


ARTICLES/ARTÍCULOS

## The role of industrialisation in education expenditure: municipal budgets in Biscay, 1860-1910

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### Abstract

This paper presents a unique database that explores how industrialisation affected municipalities' incomes, expenditures and education spending. Using the importance of the mines and steelworks in Biscay in northern Spain between 1860 and 1910 as indicators of industrialisation, the findings show that there was a positive relationship between these dimensions and towns' incomes, which was indirectly transmitted to municipalities' expenditures, showing that municipalities were able to benefit from industrialisation. However, the thriving mining and metallurgy sectors did not support an increase in education spending. The lack of short-term results from spending on education may have led town councils to divert the revenues of industrialisation into more urgent areas, or those that could deliver faster results.

**Keywords:** local government; education expenditure; Spain; 19<sup>th</sup> century; industrialisation

**JEL Codes:** H75; N33; N43; N53

### Resumen

Este artículo presenta una base de datos que explora cómo la industrialización afectó los ingresos y gastos municipales, con un especial énfasis en el gasto educativo. Usando la importancia de las minas y la siderurgia en Vizcaya entre 1860 y 1910 como indicador de industrialización, los resultados muestran que había una relación positiva entre estas industrias y los ingresos municipales. Este efecto positivo se transmitía indirectamente a los gastos municipales, mostrando que los ayuntamientos eran capaces de beneficiarse de la industrialización. Sin embargo, los boyantes sectores mineros y siderúrgicos vizcaínos no llevaron a un mayor gasto en educación. La ausencia de resultados claros a corto plazo de una inversión en educación pudo llevar a que los ayuntamientos prefirieran localizar los beneficios de la industrialización en gastos más urgentes o con resultados más a corto plazo.

**Palabras Clave:** gobiernos locales; gasto educativo; España; siglo XIX; industrialización

## 1. Introduction

In economic history, the literature that explores the evolution of education establishes a series of mechanisms through which human capital formation was affected during the 19<sup>th</sup> and early 20<sup>th</sup> centuries. Land access and living standards played an important role as they could determine whether families were able to or wanted to educate their children as well as the spending capacity of public institutions on education (Beltrán Tapia 2013; Humphries 2013; Beltrán Tapia and Martínez-Galarraga 2018; Palacios-Mateo 2023). Moreover, elites and institutions had different perceptions on how education should be provided and funded (Becker and Woessman 2009; Andersson and Berger 2016; Westberg 2018). Similarly, state development played an important role, as education could be used to reinforce the nation-building process during this period (Weber 1976; Boli *et al.* 1985).

In this regard, the effect of industrialisation on human capital formation during the 19<sup>th</sup> and early 20<sup>th</sup> centuries is still an open debate. Galor and Moav (2004, 2006) and Galor (2011, pp. 31-37) argued that the Industrial Revolution, especially at the end of the 19<sup>th</sup> century, led to an increasing demand for education. Moreover, for the same period, Diebolt *et al.* (2017) found that in France, the adoption of steam engines fostered human capital accumulation. Also in France, Montalbo (2020) showed that in mining and industrial towns, industrialisation had a significant positive effect on education provision during the first half of the 19<sup>th</sup> century. Likewise, Cinnirella and Hornung (2016) stressed that industrialisation in Prussia had a positive impact on enrolment rates from the late 19<sup>th</sup> century onwards. Moreover, Carl (2009) found that in England, France, Germany and the United States, enrolment rates were increasing through the last third of the 19<sup>th</sup> century due to the perceived need for social controls or the demand for skilled workers that industrialisation triggered.

Nevertheless, in Britain at the end of the 18<sup>th</sup> century and the first half of the 19<sup>th</sup> century, there was a de-skilling process as industrialisation spread across the territory (Pleijt and Weisdorf 2017).<sup>1</sup> This process was linked to an increase in the share of low-skilled workers and the rise of the steam engine, and a greater increase in illiteracy among skilled British workers than among semi-skilled or unskilled workers (Nicholas and Nicholas 1992). Additionally, Franck and Galor (2021) stressed that industrialisation had long-term negative effects on education, as regions of France that were industrialised during the 19<sup>th</sup> century have lower average education attainment in the 21<sup>st</sup> century.

Therefore, this study contributes to this debate by analysing the effects of Spanish industrialisation on the budgets of municipalities and spending on public education in the northern province of Biscay during the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. Moreover, the analysis of municipal income and expenditure, besides educational spending, will shed light on the dynamics within the town councils with respect to how much they spent on the human capital formation of their population. In order to understand this, I use the mining and metallurgy sectors as indicators of the industrialisation process and analyse their impact on the public accounts of 117 municipalities in Biscay, using a five-period panel dataset between 1860 and 1910.<sup>2</sup> This Spanish province represents an interesting case study, as the iron-mining industry drove industrialisation in the region through the last third of the 19<sup>th</sup> century (González Portilla 1985; Montero García 1988).<sup>3</sup> This mining-led industrialisation process resulted in Biscay becoming one of the few Spanish regions that was industrialised during this period (Martínez-Galarraga *et al.*

<sup>1</sup> See also Humphries (2013) or Borrás Llop (2005) for the role of child labour, industrialisation and schooling.

<sup>2</sup> Appendix Figure A.2 shows the geographical location of Biscay within the Spanish territory and the municipalities analysed in this paper.

<sup>3</sup> Between the mid-1880s and 1910, Biscay extracted 90 per cent of the iron ore mined in Spain, with a yearly average production of four million tonnes (Escudero Gutierrez 2006).

2021, pp. 721-725). Thus, this process shaped municipal revenues and expenses in a period when local councils were responsible for tax collection and the provision of public services such as primary education, until the early 20<sup>th</sup> century.<sup>4</sup>

The findings show interesting results for the three elements analysed here. First, the mines, particularly those of iron, bolstered the indirect taxes of the municipalities, their main source of income during the period under study. This income stimulus from the mining industry indicates the expanding consumption patterns and variety of transactions in these towns. This positive effect is reflected in municipal expenditure, as mines had an indirect impact through higher taxes on spending. Thus, as mining towns improved their revenues, they were able to invest in new public infrastructures and services. However, contrary to the expenditure of other towns, the iron mines had no effect on educational spending and other mines and steel mills hampered it. Thus, the results show that, although industrialisation benefited municipal revenues, education was neglected as other expenditures may have been more urgent. While educated citizens and workers could have been desirable for the population or some elite classes, and while the legislation may have mandated the provision of schools, in terms of skills, job prospects or social control, new sewer systems, more police officers or streetlights were preferred by the Biscay industrial town councils over education.

