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## Abstract

This paper provides new series of building wages for 18th-century Madrid. At an international level, the usual point of reference for Spain during the 18th century is the wage series that Earl Hamilton compiled (and Robert Allen included in his database) using the payrolls from the construction of the Royal Palace of Madrid. However, Hamilton did not fully exploit the rich information that those data provide about wage rates, skills and labour force participation. Contrary to the simplicity of the labour categories in Hamilton's series, our results show the existence of a complex world of skills and, consequently, of wage rates that only come to the surface when we reconstruct the working lives of the thousands of workers who participated in the building of the new palace. The new data presented in this paper provide some new insights into the functioning of labour markets and the complexity of wage (and even human capital) formation in pre-industrial Madrid.

JEL Codes: J24, J31, J49, N33, N63

Keywords: Spain, building wages, pre-industrial labour market, 18th century, construction history

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## 1. Introduction

Wage rates and prices have long attracted the attention of historians. In the last two decades, debates regarding the origins of modern economic growth and the underlying factors that brought about the industrial revolution have led to several comparative analyses of pre-industrial economies in which prices and wages play a central role (Allen, 2001, 2003, 2009, 2011; Allen, Bassino, Ma, Moll-Murata and Zanden, 2011; Broadberry and Gupta, 2006; de Pleijt and van Zanden, 2016; de Vries, 1994b, 2009; Malanima, 2013, 2018, 2009; Malinowski, 2016; Pfister, 2017; van Zanden, 1999, 2009a). The second generation of consumer price indexes (van Zanden, 2005), and particularly the model of standardised baskets devised by Robert Allen (2001, 2009, 2015), have provided new methodological tools for the study of the cost of living. Wages, however, have never attracted much attention. Only recently, with the aim of widening a panorama dominated by the wages of male construction workers, has research focused on reconstructing annual incomes and wage rates series for diverse occupations, and also on women's earnings (Burnette, 2004; Gary, 2017; Humphries and Schneider, 2019; Humphries and Weisdorf, 2015, 2017; Llopis Agelán and García Montero, 2011; van Zanden, 2011). Nonetheless, the daily wages of skilled and unskilled building workers are still the basic point of reference in many studies including comparative analyses of productivity levels, enquiries into the relationship between workers'skill levels and economic growth, and quests to identify the causes of the industrial revolution itself. However, as Stephenson (2018a, 2018b) pointed out in the case of London, many of these wage series for the building sector stem from studies that were carried out decades ago and are based on data that are very limited but in most cases have been adopted uncritically.

In Spain, the work of Earl J. Hamilton (1928, 1929, 1934, 1936, 1947) continues to dominate the study of prices and salaries, and his data remain the main Spanish point of reference in international comparative studies (Allen, 2001; Feliu, 1999; Martín Aceña, 1992; Munro, 2008; Pamuk, 2007; Pfister, 2017; Phelps Brown and Hopkins, 1959; van Zanden, 1999). Although his price series have recently been submitted to careful analysis (López Losa, 2013), his wage series have continued to be used extensively despite never having received a similar degree of scrutiny. Recent studies have increased the stock of wage series available for Madrid (Andrés Ucendo and Lanza García, 2014; Llopis Agelán and García Montero, 2007, 2011), as well as for other cities such as Bilbao, Valencia, Valladolid and Sevilla (López Losa and Piquero Zarauz, 2016; Serrano García, 1999), which add to those previously published for Valencia in the 18th century (Palop, 1977) and Early Modern Barcelona (Feliu, 1991). Nonetheless, most of these new series are only supported by a limited number of quotations from bills of repair or small construction works carried out by diverse institutions.

This research is based on an already known but barely exploited source: the payrolls

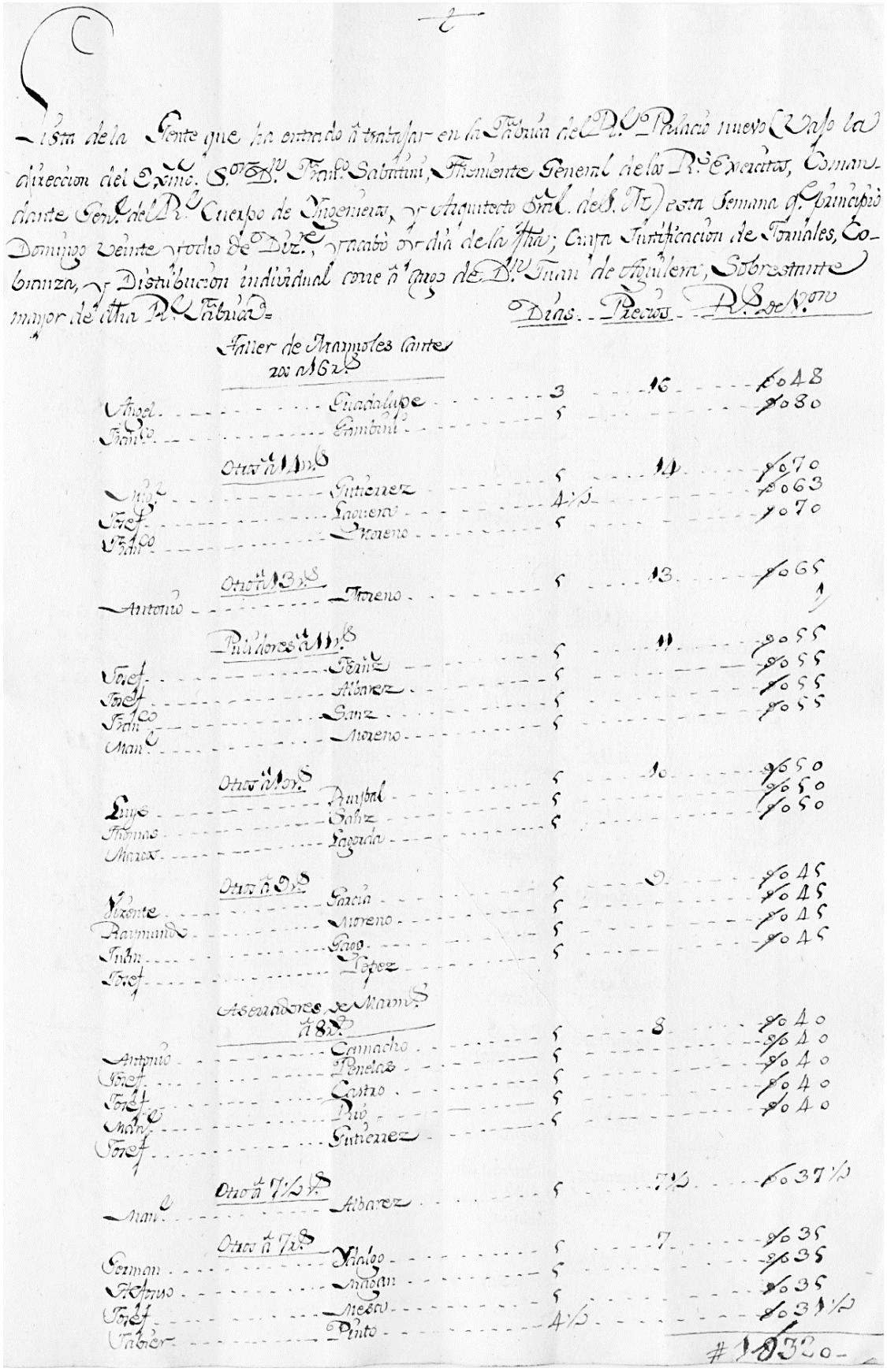
of the workers employed in the construction of the Royal Palace in Madrid. Thanks to the detailed information provided about the thousands of labourers and skilled workers who participated in the works, they constitute an extraordinary source for the study of multiple aspects related to the functioning of labour markets and the remuneration of building workers in pre-industrial Spain. The paper is organised as follows. Firstly, we describe the information provided by the payrolls. Secondly, we present new series of wage rates for skilled and unskilled building workers in 18th-century Madrid, providing data that serve as an alternative to Hamilton's well-known series (1947) and the estimates by Allen (2001) that were based on them.[1] Thirdly, we analyse the great variety and complexity of the different categories of labour, and consequently of wages, that the source reveals for the building sector in 18th-century Madrid. Against the picture formed by the traditional trio of professional qualifications (master, journeyman and labourer), the ledgers of the Royal Palace unearth a complex world of qualifications and retributions within every working category, regarding the professional training of the workers. In this sense we also try to ascertain how wages were determined and to what extent they were affected by the functioning of the labour market. Finally, the nominal lists of workers that the payrolls reproduce from 1737 to 1806 make it possibile to reconstruct the working lives of some of the journeymen and labourers who took part in the construction of the Royal Palace, offering new insights for the study of labour markets in pre-industrial Spain.

## 2. The payrolls of the Royal Palace of Madrid

The fire that devastated the old Alcázar in Madrid, on Christmas Eve of 1734, put an end to the royal residence which had housed the Habsburg dynasty in Spain as well as the first Bourbon king, Philip V. This monarch then commanded that a new palace be built on the ashes of the old one. By 1755 the construction work was almost finished, although enlargements, improvements and maintenance would keep workers busy for most of the rest of the century (Plaza Santiago, 1975, p. 96). The building works have bequeathed a rich qualitative and quantitative documentation, including the payments made to the thousands of workers who were employed, information which is largely complete from 1737 to 1806. Hence, there are more than fifty years of weekly payrolls that include the following information: name of the worker, his trade and qualifications, his daily wage, the number of days worked during the week, and total weekly pay.

Payrolls only detail the daily wages paid to workers by the Royal Administration. However, the source reveals that part of the works were carried out by contract and paid by the length or by piecework, so doubts may arise regarding how representative

[1] Allen's data for Madrid in https://www.nuffield.ox.ac.uk/people/sites/allen-research-pages/



Lista de la Gente que ha entrado á trabajar en la Fábrica del Rl. Palacio nuevo (Bajo la direccion del Exmo. Sor. Dn. Franco. Sabatini, Theniente General de los Rs. Exercitos, Comandante Genl. del Rl. Cuerpo de Ingenieros, y Arquitecto Gral. de S. M.) esta Semana q. principió Domingo veinte y ocho de Dizre., y acabó oy dia de la fha; Cuya Justificacion de Jornales, Cobranza, y Distribucion individual corre á cargo de Dn. Juan de Aguilera, Sobrestante mayor de dha Rl. Fábrica=

| | | Dias | Precios | Rs. de Von. |
|---|---|---|---|---|
| **Taller de Marmoles Canteros á 16 rs.** | | | | |
| Angel | Guadalupe | 3 | 16 | 048 |
| Franco. | Gambini | 5 | | 080 |
| **Otros á 14 rs.** | | | | |
| Miguel | Gutierrez | 5 | 14 | 070 |
| Josef | Laguera | 4½ | | 063 |
| Franco. | Moreno | 5 | | 070 |
| **Otro á 13 rs.** | | | | |
| Antonio | Moreno | 5 | 13 | 065 |
| **Pulidores á 11 rs.** | | | | |
| Josef | Fernz. | 5 | 11 | 055 |
| Josef | Albarez | 5 | | 055 |
| Franco. | Sanz | 5 | | 055 |
| Manl. | Moreno | 5 | | 055 |
| **Otros á 10 rs.** | | | | |
| Luys | Ruybal | 5 | 10 | 050 |
| Thomas | Sanz | 5 | | 050 |
| Marcos | Lagorda | 5 | | 050 |
| **Otros á 9 rs.** | | | | |
| Vizente | Garcia | 5 | 9 | 045 |
| Raymundo | Moreno | 5 | | 045 |
| Juan | Gago | 5 | | 045 |
| Josef | Lopez | 5 | | 045 |
| **Aserradores de Marms. á 8 rs.** | | | | |
| Antonio | Camacho | 5 | 8 | 040 |
| Josef | Penelas | 5 | | 040 |
| Josef | Castro | 5 | | 040 |
| Manl. | Rio | 5 | | 040 |
| Josef | Gutierrez | 5 | | 040 |
| **Otro á 7½ rs.** | | | | |
| Manl. | Albarez | 5 | 7½ | 037½ |
| **Otros á 7 rs.** | | | | |
| German | Ydalgo | 5 | 7 | 035 |
| Alfonso | Magan | 5 | | 035 |
| Josef | Mesa | 5 | | 035 |
| Xavier | Pinto | 4½ | | 031½ |
| | | | | # 1320 |

**FIGURE 1. Payroll from December 28, 1793 to January 3, 1794**

*Source*: Archivo General de Palacio [AGP hereafter], Administración General [AG], Obras de Palacio [OP], caja 548.

the earnings of the workers in the building site those wage rates were. Although the available information is sketchy we know that most of the construction work was carried out under the direct administration of the Royal authorities and paid by the day. Only for some few periods we can determine the exact number of workers who worked for the Royal administration and those who worked for contractors. For example, in 1750, we have daily reports for several months (January to May; September and November) that show that 73 per cent of the workers were directly employed by the monarchy, and paid by the day, and the other 27 per cent worked for contractors.[2] The information available is incomplete in some respects, but there appears to have been a trend to reduce the number of workers employed by contractors as the project advanced. The source also makes clear that daily wages were not complemented with any type of payment in kind (e.g. food and drink), that there were no special bonuses for carrying out arduous or dangerous tasks, and that work on Sundays and holidays was paid as if they were ordinary workdays. Therefore, in contrast with the wage rate series derived from contractors' bills, an issue that Mocarelli (2008, pp. 216–9) highlighted and that has recently generated an interesting methodological debate regarding the construction wage series in London (Allen, 2018; Stephenson, 2018a, 2018b), we can be certain that the wage rates recorded in the payrolls of the Royal Palace of Madrid were the amounts actually paid to the workers. Although records give information about the extra hours worked and paid and other various bonuses workers had a right to, unfortunately there is no way of knowing who had been paid what extra hours or bonuses because they are given aggregated at the end of the weekly payroll. The exceptional and individual nature of these rewards means it is difficult to make an accurate assessment of their impact, although that impact is sure to have been relatively small in the context of the overall payments. In 1770, for example, they constituted 0.8 per cent of the total, then 1.3 per cent in 1785, and reached a maximum of 8.4 per cent in 1790.[3]

Many of the series previously published, both in Spain and the rest of Europe, are extracted from bills for repair or renovation works at various institutions. These usually provided a simplified version of the complex world of skills, and consequently also wages, which tends to reveal itself in larger building projects such as those for cathedrals or palaces. Indeed, the construction of large buildings required many different trades apart from the usual bricklayers and carpenters, and more importantly reveals the existence of a wide variety of skill levels within generic professional ranks. For example the payroll of 1790 includes information on 24 different professions, and

[2] AGP, AG, OP, cajas 1349-1351. Regulations explicitly prohibit any worker from acting as contractors at the same time. AGP, AG, OP, caja 1030, exp. 5.

