that the end of the monopolies that occurred during the 18th and 19th centuries was probably triggered not only by political reasons, but also by the pressure of an expanding industry for free trade. García Cuadrado [2001] suggests that the printers incorporated the *Compañía* in order to undertake the printing of some books which could not be imported any longer as a consequence of the Digest of Curiel.

No evidence survives about the role of costing models, such as that described by Bordázar, in ending this monopoly. The first attempt to undertake the printing of sacred prayer books by the *Compañía* was a failure from an economic point of view. This suggests that there was no previous business planning. The *Compañía* failed to allot the whole production to only one workshop as suggested by Bordázar. The shareholders of the *Compañía* preferred to increase their own activity instead. In consequence the *Compañía* finally built its own workshop.

CONCLUSION

The Bordázar Memorandum used a costing model to challenge a monopoly in order to show that sacred prayer books could be printed and sold at lower prices. This costing model included concepts such as the imputation of indirect costs, application of interest and the separation of direct and indirect wages. In addition, the retail price was determined as a multiple of the total cost of the books.

The costing model of Bordázar entered the public domain. However, no evidence has been found of its impact on the costing models used in the printing industry. In any case, the model suggests that the costing tools and procedures described by Bordázar were known in the industry. If compared with the other costing models used in Spain before the 19th century, the Bordázar Memorandum was also oriented towards the determination of the sales price, and does not focus on other aspects of management decision making.

The main differences between Bordázar's costing model and that by Plantin, were twofold. First, Bordázar separated the wages of workers directly involved with printing from those who were not. Then, he determined a printing cost per square inch by adding the cost of fungible items to the wages of the said workers and dividing the total by the paper surface printed. Plantin's model seems to have been superior in that a new account was opened for every project, although these accounts do not include all costs. The Bordázar model also proposes the application of interest by increasing the prices of products on sale if they have to be stored for several years. The lack of concern with profits should not be considered as a weakness of the model, as both the nature of the goods produced, as well as the Catholic regulation on usury made profits unacceptable.

Although no evidence has been found regarding the Memorandum's impact on the printing industry, the publication

and its target audience suggests that the end of the monopoly in 1764 was not triggered by the legal amendments issued in 1731, but by the pressure of the industry and its consumers.

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