The structure of the paper is as follows. Section 2 explains the theoretical framework behind the analysis. Section 3 presents the context of the study through the presentation of the data employed in the analysis. Section 4 describes the methodology used and reports the results of the models. Finally, section 5 provides concluding remarks.

## 2. Theoretical framework

During the 19<sup>th</sup> century in Europe, liberal states were developed in parallel to the industrialisation process (Dincecco 2009, 2015; Magnusson 2009; Cardoso and Lains 2010).<sup>5</sup> Therefore, it is important to understand how this process shaped the expansion of the liberal state. The new modes of production, socio-economic structures, consumption and housing patterns brought about by industrialisation had a considerable impact on the administration of the Old Regime. New epidemics, ideas and innovations, and the pressing needs of the population increased demand and the political willingness to provide public services, such as public health and education infrastructures (Lindert 2004; Durevall and Henrekson 2011).<sup>6</sup> For instance, unlike previous centuries, laws establishing mass schooling became widespread in Europe in order to improve the education of the population (Westberg *et al.* 2019).<sup>7</sup>

Nevertheless, during the 19<sup>th</sup> century, municipalities played a significant role in the expansion and consolidation of the state (Pro Ruiz 2007, pp. 539-541). For instance, in England and Wales, around 60 per cent of the decrease in death rates during the second half of the century was due to local public investment in sanitary infrastructure (Chapman 2019). Moreover, despite the educational laws issued at the national level during the 19<sup>th</sup> century, Swedish, Italian or Spanish municipalities had to fund primary education with their

<sup>4</sup> Some studies focused on just one city or looked at an aggregate level (Alonso Olea 2003; García Gómez 2018).

<sup>5</sup> This process started during the late 18<sup>th</sup> century after decades of receiving revenues from trading, which was followed by a period when substantial income was generated by new industries, which allowed some countries to develop a modern state (Tilly 1990; Cox and Dincecco 2021).

<sup>6</sup> For an analysis of the development and effects of public sanitation, see García Gómez (2018), Peltola and Saaritsa (2019) or Chapman (2019).

<sup>7</sup> The expansion of education to an increasing number of people during the 19<sup>th</sup> and early 20<sup>th</sup> centuries is depicted by some authors as a complementary development to the creation of the nation-state during these decades (Boli *et al.* 1985; Green 2013, pp. 115-169; Bandiera *et al.* 2018; Alesina *et al.* 2021).

revenues.<sup>8</sup> Thus, besides the dynamics between state development and industrialisation at the national level, during this period, the effect that industrialisation, but more importantly local factories, workshops or mines had on local administrations was highly relevant.

In the particular case of the industrialisation brought about by mines and steel mills, their effects on the development of local administration could be divided according to the impact on income or expenditure. In the case of the former, the potential direct benefits that mining and metallurgy municipalities received from these industries were through the revenues or royalties they generated. The wealth produced by these sectors might have led to improvements in local public finances, which may, in turn, have resulted in more spending. However, during the 19<sup>th</sup> century, consumption and indirect taxes were among the main income sources for central and local governments (Vallejo Pousada 1996; Justman and Gradstein 1999). Thus, population growth, due to the demand for workers by mines and steel mills, might have had a greater impact than direct revenues from mines and steelworks coming from the increasing consumption from these workers, and the subsequent effect on indirect taxes.<sup>9</sup> Furthermore, as the industrialisation process continued, market interactions became more common, which led to different consumption patterns.<sup>10</sup> Hence, in industrialised towns, an increase in the range of products consumed might have expanded the tax base, and, in turn, the municipalities' revenues.

However, the potential effects of the presence of mines and steel mills on local incomes, especially royalties and direct taxes, depended on the institutional capacities and attitudes of the town councils and the political power of the mine and industrial owners.<sup>11</sup> In this sense, the presence of foreign mining companies and an export-oriented mining sector might have affected local characteristics, as mining companies could act as subsidiaries of metallurgical industries in other countries that needed the ore. Therefore, in mining-export towns, low-skilled and unskilled workers were prevalent as only ore extraction was required (Leamer 1987, 1995). This led to a lower purchasing power than in those towns with steel mills, where medium-skilled workers or higher wages were more abundant.<sup>12</sup> Therefore, besides the political power that mining and industrial owners could exert, which may or may not have been different to that of the landowners or rural elite, an export-focused mining model could have affected the local revenues and, consequently, the fiscal capacity of town councils.<sup>13</sup>

Besides the effect that mines and steelworks may have had on the local administrations' incomes, mining and industrial externalities such as population growth or mining and industrial waste would have demanded a certain provision of public goods from town councils. Increasing flows of new inhabitants due to the demand from mines and steel mills would have led to the increasing demand for paved roads, a clean water supply, schools or sewage systems in the new neighbourhoods where these new miners and workers lived. Moreover, governments influenced by mining and industrial owners may have demanded infrastructures that benefited their companies, such as railroads connecting mines and ports, increasing the expenditure of public administrations.<sup>14</sup>

<sup>8</sup> See Westberg (2018), Cappelli and Vasta (2020) and Beltrán-Tapia and Martínez-Galarraga (2018) for Sweden, Italy and Spain, respectively.

<sup>9</sup> During the 19<sup>th</sup> century, mining and industrial regions in Europe experienced significant population growth (Hornung 2015; Matheis 2016; Fernihough and O'Rourke 2021).

<sup>10</sup> See for instance Pujol Andreu *et al.* (2007) for the case of Catalonia.

<sup>11</sup> See for instance Maurer (2019) and Easton and Gwaindepi (2021).

<sup>12</sup> Palacios-Mateo (2023).

<sup>13</sup> For instance, Andersson and Berger (2016) find that the landed elite were enhancing educational investments in comparison with the capitalist elite in 19<sup>th</sup>-century Sweden.

<sup>14</sup> See Gwaindepi and Fourie (2020) the role of mining companies in the expansion of the railroads in the British Cape Colony during the 19<sup>th</sup> century.