[3] This last year use of extra hours was increased because of the fire that took place in the Plaza Mayor. Even discounting the expense re-directed to that other work, the percentage is still around 5.2 per cent. AGP, AG, OP, cajas 434-439, 505-508 and 528-531.

96 wage levels among skilled and semi-skilled workers. Among the standard unskilled workers there were in fact four different wage levels. There were also three more types of labourers tied to a specific trade and with a distinctive wage. Therefore there was not a single category of master, journeyman, helper, apprentice or labourer, but instead many different gradations of each of those ranks, and all of them were remunerated in accordance with their specific qualifications. This variety of jobs and wage rates can be appreciated in Table 1 and, in greater detail, in Appendix C.

**TABLE 1. A sample of trades, skills and wages during the building work at the Royal Palace of Madrid in 1790**

| Trade | Skills | Skill levels for category according to wage rates | Daily wage rates in rs vn (lowest-highest) |
|---|---|---|---|
| Bricklaying | Overseer (master?) | 3 | 13.0-18.0 |
| | Journeyman | 4 | 9.0-12.0 |
| | Helper | 7 | 4.5-7.0 |
| | Apprentice | 3 | 3.0-4.0 |
| Carpentry | Journeyman | 5 | 9-13.0 |
| | Helper | 3 | 6.0-8.0 |
| | Apprentice | 5 | 3.0-5.0 |
| Plumbing (2 sub-trades) | Master | 1 | 12.0 |
| | Journeyman | 3 | 9.0-11.0 |
| | Helper | 2 | 7.0-8.0 |
| Stoneworking | Master | 1 | 14.0 |
| | Journeyman | 4 | 9.0-12.0 |
| | Helper | 1 | 7.0 |
| Labourers | Unspecified labourer | 4 | 4.0-7.0 |
| | Plumber's labourer | 1 | 6.0 |
| | Sewerman's labourer | 1 | 6.0 |
| | Well's labourer | 1 | 5.0 |

Until 1798, workers were categorised by occupation in the weekly payrolls and then listed in descending order of the pay they received, which depended on their 'class' (clase) or 'ability' (havilidad). The documents do not always specify what rank—master, journeyman, helper or apprentice—the wages correspond to, and often it is difficult to ascertain where the boundary lies (see Appendix B). These problems hamper any attempt to create homogenous series, since simple changes in the types of qualifications required can be mistakenly perceived as wage increases or decreases. Indeed, as discussed below, the wage rate series published by Hamilton (1947) exhibit several limitations. These are not particularly significant in the context of his own research objectives but they are more serious if the goal is to understand how wages were determined and how the labour market worked.

## 3. New wage series for construction workers in Madrid (1737-1805)

There is no single way to compute annual wage series and the literature provides examples of different methodological options. Phelps Brown and Hopkins (1955, p.

196), though not detailing how their wage rates were obtained, apparently opted for something close to the modal value, which is probably the most commonly used parameter in the literature (van der Wee, 1963, p. 149; Boulton, 1996, p. 275; van Zanden, 2009b, p. 149; Rota and Weisdorf, 2016, p. 107). Other scholars used the median (Rappaport, 1989, p. 129), the mean (Moreno Lázaro, 2002), or expressed wage rates as a range (Gibson and Smout, 1995, pp. 273–4; Mocarelli, 2008, pp. 214–5; Woodward, 1994, 1995, p. 17).

Given the wide range of wage rates within the same profesional rank in the accounts of the Royal Palace of Madrid, neither the median nor the average nor the representation of the maximum and minimum levels proves satisfactory for the purpose of building representative wage series. Due to the complexity of the information displayed in the payrolls, we decided to develop a three-level analysis. First, we have listed the different qualifications and wage rates found for each trade, computing all the quotations every five years from 1740 to 1805 (Appendix B). Table 2 shows the amount of workday wage data collected using this method, segregating skilled from unskilled workers, and the average weekly number of workers employed in the construction project. It contains information on approximately two million workdays and is probably the biggest sample used in studies of this kind to this day.[4]

**TABLE 2. Number of workers and days worked, Royal Palace of Madrid, 1740-1805**

| | Number of days worked | | | Number of workers per week | | | |
|---|---|---|---|---|---|---|---|
| | Total number of days worked | Skilled and semiskilled workers[a] | Unskilled labourers[a] | Weekly Average | Min | Max | ST. DEV. |
| 1740 | 332,461.5 | 56,154.0 (16.9) | 276,308.0 (83.1) | 1,250.7 | 403 | 1,607 | 241.6 |
| 1745 | 150,116.5 | 26,112.0 (17.4) | 124,004.5 (82.6) | 520.8 | 105 | 800 | 239.4 |
| 1750 | 379,762.0 | 77,970.5 (20.5) | 301,791.5 (79.5) | 1,336.7 | 466 | 1,826 | 416.9 |
| 1755 | 310,279.0 | 61,576.5 (19.8) | 248,702.5 (80.2) | 1,148.8 | 383 | 1,333 | 208.1 |
| 1760 | 68,668.5 | 19,176.0 (27.9) | 49,492.5 (72.1) | 234.7 | 28 | 461 | 130.5 |
| 1765 | 268,727.5 | 92,626.0 (34.5) | 176,101.5 (65.5) | 869.2 | 396 | 1,532 | 387.5 |
| 1770 | 49,111.0 | 21,256.0 (56.7) | 21,256.0 (43.3) | 172.1 | 114 | 328 | 48.6 |
| 1775 | 56,513.5 | 25,357.5 (44.9) | 31,156.0 (55.1) | 194.8 | 126 | 293 | 54.5 |
| 1780 | 28,597.5 | 12,684.0 (44.4) | 15,913.5 (55.6) | 98.0 | 86 | 114 | 6.4 |
| 1785 | 81,563.0 | 29,910.0 (36.7) | 51,654.0 (63.3) | 275.4 | 210 | 317 | 25.9 |
| 1790 | 129,340.5 | 58,019.0 (44.9) | 71,321.5 (55.1) | 439.5 | 357 | 635 | 74.2 |
| 1795 | 91,249.0 | 46,121.5 (50.5) | 45,127.5 (49.5) | 316.7 | 276 | 363 | 23.2 |
| 1800 | 65,866.5 | 36,330.5 (55.2) | 29,536.0 (44.8) | 231.8 | 216 | 248 | 10.0 |
| 1805 | 59,902.5 | 34,476.0 (57.6) | 25,426.5 (42.4) | 207.0 | 159 | 240 | 20.6 |

[a] The figures within brackets are percentages.

In the second level of analysis, from this database, we have extracted data to build the annual wage series for two professional ranks (journeyman and unskilled labourer) and three trades (wood sawyer, carpenter, and two types of bricklayer) between 1737

[4] A useful comparison can be made with the construction of the Fabbrica of the Duomo of Milan during the second half of the 18th century, where 284 payment orders detail the cost of 256,000 workdays. Mocarelli (2008, pp. 211–2).

and 1806. In order to complete the annual series, we computed, for the interim years, the first payroll from each month. The wage rates for unskilled labourers clearly represent the majority of the unskilled workforce that participated in the building project, while the other four exhibit the wide variety of qualified employment.

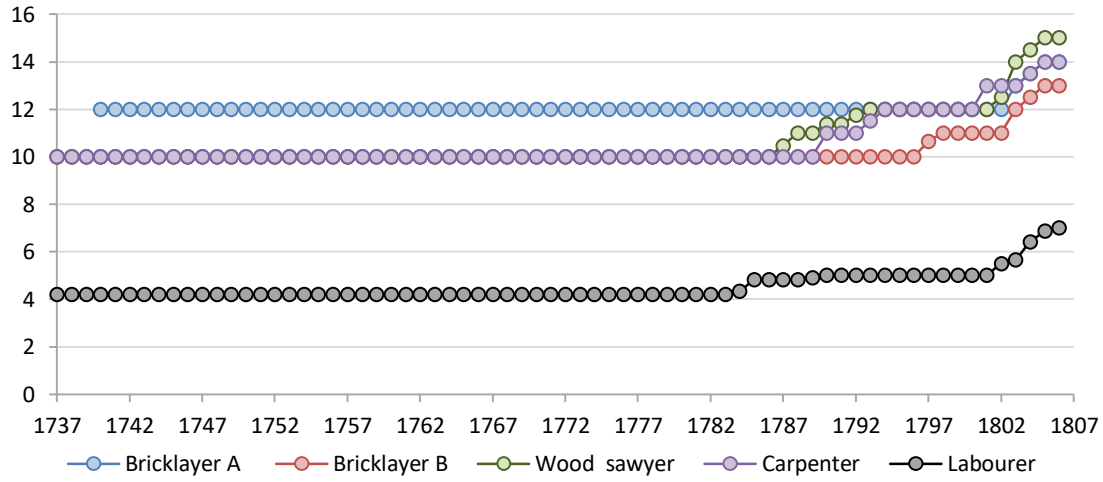



**FIGURE 2. The new wage series for the building sector in Madrid, 1737-1806 (Daily wage rates in rs vn)**
*Source*: Appendix A.

The wage series for unskilled labourers, wood sawyers and carpenters are built using the modal value. In the first two cases, the resulting figures are very close to both the mean and the median values. Among carpenter journeymen, although the mode is clearly representative, wage rate dispersion was somewhat higher. However, in the case of bricklayers the diversity of wage rates within the same generic category of journeymen makes the use of modal rates highly problematic. As Figure 3 shows, the modal rate would give the impression that wages oscillated randomly, but this did not in fact happen, as we will prove below.

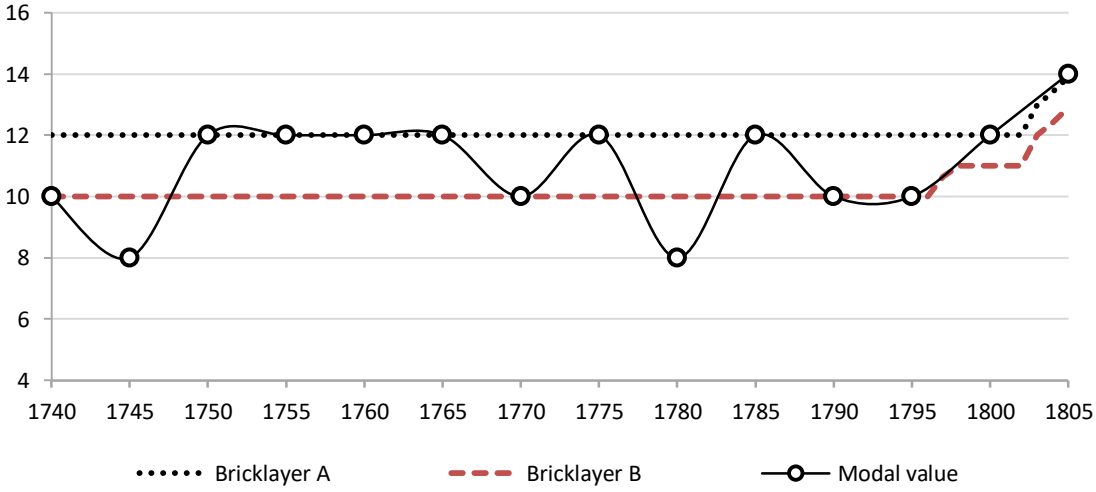



**FIGURE 3. Bricklayer journeymen. Modal rates and rates by skill (Wage rates in rs vn)**
*Source*: Appendix B.

The question of how to build the bricklayer wage series leads us to the third level of analysis in which all bricklayer and carpenter wages have been processed nominally. This enabled us, first, to confirm the validity of the modal value in order to build the carpenter journeymen wage, but only after realising that there was more than one class of bricklayer. Secondly, individual data collecting revealed the existence of two major classes of bricklayers: a highly skilled one (with a wage rate of 12 rs vn between 1737 and 1803) and what we could consider the 'standard' bricklayer (with a wage rate of 10 rs vn between 1737 and 1796). The latter echoes the wage rate also found in the accounts of many institutions in Madrid (Llopis Agelán and García Montero, 2011; López Losa and Piquero Zarauz, 2016). Finally, it also helped to explain the differences between the series of Hamilton (1947), Allen (2001) and the new ones presented in this paper.