Regarding education provision, it might be affected by different factors. As the literature stresses, elites could have different attitudes towards education, as they might be willing to promote or not its provision depending on outcomes and taxation, as Galor and Moav (2006) argue. Regarding state intervention in education provision, Boli *et al.* (1985) argue that the new liberal states during the 19<sup>th</sup> century promoted mass schooling to strengthen the building of these states.<sup>15</sup> Moreover, living standards could also affect education provision as its demand could be lower, decreasing the supply of schools that should match this lowered demand (Beltrán Tapia and Martínez-Galarraga 2018; Palacios-Mateo 2023).

Following this literature, education expenditure in mining and industrial towns could have been significantly influenced by these sectors. A high share of unskilled workers in mines or steelworks would mean a lower demand for skilled and educated workers, weakening the potential links between industrialisation and human capital formation, and, in turn, could have affected public spending on education.<sup>16</sup> Thus, a mining town council influenced or controlled by mining owners might prioritise expenditure on other public services, as education might not be a required skill for their future workers. Moreover, mining and industrial elites might also have opposed mass schooling. Although resistance to the education of the working class has largely been attributed to the nobility and the landed elites, many mining and industrial owners might have had similar views, using their political influence to shape education spending (Andersson and Berger 2016).<sup>17</sup>

Nevertheless, as mines and steel mills might require technical and skilled workers in some industrial processes, their presence may have acted as a stimulus for the population to demand access to education.<sup>18</sup> Moreover, mine owners and industrial elites might have promoted education in order to have a pool of skilled workers, or as a tool to control potential social unrest (Martin 2021).<sup>19</sup> Additionally, as mining and industrial towns experienced important population growth, the arrival of more people meant that more education infrastructure, and, in turn, more education spending, was needed. However, the reaction of a town council to an increase in the municipality's inhabitants might not have been as fast as the surge in population (Rauscher 2016).<sup>20</sup> This lag might have led to decreases in per capita school funding and higher teacher-to-student ratios in the years immediately after demographic or legal changes occurred.<sup>21</sup> Nevertheless, the increases in the populations of mining and industrial towns could be translated into agglomeration dynamics that spurred the development of more diverse economic activities. This would have increased the diversity of the available jobs, with some of these new jobs requiring different skills and education levels. In turn, such shifts in the labour market may have led to higher education expenditure, as the population demanded access to education in order to qualify for these jobs (Thisse 2018).

In conclusion, as the public administration transitioned from the Old Regime to the liberal state during the 19<sup>th</sup> century, this process was affected by industrialisation. For

<sup>15</sup> See Westberg *et al.* (2019) on how most western countries created mass-schooling laws during this period.

<sup>16</sup> For the education level of miners in the 19<sup>th</sup> century, see Mitch (1992, p. 88) or Humphries (2013).

<sup>17</sup> The authors found no participation by capitalists in Swedish mass schooling during the 19<sup>th</sup> century. For the negative role of the landed elite in education, see Cinnirella and Hornung (2016) and Beltrán-Tapia and Martínez-Galarraga (2018).

<sup>18</sup> Since the late 18<sup>th</sup> century, the mining and metallurgy sectors were among the leading sectors in terms of technological innovations (Allen 2009, pp. 160-163; Nuvolari and Verspagen 2009).

<sup>19</sup> For the social control through education exerted by coal mining and industrial elites in the UK, see also Colls (1987), Hassan (1980) or Houston (1983).

<sup>20</sup> It has been argued that institutions tend to evolve more slowly than the people in them, leading to a period of adaptation, labelled as institutional lag (Riley *et al.* 1994).

<sup>21</sup> See also Mitch (1992, p. 134).

instance, the increasing consumption of products due to the rising number of wage-earning workers boosted the revenues that states and local governments were able to obtain. Nevertheless, public administrations also affected society and the industrialisation process. New hygiene and educational ideas transformed the perception of the population and public administrations, fostering their public provision. Thus, this dual causality enhanced the expansion of the provision of public services, strengthening the development of public administrations at a national and local level.

### 3. Data and context

In Spain, the modern liberal state was not effectively developed until the 1840s.<sup>22</sup> The underdevelopment of the state during the first half of the 19<sup>th</sup> century meant that Spanish municipalities were the frontline institutions throughout the century, as they were the only effective administrative bodies in the country.<sup>23</sup> Because of the lack of state civil servants and the failure of the Spanish state to provide and fund public services such as sanitation infrastructure and primary education institutions, town councils were the administrative bodies responsible for collecting state taxes and providing public services.<sup>24</sup> For instance, the first nationwide and effectively implemented education law in Spain, which was enacted in 1857, mandated that municipalities had to fund primary education with their own revenues.<sup>25</sup> This decentralised system lasted until 1902, when the central government started to pay the wages of schoolteachers.<sup>26</sup>

Therefore, town councils played a major role in ensuring the well-being of the Spanish population and promoting local development, particularly in terms of human capital formation. Although these public services were provided for the benefit of all a municipality's inhabitants, until 1890 only the upper quantiles of the taxpayers of Spanish municipalities were eligible to serve as mayors or town councillors.<sup>27</sup> Consequently, until 1890, Spanish town councils were legally under the control of the wealthy elite, which may have shaped the provision of decentralised public services. Furthermore, even though national laws regulated municipalities' legal obligations and mandatory expenses, town councils could set their own spending priorities, such as which types of public infrastructure should be built first, how much should be spent on them and where they should be erected.

In the case of education, [Figure 1](#) shows the difference between town councils in terms of spending on public education. This figure shows the average levels of primary education spending by municipalities in each Spanish province in 1880. Although the Education Law of 1857 established that all Spanish town councils had to fund local primary education, scarce income or lack of willingness to comply with the law meant that, 20 years

<sup>22</sup> Pro Ruiz (2019).