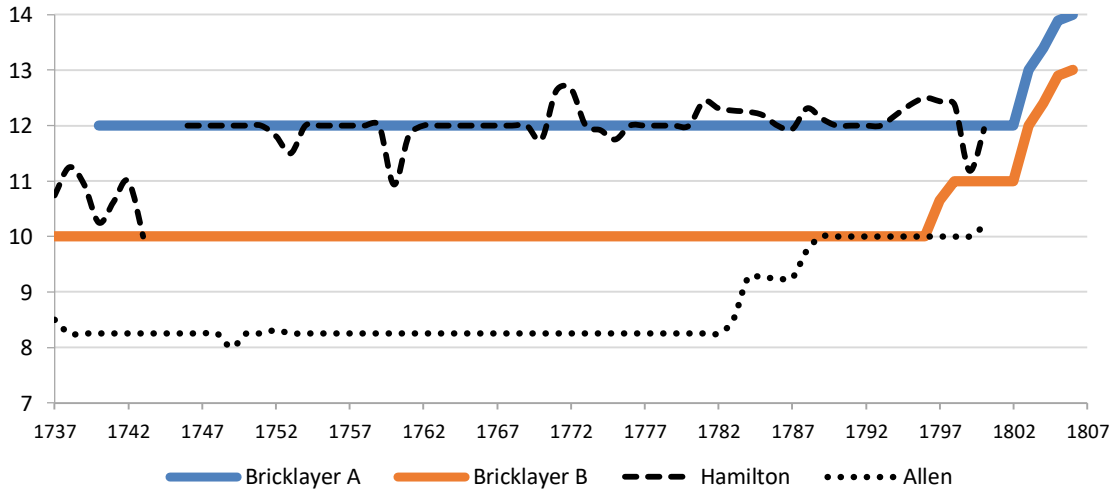



**FIGURE 4a. Wages of bricklayer journeymen in Madrid 1737-1800 (in rs vn). Comparison with Hamilton (1947) and Allen (2001)**

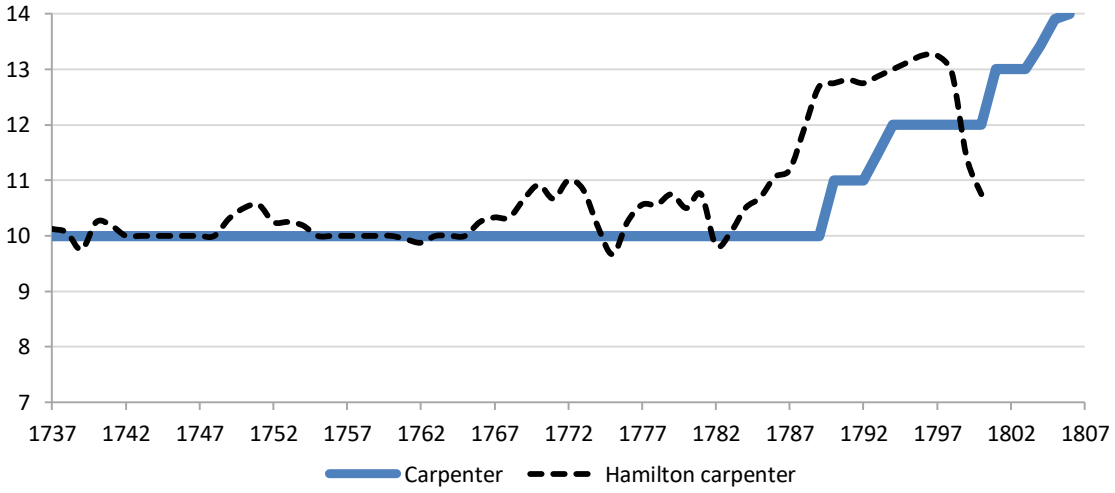



**FIGURE 4b. Wages of carpenter journeymen in Madrid 1737-1800 (in rs vn). Comparison with Hamilton (1947)**

*Source*: Appendix A; Hamilton (1947); Allen' database https://www.nuffield.ox.ac.uk/people/sites/allen-research-pages/

Our wage series for unskilled labourers are virtually identical to those of Hamilton and Allen, but this is not the case for carpenters and bricklayers. According to the new computations, the wage rates of bricklayers at the Royal Palace were significantly higher than Allen's estimates—between 21 per cent and 45 per cent higher, depending on the series we use as a reference (Figure 4a). These differences are due to the way the wage rates of bricklayer journeymen were calculated. Instead of using Hamilton's data, Allen simply doubled unskilled labourers' wage rates to arrive at the wage rate series of bricklayers, though he does not explain the reason for doing so.[5] On the other hand, our data show that standard bricklayer wages remained stable until 1796, and the highly skilled rates did so until 1803, but according to Allen the series started to rise in 1789. This results in the series appearing to reflect the same trend that occurred in the case of unskilled labourers, who, as we will explain below, received an earlier rise in wages.

The comparison with the series published by Hamilton also reveals important discrepancies. His bricklayer series traces that of the wages of highly skilled journeymen, not so much those of the standard bricklayers (Figure 4a). His carpenter series, on the other hand, show great fluctuations, particularly in the final two decades of the 18th century (Figure 4b). These random swings are directly related to the methodology Hamilton used when creating the series. As with prices, he only took the first four quotations of each quarter to calculate the annual average (Hamilton, 1947, p. 109). The wage rates, however, were not listed randomly but in descending order. Payroll lists are organised by trade and skill level, so Hamilton only collected wage data from the highest-skilled workers in each job category.[6] For example, in 1790 the payrolls include four types of bricklayer journeymen, seven helpers and three apprentices (see Figure 5). Hamilton's figure is 12 rs vn for the journeyman and 6.5 for the helper.[7] However, if we take as a reference the modal rate calculated with all the quotations for each professional rank, we would find that the wage rate attributed to journeymen by Hamilton is 20 per cent higher than their modal rate (10 rs vn). In the case of the helpers, we have identified a bi-modal distribution (114 observations with a 6 rs vn wage, and 123 with 5 rs vn), respectively 8 and 23 per cent below Hamilton's estimates. On the other hand, the weighted average of the journeymen bricklayers' wages is 10.7 rs vn, and that of their helpers 5.9 rs vn, respectively 12 and 9 per cent below the rates Hamilton published. In addition, the labour requirements of the

[5] Presumably the only possible explanation is that he considered the resulting skill premium in Madrid too high.

[6] The original manuscript annotations can be found in Earl J. Hamilton Papers, David M. Rubenstein Rare Book and Manuscript Library, Duke University. Box 6, Wages New Castile, 1651-1800.

[7] The bricklayer journeyman has the same wage throughout the 16 dates chosen (12 rs vn). The bricklayer helper's wage is calculated based on the unweighted average of the following figures: 7, 7, 6 and 6 (January), 7, 6, 6 and 5 (April), 7.5, 7, 6.5 and 6 (July), 7.5, 7, 6.5 and 6 rs vn (December). EHP, Box 6, Wages New Castile, year 1790.

project changed over time, with different levels of skills needed as the building work evolved. For all these reasons, simply picking the first figures from each category creates misleading fluctuations in the wage series as the skills of the workers listed first in the payrolls were not always the same.

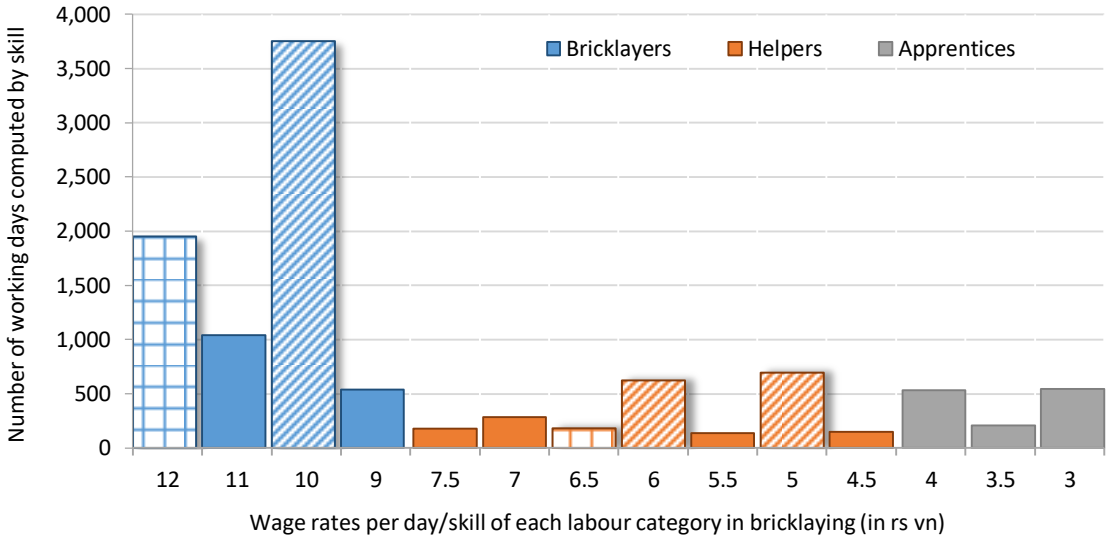



**FIGURE 5. Wage diversity in bricklaying. The building of the Royal Palace of Madrid in 1790**
*Note*: Striped bars—modal rates; grid bars—Hamilton.
*Source*: Appendix C-2.

It is important to ascertain the implications of these methodological problems when attempting to understand the evolution of wage rates and the nature of the labour market. It is not a matter of differences in wage rates but of their behaviour. The Hamilton series might insinuate the existence of a market logic in wage-rate determination. Nevertheless, our new series have substantially different characteristics that led us to question that possible interpretation. First, the new data show that the wage rates of carpenters and bricklayers did not fluctuate but instead remained unchanged until the general wage rises of the late 18th century. Second, thanks to the collection of individual information we find that there was a strict correspondence between skill levels and wages. The variations within the Hamilton series are therefore the result of mixing wage rates that corresponded to a number of different skill levels within the same generic professional category. The reconstruction of the working lives of about fifty individuals confirms that wage differences had to do with the skill levels that workers demonstrated. Wage rates did not vary at all among workers with the same recognised skills. Additionally, contrary to what Hamilton's series may suggest, no worker, apart from a few exceptions, saw his wage reduced at any time. If a bricklayer with a given level of skills was hired, he would continue to be paid the same amount unless he acquired greater expertise or wages for all workers of that level were raised. In other words, wages were not individuased. They were strictly linked to rank and professional capacities.

A more complete assessment of the evolution of the wage rates reveals different

wage behaviours depending on the characteristics of the job and the level of skill. In all cases, between the beginning of the building work in 1737 and the last twenty years of the century, wage rates remained unchanged. Only from the 1780s onwards did wage rates begin to vary at certain times (Appendix B). The first to break with this wage stability were unskilled labourers. Until 1783 their wages appear to be slightly below the standard of the time (4.5 rs vn throughout the year) as shown by the payrolls of the Alcázar—the former Royal Palace—and the bills for repairs in many other Madrilean institutions (Bona, 1996; Llopis Agelán and García Montero, 2011; López Losa and Piquero Zarauz, 2016). In April 1766, during the Esquilache Riots, unskilled labourers unsuccessfully demanded an increase in their daily rate. In a report, they complained that unlike them '…the poor labourers of this Town and Court' were normally paid 4.5, 5 and 5.5 rs vn a day by private customers and convents, 'without needing to bring any tools with them…'. They demanded a 4.5 rs vn wage rate every day of the year, which, according to them 'was the lowest price paid in Madrid, both in winter and summer'.[8] Since 1737 they had been paid 4 rs vn during the winter and 4.5 in summer (the summer season extending from the 'Cross of May', May 3, to the 'Cross of September', September 14). This amounted to an annual average of 4.2 rs vn a day. They were the only workers involved in the construction of the the Royal Palace whose wages varied with the season, a circumstance unknown in other public or private construction projects. According to Hamilton (1947, p. 213), this was due to longer working days in summer. However, no other category of workers experienced such seasonal variations in wages. Hypothetically, these changes might have been due to wages being pushed down by the arrival from the countryside of seasonal labourers who were seeking an income when less agricultural labour was required and were willing to earn less than the 4.5 rs per day that was the standard rate in the city.[9]

The rise in unskilled labourers' wages occurred in three stages. From September 1783, both winter and summer wage rates were increased by 0.5 rs vn. Then, in 1789, the daily wage throughout the year was set at 5 rs vn, with no difference between the seasons. Despite this increase during the 1780s, some sources suggest that unskilled labourers' wages continued to be below the market level (Llopis Agelán and García Montero, 2011; Piquero Zarauz and López Losa, 2016). The third and final phase takes place in the early 19th century, in part because of the 1803-1805 crisis.[10] Between 1800 and 1806 the wage rate saw a 40 per cent increase, from 5 to 7 rs vn a day. In these years the uniformity of wages among unskilled labourers began to break apart, as a small proportion of labourers began to be paid above the modal rate. The 67 per cent increase accumulated since 1783 put a stop to the quick fall of real wages, but it

[8] AGP, AG, OP, caja 1336, exp. 13.

[9] Postel-Vinay (1994) highlights the importance of the seasonal exchange of workers between agriculture and industry.

[10] Regarding the agrarian crisis of 1803-1805, see Ánes (1970, pp. 402–23); Llopis and Sánchez (2015).

did not compensate entirely for the overall decrease in purchasing power.

How representative of unskilled labourers overall were the wages of labourers in the Royal Palace? The sources are often plagued with difficulties in identifying skills and wages. On occasion the same worker and skill-level can be called differently. It is not uncommon for Spanish sources to consider the term denoting a tradesman to be synonymous with both a labourer and a journeyman. At other times the distinction between skilled and semi-skilled work is unclear. In the case of the Royal Palace, however, the documentation is explicit and leaves little doubt. This is partly because, despite the seasonality we find until the early 1780s, both the wage rates and the subsequent trends for unskilled labourers at the Royal Palace are exactly the same as those found for unskilled workers in other construction or repair projects at other institutions in Madrid. And also because the definition of unskilled work that our source provides is clear enough in this respect. The New General Regulation of 1742 had established that 'labourers had to be professionals, to avoid accidents due to their ignorance', although in fact physical strength was virtually the only requirement in order to be able to carry out any task. Those rules only distinguished between common labourers and bricklayers, since the latter had to have a small degree of specialisation in order to carry out certain tasks such as mixing mortar.[11] Notwithstanding, the payrolls of the Royal Palace usually fail to reflect that distinction. Only those labourers who had acquired expertise in certain areas from years of experience, or whose tasks were particularly arduous (quarries, masonry, plumbing, paving, sewers…), were paid more. Lastly, there were a few labourers who received lower wages, probably because of age or lack of physical strength. Nonetheless, the total number of unskilled labourers who did not fall into a standard wage category was always negligible.

The series corresponding to wood sawyers and carpenter journeymen mimics the trends seen in those for unskilled labourers, although the initial rise in wages comes four to six years later and the overall increase is not as large. In July 1787 wood sawyers began to be paid an additional 1 r vn (from 10 to 11 rs vn), a rise that would be repeated in 1792 (11 to 12 rs vn). The years 1802 and 1805 would see further increases, from 12 to 15 rs vn. The first increases for bricklayer journeymen came later. The standard journeyman did not receive an increase until 1797, when his wage rate rose from 10 to 11 rs vn. In 1803 it reached 12 rs vn, and then 13 rs vn in 1806. The most qualified bricklayers, however, received their first rise in 1803, from 12 to 13 rs vn, and reached 14 rs vn in 1806. Overall, standard bricklayers had a wage increase of 30 per cent, which was significantly higher than that of the highest-qualified journeymen (17 per cent), thus reducing the gap between the categories. However,

[11] AGP, AG, OP, caja 1030, exp. 5 and 15.

bricklayers' wage rates went up by less than those of unskilled labourers (67 per cent) and wood sawyers (50 per cent).

The differences between how wages evolved in the different trades, ranks and categories is puzzling. We are not yet in a position to explain this, but in some cases we could speculate, as a first step, that there might have been problems with the supply of labour. For example, wood sawyers were paid the same (10 rs vn) as standard bricklayers and carpenters until the mid-1780s, but then their wage trajectories diverged. Wood sawyers' wages increased more quickly, particularly in the first years of the 19th century. The source provides some hints as to why. In these last years of our series, wood sawyers were only hired when strictly necessary. For example, in the workshop, joiner helpers carried out the sawing tasks most of the time and in so doing received a bonus of about 4 rs vn per day, which put their wage almost on par with that of the sawyers.

## 3. Wage rates and labour markets in 18th-century Madrid: some hypotheses

This study pries open certain questions regarding the construction labour market in 18th-century Madrid. The criteria used to establish the wage rates, and why these were so remarkably stable, are questions which are difficult to answer given the lack of research on the topic in Spain (Llopis Agelán and García Montero, 2011, p. 307). The literature usually focuses on the importance of market segmentation, statutory regulations imposed by guilds or, at the municipal level, the influence of supply and demand, and the cost of living, as well as the importance of tradition and custom.[12]

Pre-industrial labour markets would characteristically have high levels of un- and/or under-employment, with a highly elastic labour supply. One of the most influential theories on segmentation, that of the dual labour market, proposes that the market was divided into two distinct parts: a primary and a secondary market. The first was defined by high wages/salaries, good working conditions, promotion opportunities, and stability in employment. The secondary market was composed of lower jobs, and it was rife with employment instability, highly mobile workers, few promotion opportunities, and low wages (Doeringer and Piore, 1971, p. 121). The construction sector in pre-industrial times fits well into this model. The absence of technological innovation meant there was a need for abundant, flexible, unskilled manual labour, and also for a small group of skilled workers (Chauvard and Mocarelli, 2009, pp. 69–71; Mocarelli, 2004). The construction sector in 18th-century Madrid fitted this profile, and indeed one of its outstanding characteristics was the existence of a high skill

[12] For Britain, see Boulton (1996), Clarkson (1982), Hobsbawm (1964), Schwarz (2007), Woodward (1994), and Phelps Brown and Hopkins (1955).

premium. The wage rate of the standard journeyman bricklayer was 2.4 times higher than that of the unskilled labourer between 1737 and 1782. After that, this difference fluctuated somewhat, particularly due to the above-mentioned raises that the lower ranks received. Between 1783 and 1796 the difference would come down to a factor of about two. After a small temporary increase the wage difference decreased again during the last years of our sample but remained close to the factor of two.

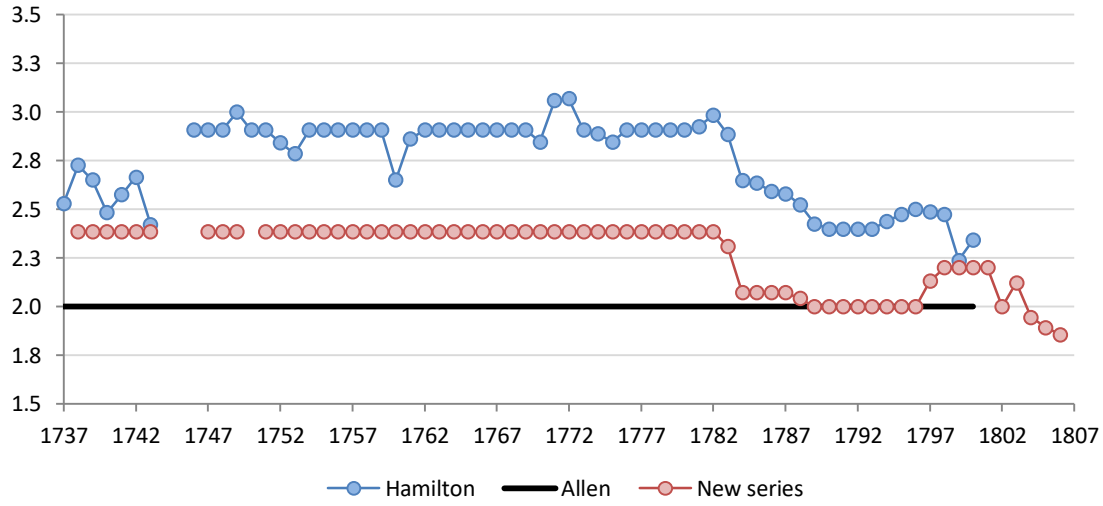



**FIGURE 6. Skill Premium in the construction sector in Madrid (1737-1806)**
*Source*: Appendix A; Hamilton (1947); Allen's database https://www.nuffield.ox.ac.uk/people/sites/allen-research-pages/

The varying supply and demand of skilled and unskilled workers, and it being difficult for unskilled workers to obtain the skills necessary for promotion, would be a plausible explanation for the high skill premium found in Madrid. According to Llopis and García Montero (2011, p. 306), these difficulties were not so much due to the existence of guilds in the building sector. It is true that guilds controlled the trades of ~~masons~~, locksmiths, cabinetmakers and joiners, but other important tradesmen in the city such as bricklayers, carpenters or painters did not have guilds (Nieto, 2013, p. 104). Payroll ledgers show that guilds had no effect on the wages allotted to each trade, or on professional mobility. This raises the possibility that wage rates were determined by unwritten rules and conventions based on experience and the so-called force of custom.

The building regulations of 1742 and 1752 provide some examples of the procedure for hiring certain tradesmen at the Royal Palace. By informally testing their abilities, the foremen decided what the wage rates of journeymen and helpers in various trades (carpenters, quarrymen, bricklayers) would be. In some of the workshops the candidates spent eight days under assessment, after which the manager decided

whether they would be hired and how much they would earn.[13] But it is unclear what criteria the foremen and managers used in order to decide these wage rates. Were their decisions based on market price or custom, or a combination of the two? In the literature it is commonly assumed that custom was the main factor. Hobsbawm (1964, p. 347) suggested that, for a long time, wages were based on custom rather than market value. Nonetheless, as Woodward (1994, pp. 36–7) pointed out, 'customary practices […] did not emerge from nowhere', and neither were they immutable. However, if market forces were the primary factor in determining wage rates, as Woodward (1994, p. 38) and Boulton (1996, pp. 286–7) suggest, the wage stickiness found in 18th-century Madrid can only be explained by a hypothetical, but quite unlikely, long-run equilibrium between labour supply and demand.

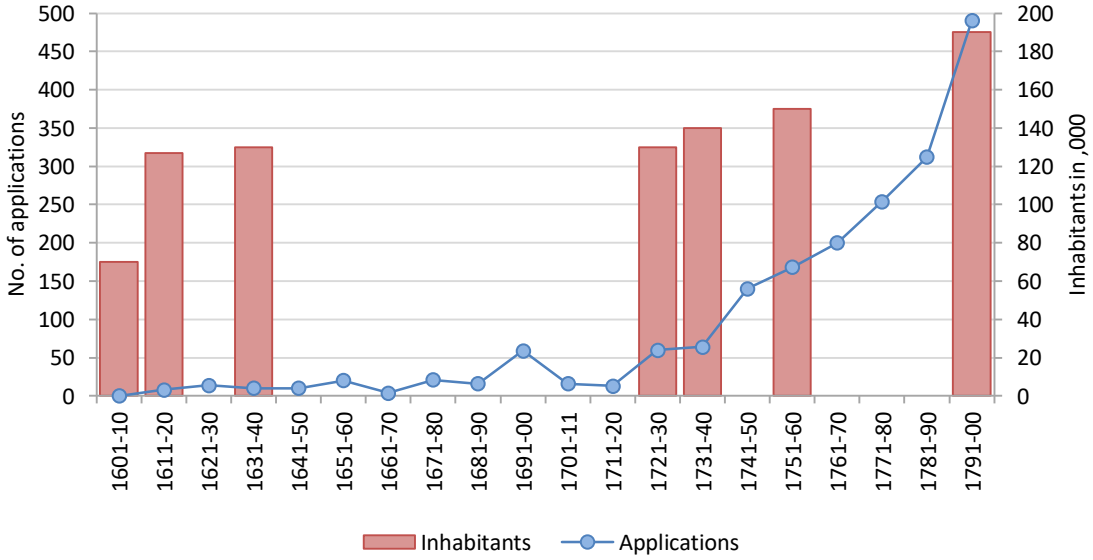



**FIGURE 7. Number of applications for building works handled in the City Council and demographic evolution in Madrid (1601-1800)**
*Source*: Bravo Lozano (1992, p. 213); Carbajo Isla (1987, pp. 225–7); Ringrose (1983, p. 28).

The 18th century was a period of urban expansion. The account books of religious institutions, which owned a third of the real estate in Madrid between 1750-1770 (Cruz, 1990, p. 243), show significant expenditure on repairs and construction—the maintenance and improvement of buildings; subdividing houses; building higher up or further in, or even creating more street-level openings to be able to fit in more shops and thus increase rental income. In addition, Madrid saw a lot of work carried out to improve the sewer system (Pinto Crespo, Gil Ruiz, and Velasco Medina, 2016) and streets. This apparently growing demand is unfortunately difficult to quantify. The data regarding the number of houses do not provide a reliable means of gauging the rate of construction. The number of houses was fairly stable in the first half of the century (8,082 in 1723; 8,099 in 1740) but estimates towards the end of the century come up

[13] AGP, AG, OP, caja 1030, exp. 5, 15 and 16.

with lower figures: 7,100 (Carbajo Isla, 1987, pp. 162–3; Caro López, 1983, pp. 99–101). This decrease probably derives from the demolition of buildings or their being joined to create larger palaces, administrative buildings or ordinary residences. A possible alternative source is the applications for building licences handled by the city council (Figure 7). Even though this information includes all construction and repair work—not just new buildings—and it is incomplete, it nevertheless reveals a significant increase in demand, especially in the second half of the century. Between 1721-1740 and 1791- 1800 the number of licences provided by the municipality rose from an annual average of 62 to 490 (Bravo Lozano, 1992, p. 213).

Labour supply, setting aside possible variations in working hours and days, would have depended on the population structure and employment rate. Madrid had grown from some 120-130,000 inhabitants in 1723 to around 190,000 in the municipal census of 1799, an increase of 46-58 per cent. This demographic growth apparently came to a halt around 1793-1794, when the number of baptisms and marriages recorded started to fall and mortality rose (Soubeyroux, 1980 pp. 71–2; Carbajo Isla, 1987, pp. 225–7). The employment rate, according to Ringrose (1983, pp. 67, 71), remained fairly stable in the second half of 18th century, at around 30 per cent. However, López Barahona (2016, pp. 44–6) contends that the sources used by Ringrose contain significant omissions; she argues that the real rate was probably above 40 per cent, with a significant participation of women in the labour market. According to her calculations the employment rate among women of working age was around 60 per cent in 1787, which is to say about 37 per cent of the female population of the city.

With this, the rise in labour supply would probably have been on a par with the overall rise in population, although little can be said regarding specific economic sectors. According to the *Catastro de Ensenada*, construction was the dominant activity of the secondary sector, occupying 16 per cent of the total workforce. In 1757 Madrid had around 6,750 inhabitants working in construction, a quarter of whom were skilled, whereas the rest were semi- or unskilled workers (Ringrose, 1983, pp. 68–9; Camarero Bullón, 2001, pp. 331–67, 374–81). Unfortunately the censuses of 1787 and 1797 do not provide the same wealth of information as that of 1757, so there is no way of determining the number of active workers in the building sector towards the end of the century. In this respect Nieto (2013, p. 100) points out that the number of carpenters—masters and journeymen—increased significantly in the second half or the 18th century. Between 1757 and 1799 the number of master carpenters grew from 157 to 599, while journeymen carpenters soared from 309 to 2,301.