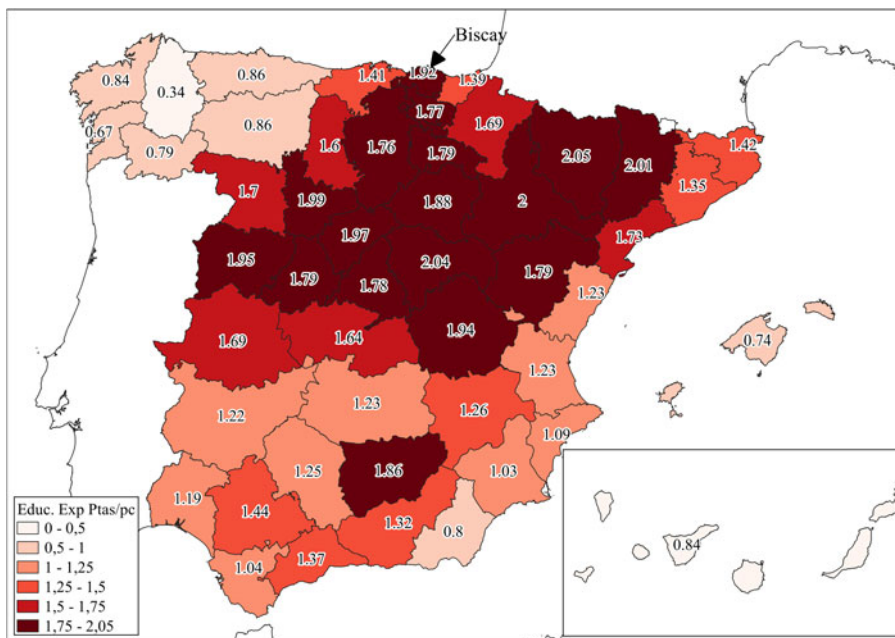
<sup>23</sup> See del Moral Ruiz (2007, pp. 72-85) and Pro Ruiz (2007, pp. 532-540).

<sup>24</sup> See del Moral Ruiz (2007, pp. 76-77) and Pro Ruiz (2007, pp. 539-541).

<sup>25</sup> This law, with some modifications, would last until 1970. However, the law provided a common legal framework, as it established the number of schools based on a municipality's population or teachers' wages (*Ley de Instrucción Pública de 9 de Septiembre de 1857, Gaceta de Madrid*, n. 1710., p. 2). This education law was supplemented by local legislation at the municipality level, as primary education was established as one of the mandatory expenditures in municipal budgets by the Law of 1845 (article 93<sup>rd</sup>) and by the Law of 1877 (article 73<sup>rd</sup>); see Orduña Rebollo and Coscolluela Montaner (2008, pp. 699 and 1033).

<sup>26</sup> In 1900, a Royal Decree shifted wages and other minor expenses from municipal budgets to the state's budget. However, this change did not take place until 1902 (*Real Decreto de 21 de Julio de 1900, Gaceta de Madrid*, n. 204, p. 319, 1900; *Real Decreto de 26 de Octubre de 1901, Gaceta de Madrid*, n. 303, pp. 497-499, 1901).

<sup>27</sup> Moreover, the electoral franchise was restricted to adult male taxpayers until universal male suffrage was established in 1890 (Orduña Rebollo and Coscolluela Montaner 2008, pp. 690-691). See also *Ley Electoral, Título I, Art. 3 (Gaceta de Madrid, no. 180, p. 901. 1890)*.



**Figure 1.** Provincial average of municipal education expenditure per capita in 1880 (Pesetas<sub>1913</sub>).<sup>28</sup>  
 Source: Estadística General de Primera Enseñanza correspondiente al decenio que terminó en 31 de diciembre de 1880. Dirección General de Instrucción Pública (1883), p. 144. Note: The amount spent by the capital of each province is subtracted from the average, as our analysis does not include Bilbao.

after its implementation, there was a considerably uneven application of this law. It is apparent that there were significant geographical differences, with a clearly higher expenditure per capita in the northern inland part of the Peninsula.<sup>29</sup> These regional differences are partly attributable to the local characteristics that shaped the municipal revenues and expenditures.

Among the provinces with higher levels of municipal spending depicted in Figure 1, Biscay stands out for two reasons. First, the centralisation process initiated in 1902 was not implemented in Biscay until 1912.<sup>30</sup> Because decentralisation took longer in Biscay than in other Spanish provinces, the local factors shaping the local provision of primary education in Biscay took effect more slowly. Second, during the 19<sup>th</sup> and early 20<sup>th</sup> centuries, Biscay underwent large-scale industrialisation processes, partly due to the province’s iron ore reserves (Nadal 1982, pp. 176-187; González Portilla 1985).<sup>31</sup> Therefore, following the literature which studies industrialisation in Spain and Biscay, the mining

<sup>28</sup> The figures in pesetas (the Spanish currency during the period under study) presented in the rest of the paper are deflated to the value of 1913 pesetas to control for the variation of prices, and to make these figures comparable across years (Maluquer de Motes 2013). Moreover, in 1913, the exchange rate of pesetas to sterling pounds was 27.1 pesetas/£ (Martínez Méndez 1990, p. 13).

<sup>29</sup> Some authors have argued that these regional expenditure differences led to significant geographical differences in schooling or literacy (see, for instance, Nuñez 1992, pp. 250-287).

<sup>30</sup> The Royal Decree of 1901, Article 10<sup>th</sup>, stated that Biscay, Gipuzkoa, Alava and Navarra were excluded from the application of this law (Ferrer and Rivero 1915, pp. 205-206). The centralisation in the four provinces was implemented by the Law of 30 December 1912 (Ferrer and Rivero 1915, p. 206).

<sup>31</sup> For the role of natural resources in the Spanish industrialisation process, see also Martínez-Galarraga (2012).

and metallurgical sectors played the transformative role that made the industrialisation and modernisation of the province possible. Thus, this paper attempts to address this transformative role, stressed by the literature, in the public sector and more precisely in education. This analysis will shed some light on how mines and steelworks, as drivers of industrialisation, were able to shape the local administration in other mining provinces such as Asturias and Cantabria in the north, or Huelva, Jaen and Murcia in the south. Moreover, the case of Biscay will enhance our understanding of the role of industrialisation in the higher expenditure seen in the northern region.

In order to analyse the evolution of the effects of the mining and metallurgy sector on primary education provision, this paper relies on information about municipal budgets and the mining and industrial sectors from 1860 to 1910. The data on municipal budgets are obtained from the annual accounts of 117 municipalities in Biscay.<sup>32</sup> The information for the metallurgy and mining variables comes from the *Boletín Oficial de la Provincia de Vizcaya* (1877-1910) and the Mining Statistics from 1862 to 1910. Appendix Table A.1 shows the descriptive statistics for the different variables described in this section, showing the observations for the 5 census years for the 117 municipalities. Panel B represents the mining and industrial towns, with an observation of each municipality in each year in which a mine or steel mill was operating.