On the other hand, a significant part of the workforce employed in construction in Madrid were temporary migrants, who were mostly but not entirely unskilled. For this reason they went unrecorded in the official statistics. The first years during the construction of the Royal Palace, when a great deal of labour was required, saw 2,000

to 3,000 labourers hired every week, a figure that would be even higher if we knew the additional number who were working for contractors. This extra demand for unskilled workers came on top of the demand deriving from the growth of Madrid. There would have been a need for continuous immigration into the city, a structural characteristic of the Madrid labour market (Llopis Agelán and García-Montero, 2011, p. 307; Pérez Moreda and Reher 1997, pp. 157–9). Notwithstanding the inconclusiveness of some of the figures, there does appear to be a relation between the growth in the demand for labour and its supply, which could be one of the explanatory factors for the long-run wage stickiness found in 18th-century Madrid.

The series reveal that in the hundred years or so that followed the monetary stabilisation of the 1680s, wages did not vary at all. Wage stickiness was not exclusive to Madrid; there was a similar phenomenon in many other Spanish, European and even Asian cities (de Vries, 1994b; Malanima, 2013; Phelps Brown and Hopkins, 1955; Saito, 1978). It is possible that long-run wage stability could be the result of statistical artifice. The use of modal values to determine the wage rate would conceal a possibly wide variability of individual wages (Schwarz, 2007, p. 152; Lindert, 1985, p. 168). As we have pointed out before, using the mode for unskilled labour, or for some skilled professionals such as sawyers, is clearly justifiable in our case. Not only does it reflect the most common wage, but it was also the amount earned by the vast majority of workers in those categories. Other trades and categories, however, show far greater variety, making the use of averages or modes less feasible. The individual careers of bricklayers and carpenters demonstrate that wage variability was due to the various sub-categories existing within the broad rank of 'journeyman'. No workers see their salaries fluctuate while in the same qualification level. The bricklayer journeymen mode (Figure 3) and Hamilton's methodology conceal this stability behind inexplicable variability. The wage rate of a worker only changed when he obtained the skills necessary to be promoted to another category, and that wage corresponded to the workers already at that level.

Jan de Vries (1994a) proposes an alternative interpretation based on his Dutch case. The picture of long-term stability in daily wages might not correspond with the actual earnings of the workers. Behind the wage stickiness, entrepreneurs and workers would have pursued different strategies for adjusting payments and earnings to the market situation. Some of them implied bonuses, adjustments in the calendar that determined when summer or winter rates were applied, or even the use of the wage rate as a unit of measure, enabling workers to be paid in 'numbers of daily wages' on an ordinary workday. But all these possibilities have no support in our case. Until winter and summer wages were made equal in 1788, there is no evidence of any tinkering with this system that would have led to annual variations in earnings. On the other hand, both at the Royal Palace and in all other construction work in the city, the wage rate was applied to a full workday. Increasing the number of working hours in the day

and/or augmenting the number of workdays in the year may have served to compensate for the fall in real income due to the rise in prices (Angeles, 2008; Broadberry, Campbell, Klein, Overton and van Leeuwen, 2015; Humphries and Weisdorf, 2015; Malanima, 2009; Palma and Reis, 2016; Voth, 1998). Nonetheless, the duration of the workday in Madrid did not change and in the construction project at the Royal Palace the number of working days remained high. The ten net hours per day would have been standard in Madrid, close to the 9.5 calculated by Monasterio (1867, p. 44) in the mid-19th century, while the number of days of work over the course of a year, based on a variety of primary sources, would have been around 290 (López Losa and Piquero Zarauz, 2018).[14] At the Royal Palace the number oscillated between 288 and 294 days (293 was the average) between 1760 and 1805.

Without rejecting other possible reasons, it appears that the main long-term factors affecting wage rates were labour supply and demand, and also, in particular, the evolution of the cost of living. Unless there was a great imbalance between supply and demand, it would have been the cost of subsistence that determined the wage rate. This was expressed by Soler y Faneca (1816, p. 7) when analysing the costs of the construction of the Urgel Canal:

> The wage rate is the most important factor when calculating the cost of construction work, because it also determines the cost of materials which must be prepared and elaborated. The real rate depends on the food that the labourer and his family need, as well as on the number of workers who turn up, which in turn depends on whether the nation is in a decadent, stationary or progressive state. That is, the relation between the number of daily wages, and of day labourers, as in all other things, as long as the population and employment remain stable, will depend wholly on the price of food.

In Figure 8, the graphic representation of the evolution of prices and wages shows that they had been closely linked from the early 16th until the mid-18th century. Between 1680 and 1760—except for the subsistence crises of 1698-1699, the 1710s and mid-1750s—inflation was low, which would explain the wage stability we have observed.[15] Phelps Brown and Hopkins' interpretation of this stability, which was also the case in England, may be applicable. According to them, 'it is unlikely that supply and demand remained exactly balanced at the ruling price'; price fluctuations, nonetheless, were probably insufficiently large or lasting to break the value of custom (Phelps Brown and Hopkins 1955, p. 202).

[14] The number of potential days of work was also high in 18th-century Spain. See García-Zúñiga (2014).
[15] As Schwartz (2007, p. 152) wrote '… when inflation was low it is not surprising if wages changed little and certain rates of pay came to be seen as "customary"'.

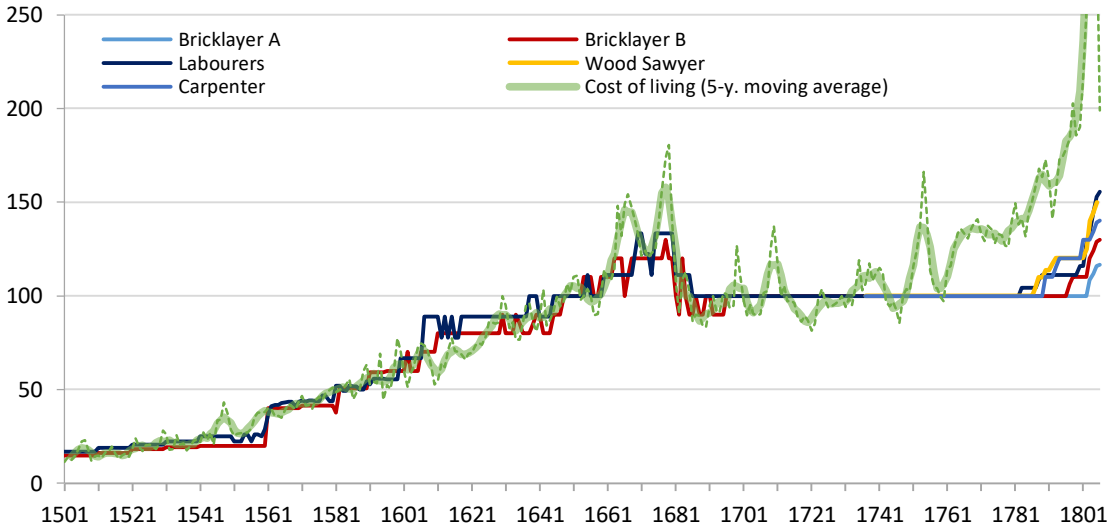



**FIGURE 8. Wage rates and cost of living (rs vn) in Madrid (1751-60 = 100)**
*Source*: López Losa and Piquero Zarauz (2016); Appendix A.

This relation, however, appears to break apart in the early 1760s. After that, prices and salaries diverged significantly. Between 1760 and 1783, prices increased by about 40 per cent whereas wages did not change. Between 1783, when the first major wage rise took place, and 1801—right before the crisis of 1803-1805—prices again increased by some 50 per cent but wages failed to follow suit: unskilled labourers' wages rose by 16 per cent while, among the journeymen, bricklayers' wages rose by 10 per cent, wood sawyers' by 20 per cent, and carpenters' by 30 per cent. Despite the overall increase in wages after 1802, the subsequent crisis sent prices far above these relatively modest increases. The cost of living rose by about 75 per cent between 1802 and 1805, but the wages of the unskilled, as well as those of sawyers and standard journeymen bricklayers, increased only by about 20 per cent, while daily wages among carpenters and the most qualified journeymen bricklayers increased to an even lesser extent (16 per cent and 7 per cent respectively). Overall, whereas prices tripled between 1760 and 1805, the wage rate for unskilled labourers rose by 67 per cent; and for journeymen by between 40 and 50 per cent, depending on the trade (Appendix A).

Why did wages not keep pace with prices in the second half of the century? Unfortunately there is no conclusive explanation for this divergence. The mismatch could have originated from an excess supply of labour, but there is no actual evidence for this.

## 4. From the macro to the micro: wages and working lives

Using modal values has certain limitations that go beyond the methodological debates about their significance. The mode may conceal individual trajectories and the diversity of wage rates and skill levels. As a stunningly rich source of information, the Royal Palace payrolls make possible an unforeseen line of inquiry: that of professional

careers. The weekly payrolls have provided detailed information on the working lives of around fifty people, in some cases spanning three or more decades. This sample is small, considering the thousands of workers paid every day, and it is therefore hardly representative. The information it contains, however, does provide new possibilities for further research questions regarding how the labour market worked, and how human capital was accumulated in the pre-industrial world.

There are reasons for how few individual careers we have been able to document so far. These include the sheer number of workers who appear in the sources, a problem which is especially dramatic among the unskilled (Table 2). A second reason is labour mobility—among both the skilled and unskilled—which makes it difficult to track any one individual. This is compounded by the difficulty of identifying names when only the given name and first surname are included, and these were often very common (i.e. the 'John Smith effect'). On top of it all, the categories that individuals were included in were sometimes erroneous, or changed for professional reasons, which further hampers attempts to distinguish between individuals of the same name on the basis of their respective trades. These issues have led us to use a method based on identifying certain workers with uncommon names, who were therefore easy to spot throughout the payrolls.

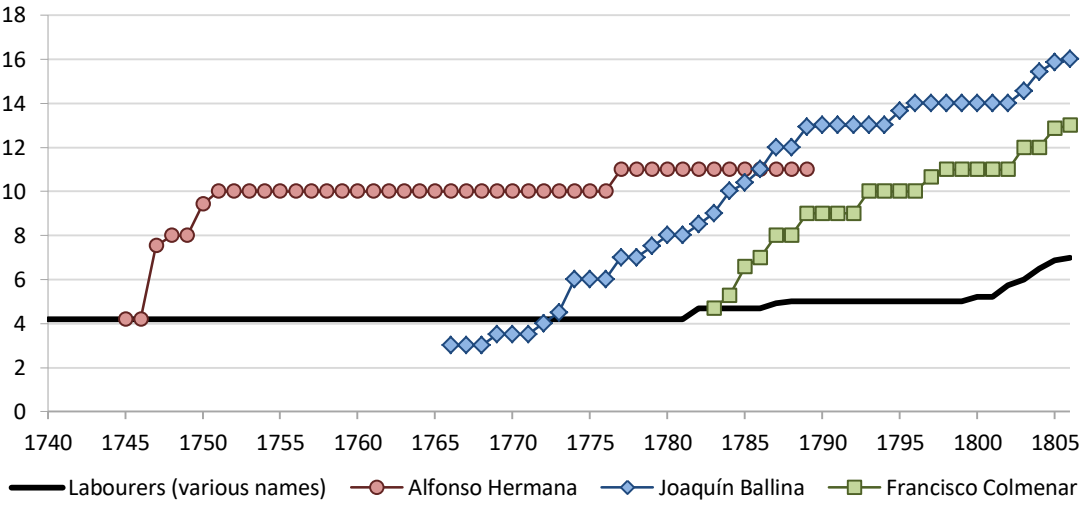



**Figure 9. Skills and wages. Daily wage rates in rs vn**
*Source*: AGP, AG, OP, cajas. 14-580.

The graphic representation of a sample of skilled and unskilled wage rates would resemble the model proposed by Gary Becker (1994). His theory of human capital attempted to explain income differences through increased productivity by learning new skills and perfecting old ones while on the job. In the absence of on-the-job training, earnings would depend entirely on that initial level, which would not increase with age but instead remain the same. On the other hand, those workers who invested in their human capital might have earned less in the initial years but then found that their wages increased progressively over time as they acquired new skills. Training thus

increases the gradient of ascent, even accounting for a certain concave appearance of the resulting chart.

The careers of the workers at the Royal Palace reveal a stairstep ascent based only partially on seniority. Experience is constantly a factor, because only it provides room for training, and hence for an ascent in level, which means higher pay. Seniority alone, however, was no guarantee of progression or protection from outside competition. Only when a worker proved his acquisition of new skills did he get promoted to a higher level. For example, in the week of 3-9 January 1796, the need for marble sawyers in the 8 rs vn category increased, which prompted the hiring of a new worker rather than the promotion of the existing ones despite the fact that there were already several with very similar qualifications (7.5 and 7 rs vn). A month later, one of those sawyers who was already in the payrolls before the new journeyman was hired, Pedro Salomón, was promoted and his wage increased from 7 to 8 rs vn. However, Manuel Álvarez, who apparently had slightly better skills than Salomón, as he earned half a real more per day, was not promoted and continued to receive his 7.5 rs vn wage rate.[16] The source provides numerous such examples of the functioning of the internal labour market. The following paragraphs flesh out the careers of some of these workers with greater detail, so as to provide an insight into how they were able to access training opportunities in order to increase their human capital and hence improve their position within the construction sector in 18th-century Madrid.