### 3.1. Municipal annual accounts 1860-1910

Following the enactment of the local administrations Law of 1856, Spanish municipalities had to produce an annual account that differed from the budget, as it recorded the municipality's real annual revenues and payments instead of its planned income and expenditures.<sup>33</sup> These annual accounts were produced by the municipalities and approved by the regional government in Biscay. Therefore, the documents used in this paper are more accurate than municipal budgets, as the annual accounts represent the resources that the municipalities actually collected and spent. The two items I collected from these annual accounts are education expenditure and income. Due to the number of documents generated, I have selected the annual accounts for the population census years (1860, 1877, 1887, 1900 and 1910) for the 117 Biscay municipalities (see Appendix Figure A.1 for an illustration of the source). Similarly, to allow for comparability across municipalities, the data are computed per capita.<sup>34</sup>

#### 3.1.1. Incomes: indirect taxes

Spanish municipalities received no direct benefits from mining and industrial royalties or taxes, as mining production in Spain could only be taxed by the state.<sup>35</sup> Moreover, the municipalities in Biscay could not tax the production of steel mills, as the industrial tax (*Contribución de industria y comercio*) was not applied in this province due to its special taxation system.<sup>36</sup> Therefore, the mining and metallurgy towns in Biscay lacked the fiscal

<sup>32</sup> Although there were 123 municipalities during this period, Bilbao and Abando were excluded from the sample as Abando was absorbed by Bilbao in 1890, and it was not possible to access the budgets of Bilbao. The data for Fica were lost; and Nachitua, Luno and Alonsotegui were included in Ea, Guernica and Baracaldo, respectively, due to a process of assimilation during the period under study.

<sup>33</sup> Orduña Rebollo and Cosculluela Montaner (2008, p. 742).

<sup>34</sup> Although some authors have used the percentage over total revenues or expenses, this approach could conceal important information. As noted above, municipalities had to provide a plethora of services during the period under study. Thus, using the percentage would not reflect the reality, as a loan, new construction or other one-off incomes or expenditures would distort the shares of other expenses or incomes.

<sup>35</sup> Mining Law of 1868, Article 85<sup>th</sup>.

<sup>36</sup> See Alonso Olea (1995) for a detailed explanation of this taxation system in the Basque Country.



tools necessary to secure direct revenues from these sectors. Although direct taxes were levied, the concealment of wealth and the unwillingness of local politicians to pursue fraud led to the widespread use of indirect taxes as the main sources of local income.<sup>37</sup> For instance, as Appendix Table A.2 shows, the main income sources for the municipalities in Biscay were indirect taxes, accounting for around 90 per cent of their total income.<sup>38</sup> Therefore, other income sources are not included in the analysis, due to their negligible role in town's annual accounts.<sup>39</sup>

Thus, in order to account for the effect that mines and steel mills may have had on towns' budgets, I have collected information on indirect taxes. To calculate this amount for each town and period, I use the information from item 3.º *Impuestos* in *Cuenta del Presupuesto de Ingresos* in the annual accounts. This item included all of the taxes each municipality collected, with the most important one being the consumption tax. Therefore, this variable reflects the municipality's ability to tax the consumption of its inhabitants, and the potential impact that industrialisation had on the town.

The main product that was taxed during this period—and therefore the main source of indirect taxes—was alcohol. Appendix Figure A.3 shows the percentage of the 5-year moving average of the revenues from alcohol taxes over total incomes in four different Biscay towns from 1889 to 1921.<sup>40</sup> Before 1900, the four municipalities collected most of their revenues from alcohol taxes, which limited towns' tax capacity, as most food transactions were not taxed. Additionally, because of the lack of civil servants, the Biscay town councils estimated the amount of tax that would be collected in a year, and they auctioned the right to collect that amount to private individuals. For instance, in June 1890 in Abanto, a mining town, the right to collect indirect taxes was sold for 157,712.<sup>41</sup> Regardless of the real consumption during that year in Abanto, the municipality's income in indirect taxes for that year was limited to the auctioned amount (157,712 pesetas), which represented 96 per cent of the town's income that year.<sup>42</sup> Thus, this system greatly constrained the municipality's ability to increase its income, as the real consumption in the town did not matter, because the amount was determined in advance, thereby limiting the town's revenues, and, in turn, its spending capacity.

Despite these tax features, as shown in Figure 2, where indirect taxes/pc are represented for the whole period, there was a clear increase in the revenue of the towns. Following Appendix Figure A.3, the evolution depicted in Figure 2 shows that the diversification of the taxed products enhanced incomes/pc, especially in 1900 and 1910. Moreover, this transition was faster outside the rural towns in the interior areas. Between 1887 and 1900 some of these towns still had revenues below 2.5 pesetas<sub>1913</sub>/pc, similar to 1860. However, mining and industrial towns to the west and northwest of Bilbao, having similar income levels to rural towns in 1860, started to present incomes above 10 pesetas<sub>1913</sub>/pc as early as 1877. Furthermore, this significant increase in municipal revenues expanded their bureaucracy, which, in turn, improved their taxation

<sup>37</sup> For instance, some Biscay municipalities used the *repartimiento vecinal*, a quota distributed among the town's inhabitants based on the municipality's wealth cadastre. However, as Pro Ruiz (2007, pp. 536-541) noted, as the local elites entered into the formation of this wealth cadastre, the wealthier potential taxpayers were largely able to evade these direct taxes.