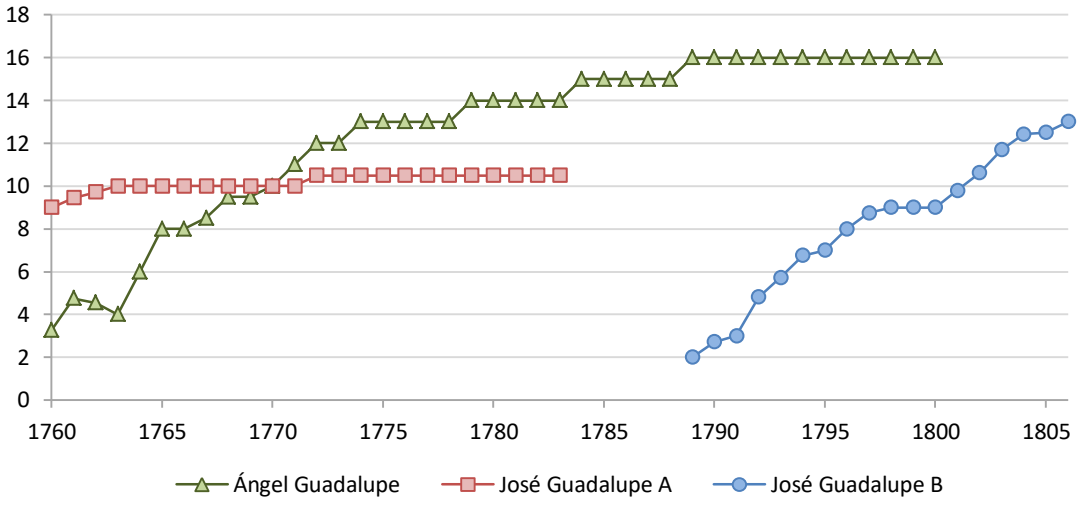



**FIGURE 10. On-the-Job training and wages: Working at the marble workshop. Daily wage rates in rs vn**
*Source*: AGP, AG, OP, cajas 14-580.

Ángel Guadalupe provides an excellent example of investment in his own human capital, sacrificing short-term income for long-term gains. The first time that

[16] AGP, AG, OP, caja 552.

José and Ángel Guadalupe, presumably father and son, appeared in the payrolls was in the week of 17-23 February 1760. José was a marble polisher earning 9 rs vn a day. Ángel was an apprentice marble sawyer with a daily rate of 3 rs vn, but he progressed quickly to 4 rs vn in October and then 4.5 by December. The last time Ángel was listed among the marble sawyers was 14 August 1762, by which time his wage had risen to 6 rs vn, the most common rate for his particular trade. The following week he disappeared from the lists of marble sawyers but appeared at the bottom of the list of marble masons (no doubt as an apprentice again, though this is not stated), earning only one-third of his previous wage: 2 rs vn.

Ángel's strategy seems clear. At this time the highest-qualified marble sawyers could earn no more than 8 rs vn, while marble masons could be promoted to a maximum 15 rs vn. Given his probable inteligence and ability to learn new skills quickly, his wage progression was spectacular: in early 1764 he was receiving 6 rs vn, which by March had risen to 7.5; then 8 in 1765, 10 by 1770, 12 in 1772, 14 in 1779 and 15 in 1784. His wage would hit a maximum 16 rs vn in 1789, the highest rate possible for marble mason that year. Had Ángel not changed his trade, the maximum he could have aspired to was the 9 rs vn, the same as his father earned when he started working at the Royal Palace. José, on the other hand, continued in a trade that required less skill than that of a marble mason, so his wage hit a maximum level in the 1770s. If in the late 1760 his son's wage was half, ten years later it was the same, and in 1783, when José ceased to appear in the payroll, it was already a third higher. A different José Guadalupe, presumably the son of Ángel, followed a similar strategy some years later.

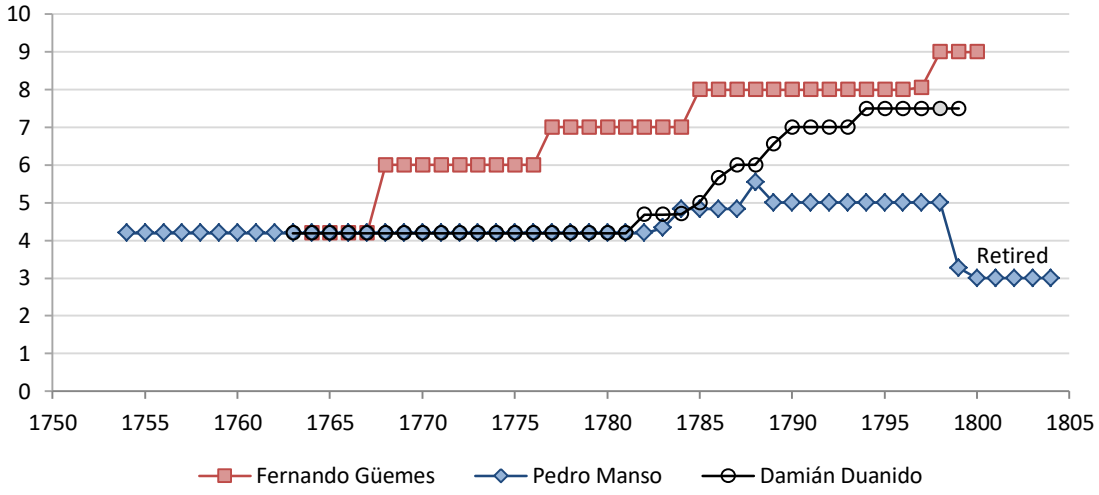



**FIGURE 11. On-the-Job training and wages. Daily wage rates in rs vn**
*Source*: AGP, AG, OP, cajas 14-580.

Pedro Manso is a good example of a more conservative approach to a professional career. He could not or did not want to acquire new skills. He appeared in the payroll in 1754 as a common labourer and was paid as such until he retired, apart from five

months in 1788 when he was temporarily paid as a doorman (from 24 February to 4 April, when he earned 6 rs vn) and then as an assistant bricklayer (20 April to 12 July; 7 rs vn). His career contrasts with that of Damian Duanido, who was a labourer for twenty years (1764-1784) until he was hired as a doorman in 1785, and then a sewer labourer until September 1787. After that Damián would become an assistant carpenter, initially earning 6 rs vn but climbing to 7.5 during the 1790s. The case of Fernando Güemes is illustrative of the possibilities that previous skills or education could eventually bring into play. He knew how to read and write, and probably had a basic notion of arithmetics. He first appeared in the records in 1764. After four years as a labourer he was listed as a clerk, 'making lists', and then as 'appointed'. He may well have been assigned to writing the payrolls or to other accounting tasks, which allowed his salary to increase to 9 rs vn, slightly more than double what he had earned in 1764 when he was first hired.

As Gary Becker's theory suggests, the increase in earnings was greater in the early years of training than after, but we have no information regarding the time and effort necessary to advance in skill level and then in wage level. Some workers progressed more quickly than others, and it is difficult to establish why. Unfortunately there is no information regarding the ages of workers, so that line of inquiry cannot be pursued.

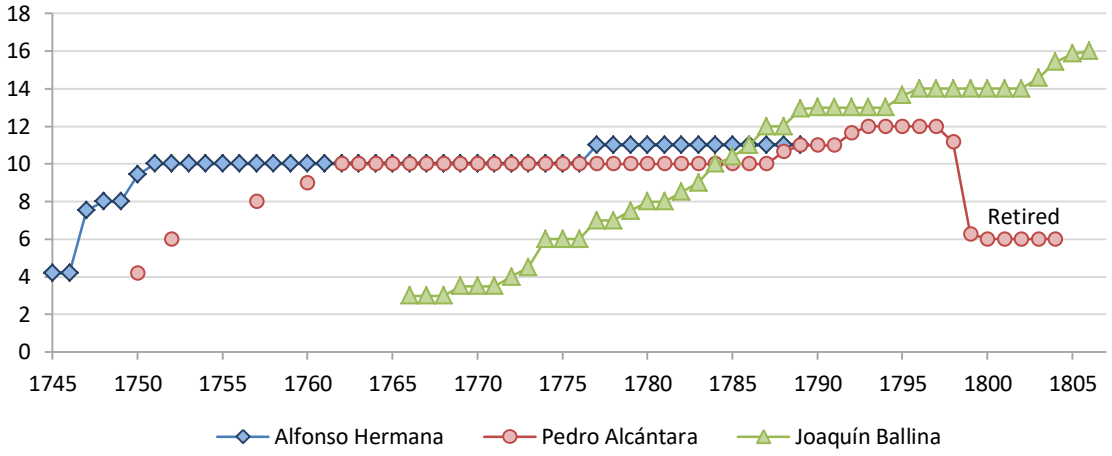



**FIGURE 12. On-the-Job Training (Family) and Wages: Three Carpenters. Daily Wage Rates in rs vn**
*Source*: AGP, AG, OP, cajas 14-580.

Family connections, however, do seem to have been a significant factor in helping some workers obtain training and thus promotion. Alfonso Hermana became an carpenter helper after spending two years as a carpentry labourer. His wage went up from 4.2 to 8 rs vn thanks to that promotion, and three years later it would rise further when be became a journeyman earning 10 rs vn, the modal wage among carpenter journeymen in 1789. There is no indication as to whether Alfonso first entered carpentry at the Royal Palace or had some previous experience that could help explain his rapid advance. In just five years his salary multiplied by 2.4. The fact that a

probable relative, Tomás de Hermana, already appeared as master carpenter in 1750 could provide an alternative explanation for Alfonso's success. And family connections did not only affect access to on-the-job training and speed of promotion: sometimes they could also help break the glass ceilings that made it hard to reach the highest wage levels.

Pedro Alcántara also started as a carpenter labourer in 1750. It took him 12 years to reach the standard wage rate among journeymen carpenters but he spent the following 36 years earning the same wage until he retired in 1798. The working life of Joaquín de la Ballina tells a different story. In the beginning his progression was somewhat slower, as it took him 18 years to reach the most common wage rate among journeymen carpenters, but after that he continued climbing the professional ladder until he reached the highest level recorded for his rank. Was he perhaps related to the architects José and Manuel de la Ballina?

The careers of the afore mentioned Pedro Alcántara and Pedro Manso point to a reality which had remained obscure: they worked into their retirement, earning a wage some 40 or 50 per cent lower than what it had been before. In the week of 14-20 October 1798, Pedro Alcántara was apparently demoted from carpenter, earning 12 rs vn, to helper, with a wage of 7 rs vn. Shortly after, in the week of 17-23 February 1799, he was already listed as retired. This assistant phase may have been a convenient way of keeping a journeyman on the job so he could train his replacement. This might also have happened to Luis Ruibal, a marble sawyer between 1763 and 1782 and then a polisher from 1783 to 1798, who ended his career as 'retired', earning 5 rs vn—half what he had been earning as a polisher since 1785. This semi-retirement is insufficient to explain the case of Pedro Manso or other unskilled labourers. In the first payroll of 1798 there is a group of labourers described as 'invalids, old, limp and blind in various ways' who were nevertheless paid as much as other labourers, at least until February of the following year when their wage was lowered to 3 (40 per cent less).

## 5. Conclusions

This paper presents the initial results of a research project on worker income and labour markets in Early Modern Spain. It makes use of an extraordinarily rich source, the payrolls of the workers who participated in the construction of the Royal Palace in Madrid between 1737 and 1806. By focusing on wage rates, professional categories and working lives, we have shed light on the complex world of skills, salaries and professional relations existing in the Spanish building sector at that time. Despite the daunting diversity of ranks and wages, there was a logic behind a system: each wage rate was the result of the workers' skills, which were categorised into various levels.

Revealing this logic has allowed us to create new wage series for journeymen

carpenters, bricklayers and sawyers, and unskilled labourers, which provide further insight into the evolution of wages in 18th-century Madrid. The new data serve to improve, or even correct, the information in Allen, whose methodology led to the underestimating of bricklayer salaries by at least 20 per cent. On the other hand, the fluctuations witnessed in Hamilton's series are just the result of a statistical illusion that stems from the use of a methodology that did not adapt to the characteristics of the source used. The ups and downs of bricklayer and carpenter wages in Hamilton's series were due to the haphazard combinations of salaries from various levels of skills. A single generic rank within a trade was in fact composed of various skill levels, each of which had an established wage rate. This has been confirmed by reconstructing the professional careers of individuals whose wage rates only changed when they acquired new skills and that fact was recognised through promotion, or there was a general rise benefiting all the workers of a given rank. Wage rates, therefore, were not set individually but through a well-established ranking of professional capacities.

Another significant characteristic of the new series is the wage stickiness throughout most of the 18th century. In the latter part of the century certain ranks and professions started benefiting from general wage rises. This stability, insofar as our sources begin in 1737, could be projected backwards using the series published elsewhere (Andrés Ucendo and Lanza García, 2014; Llopis Agelán and García Montero, 2007), revealing that it had been in place since the 1680s. In other words, wages remained the same for about a hundred years. Some authors have tried to explain this away by blaming statistical illusions resulting from how the wage data are understood and managed (de Vries, 1994; Schwarz, 2007). Nonetheless, the Royal Palace data are clear and conclusive. The daily wage was simply the reward for one whole day of work and it was determined by the skills necessary to carry out that work. Wages did not change within the same professional category. The question that arises, therefore, is how wage rates remained unchanged for so long. It could be answered in terms of consuetudinary regulation, a factor whose impact is hard to deny in pre-industrial economies. Our review of the data, however, leads us not to base our answer on tradition. Indeed, certain economic factors such as labour supply and demand, and particularly the cost of living, played a role. From the early 16th century until around 1760, wages were more or less able to follow prices. Except during the aforementioned subsistence crises, between 1680 and 1760 prices remained fairly stable and so did wages. Therefore the wage stability between 1680 and 1760 may have reflected a general absence of inflation. However, after 1760, for the next 25-35 years, prices began to rise steadily but wages remained unchanged. There is insufficient evidence to determine why this happened, and further research is needed in order to ascertain whether the underlying cause could be a hypothetical imbalance between labour supply and demand or whether there are other possible explanations.