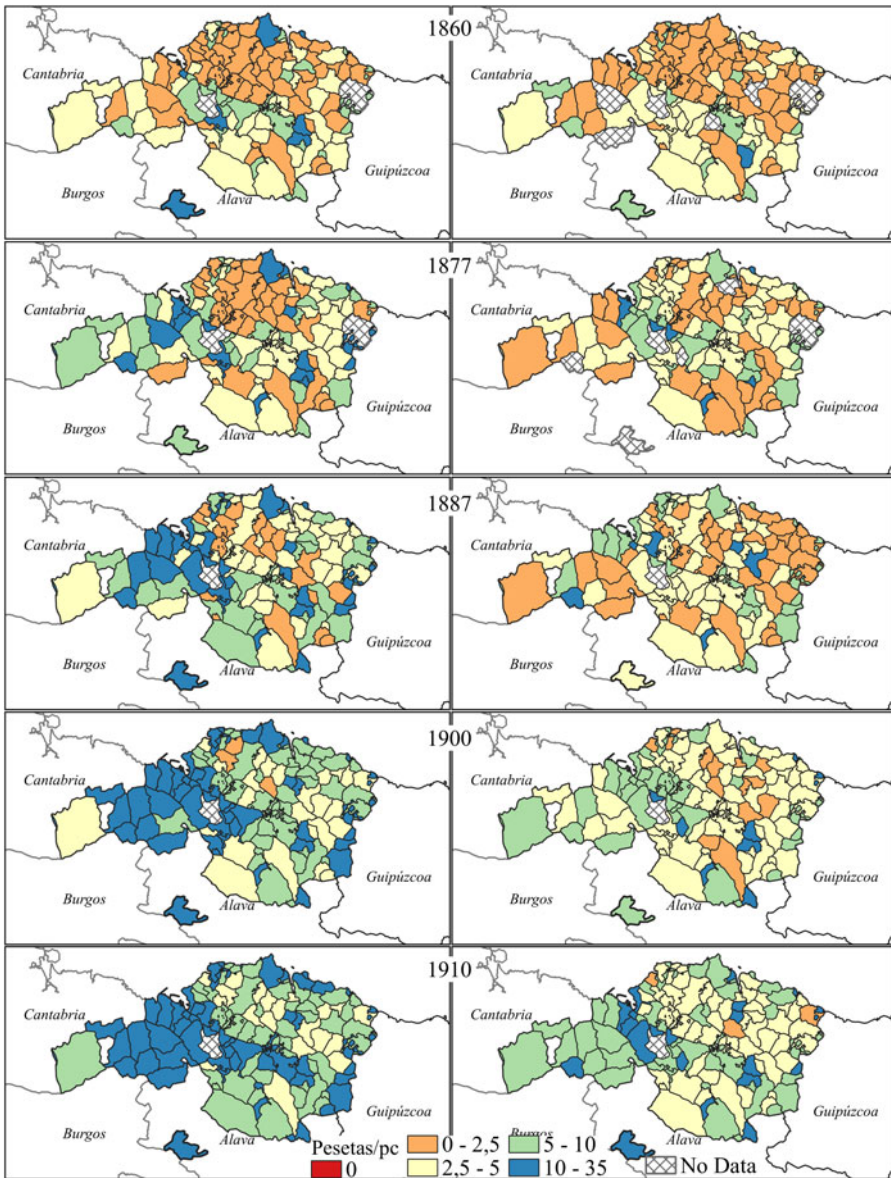
<sup>38</sup> Besides rents from towns' properties, revenues also came from other sources, such as tuition fees or payments to the local hospital, clinic or jail. However, these amounts were negligible and are not, therefore, used in the analysis.

<sup>39</sup> The analysis in the next section was carried out including rents on communal properties, however, there was no effect in any of the regressions, and therefore section 4 will present models without this variable.

<sup>40</sup> The four towns are: Baracaldo (industrial), Abanto (mining), Ceberio (rural) and Bermeo (maritime).

<sup>41</sup> Archivo Foral de Bizkaia, Archivos Municipales, Abanto y Ciervana 0102/001.

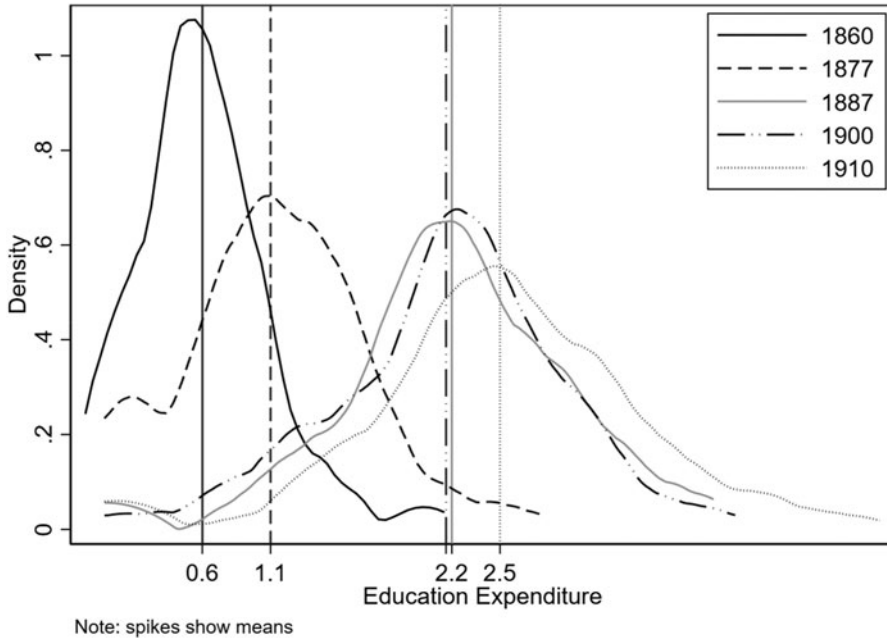
<sup>42</sup> Archivo Foral de Bizkaia, Archivos Municipales, Abanto y Ciervana 0102/006.



**Figure 2.** Municipalities' indirect taxes (left) and expenditure (right) in pesetas<sub>1913</sub>/pc.

capacity, once again reinforcing the local administration capacity and so on. Thus, this virtuous circle, fostered by an increasing variety in the amount of products purchased explains this increase in indirect taxes/pc observed throughout the period.

In conclusion, indirect taxes per capita enable us to see how mines and steel mills affected local revenues throughout the period of administrative and bureaucratic expansion. Moreover, the relationship with expenditure shows how revenues were translated into public services investments, disentangling an indirect effect of industrialisation on local spending. Nevertheless, during the period under study, the incomes of the Biscay municipalities relied on both mono-product taxation and the selling of taxation rights.



**Figure 3.** Kernel density of municipalities' education exp. pesetas<sub>1913</sub>/pc.

The former limited the taxation base and could have led to a failure to take into account the more diverse consumption patterns in industrial, mining or more populated towns. The latter severed the link between real consumption and the income received. However, the evolution seen in Figure 3 may indicate that these two restrictions became less important throughout the period under study.

### 3.1.2. Expenditure

For the expenditure of Biscay municipalities, the items related to town council expenditures, police and security, parks and public spaces, poverty relief, health facilities and infrastructure upkeep have been selected.<sup>43</sup> Education expenditures are analysed separately, and, therefore, are not included in the expenditure calculated here. Moreover, the purpose of this variable is to measure the provision of public goods and, therefore, debts and new constructions are not included; neither are refunds and exceptional items. In the case of new constructions, although this reflects the willingness of the town council to invest in new public facilities, the introduction of this item would distort the results. Although new constructions could be present in the annual accounts for more than one year, it was an infrequent expenditure which, when looking at only 5 years, would not reflect the real investment in new constructions. However, infrastructure upkeep could control for this increasing spending after a new construction.<sup>44</sup>

Figure 2 shows the expenditure/pc without education. It reveals a positive evolution, although when comparing 1860 and 1910, it is less intensive than for revenues.

<sup>43</sup> The items from the annual accounts in Spanish are: 1° Gastos del Ayuntamiento; 2° Policía de Seguridad; 3° Policía urbana y rural; 5° Beneficencia; 6° Obras públicas; 7° Corrección Pública; and 8° Montes.

<sup>44</sup> For instance, in 1910, in Bermeo, a northern coastal town, after one decade of building new facilities such as public water supply systems, its infrastructure upkeep doubled from 2510.5 pesetas<sub>1913</sub> in 1900 to 5136.4 pesetas<sub>1913</sub> in that 1910 (Archivo Foral de Bizkaia, Archivo Administrativo, R-01895/005 and R-01897/003).

Nevertheless, the expenditure/pc more than doubled during this period, increasing from 3.1 pesetas<sub>1913</sub> in 1860 to 6.7 in 1910. In comparison with revenues, expenditures/pc exhibited a similar geographical pattern. Rural towns in the northern inland area had a lower level of spending, which was surpassed by the mining and industrial towns around Bilbao between 1887 and 1900.

Therefore, this variable seeks to determine how municipal expenditure was influenced by mines and steel mills and whether there was a different pattern in comparison with education spending. In this regard, town councils may have prioritised the investment in urgent facilities such as sewer systems or more police. For instance, although education could have played a role in the control and moral formation of future workers, increasing the number of police officers might have been an easier and faster way to deal with social unrest.

### 3.1.3. Education expenditure

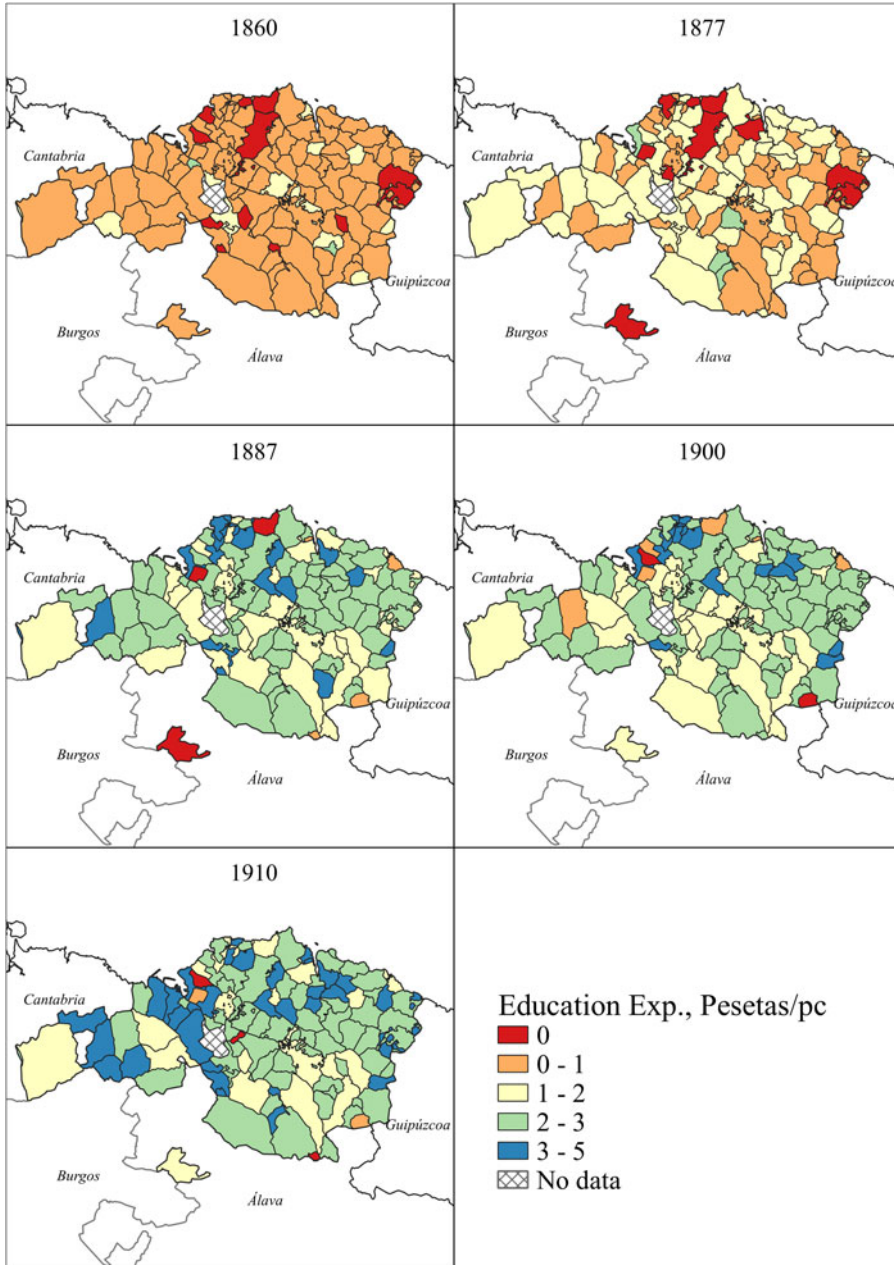
The educational expenditure of Spanish municipalities was framed within the Education Law of 1857. The law established that all Spanish municipalities had to provide public primary schools, indicating their number according to the population. The first threshold was for those towns with fewer than 500 inhabitants which had to maintain at least two schools, one for girls and another for boys, as education was mandatory for both sexes between 6 and 9 years old. Municipalities with between 500 and 2,000 inhabitants had to fund four schools at a cost of 625 pesetas a year per teacher. Moreover, for every 2,000 inhabitants above this threshold, the town councils had to provide two extra schools, increasing the salary to 825 pesetas a year.<sup>45</sup> Thus, educational expenditure was subject to the legal requirements of the law and the willingness and resources of town councils to comply with it.