Nevertheless, against this macroeconomic backdrop of enduring stability that came

to an end only in the final decades of the 18th century, we discover the personal histories of the workers who participated in the construction of the Royal Palace. Though labour mobility was high, the fact that our source includes the payrolls for nearly 70 years enables us to recreate the careers of some of those individuals, in some cases over a period of more than 30 years. A close examination of these men's working lives shows that they took what chances they had to gain new skills and achieve promotion, and thus earn higher wages. This new information also opens up fresh research perspectives on the functioning of labour markets in a sector as influential as construction was in pre-industrial times.

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## Appendix A. Nominal daily wage rates, 1737-1805 (in rs vn and grams of silver)

| | rs. vn. | | | | | Grames of silver | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Bricklayer A | Bricklayer B | Wood sawyer | Carpenter | Labourer | Bricklayer A | Bricklayer B | Wood sawyer | Carpenter | Labourer |
| 1737 | | (10.00) | 10.00 | 10.00 | 4.19 | | (12.63) | 13.11 | 13.11 | 5.49 |
| 1738 | | 10.00 | 10.00 | 10.00 | 4.19 | | 12.63 | 12.63 | 12.63 | 5.29 |
| 1739 | | 10.00 | 10.00 | 10.00 | 4.19 | | 12.63 | 12.63 | 12.63 | 5.29 |
| 1740 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1741 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1742 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1743 | (12.00) | 10.00 | 10.00 | 10.00 | 4.19 | (15.16) | 12.63 | 12.63 | 12.63 | 5.29 |
| 1744 | (12.00) | (10.00) | 10.00 | 10.00 | 4.19 | (15.16) | (12.63) | 12.63 | 12.63 | 5.29 |
| 1745 | (12.00) | (10.00) | 10.00 | 10.00 | 4.19 | (15.16) | (12.63) | 12.63 | 12.63 | 5.29 |
| 1746 | (12.00) | (10.00) | 10.00 | 10.00 | 4.19 | (15.16) | (12.63) | 12.63 | 12.63 | 5.29 |
| 1747 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1748 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1749 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1750 | 12.00 | (10.00) | 10.00 | 10.00 | 4.19 | 15.16 | (12.63) | 12.63 | 12.63 | 5.29 |
| 1751 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1752 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1753 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1754 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1755 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1756 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1757 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1758 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1759 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1760 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1761 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1762 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1763 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1764 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1765 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1766 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1767 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1768 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1769 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1770 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1771 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1772 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 15.16 | 12.63 | 12.63 | 12.63 | 5.29 |
| 1773 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 14.67 | 12.22 | 12.22 | 12.22 | 5.12 |
| 1774 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 14.57 | 12.14 | 12.14 | 12.14 | 5.09 |
| 1775 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 14.57 | 12.14 | 12.14 | 12.14 | 5.09 |
| 1776 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 14.57 | 12.14 | 12.14 | 12.14 | 5.09 |
| 1777 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 14.57 | 12.14 | 12.14 | 12.14 | 5.09 |
| 1778 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 14.57 | 12.14 | 12.14 | 12.14 | 5.09 |
| 1779 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 14.57 | 12.14 | 12.14 | 12.14 | 5.09 |
| 1780 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 14.57 | 12.14 | 12.14 | 12.14 | 5.09 |
| 1781 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 14.57 | 12.14 | 12.14 | 12.14 | 5.09 |
| 1782 | 12.00 | 10.00 | 10.00 | 10.00 | 4.19 | 14.57 | 12.14 | 12.14 | 12.14 | 5.09 |
| 1783 | 12.00 | 10.00 | 10.00 | 10.00 | 4.33 | 14.57 | 12.14 | 12.14 | 12.14 | 5.25 |
| 1784 | 12.00 | 10.00 | 10.00 | 10.00 | 4.83 | 14.57 | 12.14 | 12.14 | 12.14 | 5.86 |
| 1785 | 12.00 | 10.00 | 10.00 | 10.00 | 4.83 | 14.57 | 12.14 | 12.14 | 12.14 | 5.86 |
| 1786 | 12.00 | 10.00 | 10.00 | 10.00 | 4.83 | 14.57 | 12.14 | 12.14 | 12.14 | 5.86 |
| 1787 | 12.00 | 10.00 | 10.46 | 10.00 | 4.83 | 14.47 | 12.06 | 12.61 | 12.06 | 5.82 |
| 1788 | 12.00 | 10.00 | 11.00 | 10.00 | 4.89 | 14.38 | 11.98 | 13.18 | 11.98 | 5.86 |
| 1789 | 12.00 | 10.00 | 11.00 | 10.00 | 5.00 | 14.38 | 11.98 | 13.18 | 11.98 | 5.99 |
| 1790 | 12.00 | 10.00 | 11.00 | 11.00 | 5.00 | 14.38 | 11.98 | 13.18 | 13.18 | 5.99 |
| 1791 | 12.00 | 10.00 | 11.00 | 11.00 | 5.00 | 14.38 | 11.98 | 13.18 | 13.18 | 5.99 |
| 1792 | 12.00 | 10.00 | 12.00 | 11.00 | 5.00 | 14.38 | 11.98 | 14.38 | 13.18 | 5.99 |
| 1793 | 12.00 | 10.00 | 12.00 | 11.50 | 5.00 | 14.38 | 11.98 | 14.38 | 13.78 | 5.99 |
| 1794 | 12.00 | 10.00 | 12.00 | 12.00 | 5.00 | 14.38 | 11.98 | 14.38 | 14.38 | 5.99 |
| 1795 | 12.00 | 10.00 | 12.00 | 12.00 | 5.00 | 14.38 | 11.98 | 14.38 | 14.38 | 5.99 |
| 1796 | 12.00 | 10.00 | 12.00 | 12.00 | 5.00 | 14.38 | 11.98 | 14.38 | 14.38 | 5.99 |
| 1797 | 12.00 | 10.65 | 12.00 | 12.00 | 5.00 | 14.38 | 12.77 | 14.38 | 14.38 | 5.99 |
| 1798 | 12.00 | 11.00 | 12.00 | 12.00 | 5.00 | 14.38 | 13.18 | 14.38 | 14.38 | 5.99 |
| 1799 | 12.00 | 11.00 | 12.00 | 12.00 | 5.00 | 14.38 | 13.18 | 14.38 | 14.38 | 5.99 |
| 1800 | 12.00 | 11.00 | 12.00 | 12.00 | 5.00 | 14.38 | 13.18 | 14.38 | 14.38 | 5.99 |
| 1801 | 12.00 | 11.00 | 12.00 | 12.00 | 5.00 | 14.38 | 13.18 | 14.38 | 14.38 | 5.99 |
| 1802 | 12.00 | 11.00 | 12.50 | 13.00 | 5.50 | 14.38 | 13.18 | 14.98 | 15.58 | 6.59 |
| 1803 | 13.00 | 12.00 | 14.00 | 13.00 | 5.65 | 15.58 | 14.38 | 16.77 | 15.58 | 6.77 |

| | rs. vn. | | | | | Grames of silver | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Bricklayer A | Bricklayer B | Wood sawyer | Carpenter | Labourer | Bricklayer A | Bricklayer B | Wood sawyer | Carpenter | Labourer |
| 1804 | 13.50 | 12.50 | 14.50 | 13.50 | 6.42 | 16.18 | 14.98 | 17.37 | 16.08 | 7.70 |
| 1805 | 14.00 | 13.00 | 15.00 | 14.00 | 6.87 | 16.77 | 15.98 | 17.97 | 16.77 | 8.23 |
| 1806 | 14.00 | 13.00 | 15.00 | 14.00 | 7.00 | 16.77 | 15.58 | 17.97 | 16.77 | 8.39 |

*Sources*: AGP, AG, OP, cajas 14-580

## Appendix B. Number of daily wages paid by trade, work category and wage rate, 1740-1805 (in rs vn)

| | Wage Rate | 1740 | 1745 | 1750 | 1755 | 1760 | 1765 | 1770 | 1775 | 1780 | 1785 | 1790 | 1795 | 1800 | 1805 | Skills |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bricklayer | 21.0 | | | | | | | | | | | | | | 294 | Building Engineers |
| | 18.0 | | | 362 | | | | | | 295 | 313 | 75 | 236 | 287 | 300 | |
| | 16.0 | | | | | | | | | | | 39 | 57 | | | |
| | 15.0 | | | | | | | | 291 | | | | 166 | | | |
| | 14.0 | | | | | | | | | 282 | 792 | | 292 | | 1,461 | Bricklayers |
| | 13.0 | 1,592 | | | | | | | | | 415 | 292 | 457 | 281 | 856 | |
| | 12.0 | 117 | | 10,523 | 4,944 | 224 | 4,874 | 318 | 964 | 494 | 1,423 | 1,951 | 942 | 2,079 | 282 | |
| | 11.0 | 2 | | | 1,893 | 380 | 1,267 | 440 | 284 | | 949 | 1,044 | 188 | 519 | 397 | |
| | 10.0 | 5,750 | | | 3,855 | 23 | 3,769 | 979 | 694 | 60 | 1,058 | 3,753 | 1,201 | 462 | 144 | Helpers |
| | 9.0 | 2,884 | | 110 | 374 | 197 | 1,753 | 448 | 91 | | 834 | 542 | 534 | 738 | 58 | |
| | 8.5 | | | | | | | | | | | | | | 80 | |
| | 8.0 | 2,742 | 250 | 601 | 1,348 | | 678 | 176 | 217 | 1,393 | 280 | | 431 | 355 | 507 | |
| | 7.5 | | | | | | | | | | 18 | 180 | | | | Apprentices |
| | 7.0 | 2,323 | 35 | 590 | | | 402 | 224 | 128 | | 372 | 284 | 174 | 414 | 262 | |
| | 6.5 | | | | | | | | | | | 181 | | 164 | | |
| | 6.0 | 2,495 | 44 | 492 | 83 | 29 | 358 | 127 | 365 | 575 | 125 | 623 | | 95 | 802 | |
| | 5.5 | | | | | | | | | | | 136 | 525 | 30 | 908 | |
| | 5.0 | 22 | | 6 | | | 61 | | 61 | | | 695 | 220 | 784 | 897 | |
| | 4.5 | | | | | | | | | | | 150 | | | | |
| | 4.0 | | | | | | | | | | | 534 | | | 252 | |
| | 3.5 | | | | | | | | | | | 211 | | | | |
| | 3.0 | | | | | | | | | | | 547 | | | | |
| | 2.5 | | | | | | | | | | | | 171 | | | |
| Carpenter/Joiner | 18.0 | | | | | | | | | 306 | 157 | | | | | Master/Foremen |
| | 17.0 | | | | | | | | | | | | | | 294 | |
| | 16.0 | | 363 | 348 | | | | | | | 63 | | | | 459 | Carpenters/Joiners |
| | 15.0 | | | 19 | | | 2 | 296 | 308 | 293 | 119 | | | | 882 | |
| | 14.0 | | | | | | 355 | | | | | | 479 | 574 | 1,307 | |
| | 13.0 | 749 | | | | | | | | | | 898 | 1,555 | 930 | | |
| | 12.0 | 162 | | 58 | | | 295 | | | | 212 | 1,844 | 3,999 | 1,169 | | |
| | 11.5 | | | | | | | | | | | | | | 557 | |
| | 11.0 | 154 | | 605 | | 14 | 1,240 | 884 | 938 | 293 | 627 | 3,829 | 854 | | 446 | Helpers |
| | 10.0 | 1,802 | 3,115 | 4,208 | 152 | 916 | 1,524 | 2,435 | 2,000 | 194 | 2,455 | 2,950 | 623 | 546 | 246 | |
| | 9.0 | 2,777 | | | | 157 | 4,836 | 1,104 | 597 | 112 | 1,164 | 936 | 713 | | 446 | |
| | 8.0 | 3,481 | 3,979 | 5,635 | 1,469 | 230 | 1,885 | 491 | 238 | 175 | 198 | 131 | 371 | 563 | 283 | |
| | 7.5 | | | | | | | | | | | | 293 | 151 | 449 | |
| | 7.0 | 2,948 | 516 | 1,923 | 100 | | 658 | 166 | 17 | | 555 | 763 | 292 | 989 | 222 | |

| | Wage Rate | 1740 | 1745 | 1750 | 1755 | 1760 | 1765 | 1770 | 1775 | 1780 | 1785 | 1790 | 1795 | 1800 | 1805 | Skills |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6.5 | | 217 | | | | | | | | | | 291 | | 52 | Apprentices |
| | 6.0 | 407 | | 1,068 | 3 | | 347 | 471 | 569 | 311 | 371 | 686 | 180 | 484 | | |
| | 5.0 | 798 | | | | | 2 | | 169 | | | 369 | 930 | | 294 | |
| | 4.5 | 29 | | | | | | | | | | 118 | | 191 | 588 | |
| | 4.0 | 49 | | | | | | 288 | | | | 717 | 389 | | | |
| | 3.5 | | | | | | | 457 | | | | 99 | 283 | 96 | 283 | |
| | 3.0 | 21 | | | | | 761 | 58 | | | | 452 | | 277 | | |
| Wood sawyer | 16.0 | | | | | | | | | | | | | | 31 | Wood sawyers |
| | 15.0 | | | | | | | | | | | | | | 209 | |
| | 14.0 | | | | | | | | | | | | | | 11 | |
| | 13.0 | | | | | | | | | | | | | | 142 | |
| | 12.0 | | | | | | | | | | | 595 | 1,343 | 1,007 | | |
| | 11.0 | | | | | | | | | | | 1,078 | | | | |
| | 10.0 | 596 | 682 | 1,603 | 621 | 161 | 1,671 | 621 | 733 | 148 | 868 | | | | | |
| Labourer (unspecified) | 8.0 | | | | | | 604 | | | | | | | | 326 | Unspecified |
| | 7.5 | | | | | | | | | | | | | | 1,251 | |
| | 7.0 | | | | | | | | | | | 647 | | 11 | 15,926 | |
| | 6.5 | | | | | | | | | | | | | | 567 | |
| | 6.0 | | | | | 195 | 3,213 | | | | | 66 | | 2,053 | | |
| | 5.5 | | | | | | 597 | | | | | | 4,421 | 6,696 | 81 | |
| | 5.0 | | | 4 | 280 | | 1,087 | | | | | 61,417 | 33,615 | 14,050 | 668 | |
| | 4.7 | | | | | | | | | | 41,166 | | | | | |
| | 4.5 | | | | | | | | 263 | | | | | | | |
| | 4.2 | 273,115 | 124,005 | 301,788 | 247,626 | 46,599 | 163,411 | 18,997 | 24,666 | 10,917 | | | | | | |
| | 4.0 | | | | | | | | | 428 | 887 | 292 | 295 | 902 | | |
| | 3.5 | | | | | | | 12 | | | 357 | | | | | |
| | 3.0 | | | | | | 7 | | | 3 | | | | | | |
| Labourer, specialised | 8.0 | | | | | | | | 6 | | | | | | 338 | Specialised |
| | 7.5 | | | | | | | | | | | | | | 570 | |
| | 7.0 | | | | | | | 363 | 1,255 | 305 | 357 | | 596 | 95 | 2,621 | |
| | 6.5 | | | | | | 652 | | | | | | | 189 | | |
| | 6.0 | | | | 157 | 665 | | | 306 | | | 4,038 | 3,286 | 777 | | |
| | 5.5 | | | | | | 4,569 | 994 | 1,231 | 422 | 890 | 4,330 | 2,771 | 729 | | |
| | 5.0 | | | | | 788 | 2,469 | 1,253 | 1,314 | 1,183 | 3,661 | 254 | | 204 | | |
| | 4.5 | | | | | | | | | | | | | | | |
| | 4.2 | 3,193 | | | 284 | 492 | 98 | | 889 | | | | | | | |
| | 4.0 | | 2 | | | | | | | | | | | | | |

*Notes*:
Wage rates: decimals rounded up.
Dotted lines mark unclear boundaries between skills.

## Appendix C-1. Wage rates (in rs vn) and number of working days computed by trade and job category (skill) in 1750

| Trade | Job category | Daily wage rate | Days worked and paid |
|---|---|---|---|
| Italian bricklayer | Bricklayer | 16.0 | 45.5 |
| | Bricklayer | 14.0 | 4,042.0 |
| | Bricklayer | 12.0 | 4,516.0 |
| | Bricklayer | 10.0 | 971.5 |
| Italian bricklayer's warden | | 4.5 | 362.0 |
| Bricklayer | Building engineer | 18.0 | 362.0 |
| | Bricklayer (journeyman) | 12.0 | 10,523.0 |
| | Helper | 9.0 | 109.5 |
| | Helper | 8.0 | 601.0 |
| | Helper | 7.0 | 589.5 |
| | Helper | 6.0 | 491.5 |
| | Helper | 5.0 | 5.5 |
| Asentador (?) | )Unspecified | 12.0 | 5,019.0 |
| Wood sawyer | Unspecified | 10.0 | 1,603.0 |
| Stonemason | Unspecified | 10.5 | 282.0 |
| | Unspecified | 10.0 | 1,261.0 |
| | Unspecified | 9.5 | 3,703.5 |
| | Unspecified | 9.0 | 349.5 |
| | Unspecified | 8.5 | 266.0 |
| Carpenter | Foreman | 16.0 | 348.0 |
| | Carpenter (journeyman) | 11.0 | 547.5 |
| | Carpenter (journeyman) | 10.0 | 4,056.5 |
| | Helper | 8.0 | 5,634.5 |
| | Helper | 7.0 | 1,923.0 |
| | Helper | 6.0 | 1,046.5 |
| Joiner | Master? | 15.0 | 18.5 |
| | Joiner | 12.0 | 57.5 |
| | Joiner | 11.0 | 57.5 |
| | Joiner | 10.0 | 151.0 |
| | Helper | 6.0 | 21.0 |
| Wheelwright | Foreman | 14.0 | 348.0 |
| | Director | 12.0 | 348.0 |
| | Wheelwright | 10.0 | 1,639.0 |
| | Helper | 7.0 | 668.0 |
| Locksmith | Master | 18.0 | 362.0 |
| | Locksmith (journeyman) | 11.0 | 286.5 |
| | Locksmith (journeyman) | 9.0 | 456.0 |
| | Locksmith (journeyman) | 8.0 | 1,101.0 |
| | Locksmith (journeyman) | 7.5 | 393.5 |
| | Locksmith (journeyman) | 7.0 | 117.0 |
| | Helper | 6.5 | 290.5 |
| Blacksmith | Blacksmith (journeyman) | 12.0 | 287.5 |
| | Blacksmith (journeyman) | 11.5 | 288.5 |
| | Blacksmith (journeyman) | 10.0 | 823.5 |
| | Blacksmith (journeyman) | 9.0 | 418.0 |
| | Blacksmith (journeyman) | 8.0 | 639.0 |
| | Blacksmith (journeyman) | 7.5 | 357.5 |
| | Helper | 7.0 | 2,089.0 |
| | Helper | 6.5 | 1,976.0 |
| | Helper | 6.0 | 1,983.5 |
| Sonador/machacador (?) | Unspecified | 5.0 | 3,204.0 |
| Tapajuntas (Sealing joints?) | Unspecified | 12.0 | 252.5 |
| Labourer | Unspecified | 5.0 | 3.5 |
| | Unspecified | 4.2 | 301,788.0 |
| Teniente arquitecto (Deputy architect?) | Unspecified | 20.0 | 1,065.0 |
| Interventor de las fraguas (Forge foreman?) | Unspecified | 10.0 | 348.0 |
| Medidor de la Piedra (Stone accountant) | Unspecified | 18.0 | 348.0 |

| Trade | Job category | Daily wage rate | Days worked and paid |
|---|---|---|---|
| Pagador de la Piedra (Stone payer?) | Unspecified | 12.0 | 348.0 |
| Stone assistant | Unspecified | 8.0 | 31.0 |
| Escribiente de la Piedra (Stone scribe?) | Unspecified | 10.0 | 348.0 |
| | Unspecified | 6.0 | 348.0 |
| | Unspecified | 5.0 | 348.0 |
| Recibidor (?) | Unspecified | 15.0 | 355.0 |
| | Unspecified | 12.0 | 1,768.0 |
| Overseer | Unspecified | 12.0 | 1,813.0 |
| Enlister | Unspecified | 10.0 | 2,116.0 |
| Propio (?) | Unspecified | 7.0 | 461.5 |
| Scribe | Unspecified | 5.5 | 964.0 |
| | Unspecified | Total | 379,762.0 |

## Appendix C-2. Wage rates (in rs vn) and number of working days computed by trade and job category (skill) in 1790

| Trade | Job category | Daily wage rate | Days worked and paid |
|---|---|---|---|
| Bricklaying | Overseer | 18.0 | 74.5 |
| | Overseer | 16.0 | 39.0 |
| | Overseer | 13.0 | 292.0 |
| | Bricklayer (journeyman) | 12.0 | 1,951.0 |
| | Bricklayer (journeyman) | 11.0 | 1,043.5 |
| | Bricklayer (journeyman) | 10.0 | 3,752.5 |
| | Bricklayer (journeyman) | 9.0 | 541.5 |
| | Helper | 7.5 | 179.5 |
| | Helper | 7.0 | 284.0 |
| | Helper | 6.5 | 181.0 |
| | Helper | 6.0 | 623.5 |
| | Helper | 5.5 | 135.5 |
| | Helper | 5.0 | 694.5 |
| | Helper | 4.5 | 149.5 |
| | Apprentice | 4.0 | 533.5 |
| | Apprentice | 3.5 | 210.5 |
| | Apprentice | 3.0 | 547.0 |
| 'with the painters' (Bricklayer?) | Journeyman | 16.0 | 444.5 |
| | Journeyman | 14.0 | 32.0 |
| | Journeyman | 12.0 | 1,529.5 |
| | Journeyman | 10.0 | 33.0 |
| | Unspecified | 7.0 | 290.0 |
| | Unspecified | 6.0 | 348.0 |
| Carpenter | Carpenter (journeyman) | 13.0 | 898.0 |
| | Carpenter (journeyman) | 12.0 | 1,844.0 |
| | Carpenter (journeyman) | 11.0 | 3,829.0 |
| | Carpenter (journeyman) | 10.0 | 2,950.0 |
| | Carpenter (journeyman) | 9.0 | 936.0 |
| | Helper | 8.0 | 131.0 |
| | Helper | 7.0 | 763.0 |
| | Helper | 6.0 | 686.0 |
| | Apprentice | 5.0 | 368.5 |
| | Apprentice | 4.5 | 118.0 |
| | Apprentice | 4.0 | 716.5 |
| | Apprentice | 3.5 | 99.0 |
| | Apprentice | 3.0 | 451.5 |

| Trade | Job category | Daily wage rate | Days worked and paid |
|---|---|---|---|
| Wheelwright | Helper | 6.0 | 293.0 |
| Wood sawyer | Unspecified | 12.0 | 595.0 |
| | Unspecified | 11.0 | 1,078.0 |
| Stone mason | Unspecified | 14.0 | 93.0 |
| | Unspecified | 12.0 | 1,080.0 |
| | Unspecified | 11.0 | 1,786.0 |
| | Unspecified | 10.0 | 189.0 |
| | Unspecified | 9.0 | 85.0 |
| | Unspecified | 7.0 | 63.0 |
| | Apprentice | 5.0 | 114.0 |
| | Apprentice | 4.5 | 72.0 |
| | Apprentice | 3.0 | 137.0 |
| Marble mason | Unspecified | 17.0 | 140.5 |
| | Unspecified | 16.0 | 300.0 |
| | Unspecified | 15.0 | 290.0 |
| | Unspecified | 14.0 | 293.5 |
| | Unspecified | 13.0 | 507.0 |
| | Unspecified | 12.0 | 742.5 |
| Marble sawyer | Unspecified | 8.0 | 581.5 |
| | Unspecified | 7.5 | 291.5 |
| | Unspecified | 7.0 | 1,544.0 |
| | Unspecified | 6.5 | 291.5 |
| | Unspecified | 6.0 | 2,230.0 |
| | Apprentice | 5.5 | 4.0 |
| | Apprentice | 5.0 | 240.5 |
| | Apprentice | 4.0 | 212.0 |
| | Apprentice | 3.0 | 293.5 |
| | Apprentice | 2.0 | 82.0 |
| Polisher, marble | Unspecified | 11.0 | 785.0 |
| | Unspecified | 10.5 | 292.0 |
| | Unspecified | 10.0 | 1,190.5 |
| | Unspecified | 9.0 | 875.0 |
| Paver | Master? | 12.0 | 200.0 |
| | Journeyman | 10.0 | 510.5 |
| | Journeyman | 9.0 | 2.0 |
| Tiler | Unspecified | 12.0 | 226.0 |
| Pisador? | Unspecified | 7.0 | 376.0 |
| Plumber (Fontanero) | Master | 10.0 | 292.0 |
| | Journeyman | 11.0 | 315.5 |
| | Journeyman | 9.0 | 246.5 |
| | Helper | 8.0 | 3.0 |
| Plumber (Plomero) | Unspecified | 12.0 | 123.0 |
| | Unspecified | 11.0 | 632.5 |
| | Unspecified | 10.0 | 47.0 |
| | Helper | 7.0 | 291.0 |
| Sewermen | Helper | 7.0 | 142.0 |
| | Helper | 6.0 | 325.0 |
| Well digger | Master? | 15.0 | 152.0 |
| | Journeyman | 12.0 | 160.0 |
| | Helper | 9.0 | 255.5 |
| | Helper | 8.0 | 6.0 |
| Boy | | 3.0 | 603.5 |
| Labourer | Unspecified | 7.0 | 647.0 |
| | Unspecified | 6.0 | 66.0 |
| | Unspecified | 5.0 | 61,417.0 |
| | Unspecified | 4.0 | 292.0 |
| | De almacén y varas (warehouse) | 6.0 | 682.5 |
| | Well digger | 6.0 | 927.0 |
| Labourer | Plumber (Lead works?) | 6.0 | 697.0 |
| | Plumber | 6.0 | 1,406.0 |

| Trade | Job category | Daily wage rate | Days worked and paid |
|---|---|---|---|
| Labourer | Wheelwright | 5.5 | 4,330.0 |
| | Sewer | 5.0 | 253.5 |
| Sculptor | Unspecified | 40.0 | 475.0 |
| Carver | Unspecified | 16.0 | 158.0 |
| Painter | Unspecified | 30.0 | 251.0 |
| Moledor de colores | Unspecified | 6.0 | 211.0 |
| | Unspecified | 4.0 | 93.0 |
| Draughtsman | Unspecified | 14.0 | 152.0 |
| | Unspecified | 12.0 | 287.0 |
| | Unspecified | 10.0 | 538.0 |
| | Unspecified | 8.0 | 90.0 |
| | Unspecified | 7.0 | 363.0 |
| | Unspecified | 5.0 | 292.0 |
| 'Appointed' | Unspecified | 9.0 | 505.0 |
| | Unspecified | 8.0 | 768.0 |
| | Unspecified | 7.0 | 761.0 |
| | Unspecified | 6.0 | 1,998.0 |
| Empleado en hacer listas (Clerk?) | Unspecified | 10.0 | 546.0 |
| | Unspecified | 9.0 | 896.0 |
| | Unspecified | 8.0 | 551.0 |
| | Unspecified | 6.0 | 307.0 |
| | | Total | 129,340.5 |

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