Therefore, to measure public educational spending, I use the total expenditures in item 4.° *Instrucción Pública* in *Cuenta del Presupuesto de Gastos* in the annual accounts. This item includes information on teachers' wages and salary supplements, expenditures on education materials and the rent and upkeep of schools, rewards for students and grants and subsidies. To ensure that I am only counting direct public expenditures, income from tuition fees, rents and other education-related revenues listed in item 5.° *Instrucción Pública* in *Cuenta del Presupuesto de Ingresos* have been subtracted from the total education expenditure figures.<sup>46</sup>

Figure 3 represents the distribution of annual per capita education expenditures in pesetas<sub>1913</sub>, and Figure 4 shows five maps with the education spending by municipality and year. As can be seen, there is a clear positive evolution through the period under study. The municipalities increased their education expenses most significantly from 1860 to 1887. In each of these years (1860, 1877 and 1887), the average per capita education expenditure doubled, from 0.6 to 1.1, and, finally, to 2.2 pesetas<sub>1913</sub>/pc. Although the maps show that in 1887, there were still towns that had no expenditures, the education supply increased substantially during these first three decades. However, in the following decades (from 1887 to 1910), this growth stagnated. The average expenditure in 1900 was almost the same as in the previous census year (2.17 in 1900 and 2.21 in 1887). Similarly, in 1910, the average expenditure had increased only slightly, to 2.5 pesetas<sub>1913</sub>/pc.

<sup>45</sup> Ferrer and Rivero (1915, pp. 135-136).

<sup>46</sup> The construction of new schools is not included, as this spending was classified in 6.° *Obras Públicas* and 10.° *Obras de nueva construcción*. In these two items, schools were classified under the sub-item civil construction, but the purpose of the amount was not specified. Thus, the expenditure in this sub-item could refer to a new school, but also a new town hall or a new town square. However, the effects of the construction of a new school were reflected in the expenditure of subsequent years. Therefore, the omission of the data from the construction of schools should not be a problem.



**Figure 4.** Municipalities' public education expenditure (Pesetas<sub>1913</sub>/pc).

Thus, after the implementation of the Education Law of 1857, education supply in the municipalities gradually increased until 1887. Nevertheless, from this year onwards, the expenditure levels did not increase significantly. The results shown in Figure 3 suggest that from 1857 to the early 1880s, town councils started to build schools and hire teachers based on their populations, as the Education Law established. The overall evolution of education expenditure levels through the period indicates that a threshold was reached

between 1877 and 1887, most likely when the requirements established by the Education Law of 1857 had been met.

Thus, once the legal requirements were reached, other factors, such as the demands of the population or the willingness to invest in education by the members of the town council, led to further increases in education expenditure. Although these factors were also present in the previous decades, they were probably more important in the early years of the 20<sup>th</sup> century, which would explain the slight overall increase in education spending in 1910.

### 3.2. Mining statistics

To obtain the mining and industrial data used in the analysis, I collected information from two data sources that reported the production of mines and steel mills during the period under study. The first source is the *Boletín Oficial de la Provincia de Vizcaya*, an official bulletin that published information on state and regional laws, government calls and financial information.<sup>47</sup> Every 4 months from 1877 to 1911, the bulletin reported information on each mine, including its location, register number, name, owner and lessee, minerals, tonnes extracted, the price of the minerals and the royalties applied and paid by each active mining concession. Therefore, all the mining concessions in the same town are then merged to obtain the mining production for each municipality. The ores are classified as iron and other minerals (mostly lead, coal and zinc).<sup>48</sup>

To complement the information from the *Boletín*, I used the information provided by mining engineers in the yearly Mining Statistics reports. As these statistics contain detailed information about the mining and metallurgical industries of each Spanish province since 1862, information about mining production for 1860 was gathered from statistics and descriptions in the annual reports of 1862 and 1863.<sup>49</sup> Similarly, information on the metallurgy production was also collected from this data source, as in each province description there was a detailed account of the wrought iron, cast iron and steel produced during the period by each Biscay steel mill. Nevertheless, only steelworks with blast furnaces, and with Bessemer converters and Siemens-Martin open-hearth furnaces during the 1880s and 1890s are included, as the aim is to take into account only forms of industrialisation that used cutting-edge technologies.<sup>50</sup>

Therefore, with the information from the *Boletín* and the mining statistics, I compute the production per capita between 1860 and 1910. This production reflects the importance of mineral and metal activities in each municipality, and thus indicates the level of mining and industrial development in the town.<sup>51</sup> Moreover, by separating the mining and metallurgical sectors, I will be able to see whether the predominance of labour-intensive or capital-intensive patterns in each sector had different effects on education expenditure.

<sup>47</sup> See Appendix Figure A.4 for an illustration of the source.

<sup>48</sup> This classification is due to the overwhelming importance of iron mining in Biscay in this period. In 1877, 1,233,661 tonnes of iron ore were mined, accounting for 99.9 per cent of the production, while only 68.5 tonnes of other minerals were extracted. However, by 1910 the production of other minerals had risen to 749.5 tonnes. Despite this surge in the production of other minerals, due to the extraction of 3,760,838.1 tonnes of iron ore in that year, the ferrous mineral still accounted for 99.9 per cent of the ore extracted in the province in 1910.

<sup>49</sup> *Estadística Minera correspondiente al año de 1862* (1864, pp. 11–13), and *Estadística Minera correspondiente al año de 1863* (1865, pp. 39–41 and 43–46).

<sup>50</sup> In earlier years (1860 and 1877), it also reported the production in some minor and traditional foundries and ironworks. However, from 1880 onwards, this production was no longer reported, and even in previous years, it represented a minor share of the total metallurgical production.

<sup>51</sup> Instead of using total population, only males are selected as only males were employed in mining or metallurgy in Biscay (Pérez de Perceval Verde *et al.* 2020).

Moreover, in order to control for the role of foreign companies, I use the information about the owners and lessees of each mining concession from the *Boletín*. I create a dummy variable that takes a value of one when foreign companies were involved in the local mining sector, either as owners or lessees. Given the number of mining concessions, and the fact that in some cases the name of the lessee or the owner was not clear, I have decided not to use the percentage of foreign mining production over the total production, as these figures could not be calculated with certainty for all towns and years. Therefore, I have chosen to use a conservative measurement of the presence of foreign firms, even though it might not be a perfect proxy. Consequently, this variable controls for the potential effects of the export-oriented production and its implications for local conditions and finances, accounting also for the influence of foreign companies on local politics.

Figure 5 illustrates the spatial distribution of the mining and metallurgy municipalities in Biscay throughout the period.<sup>52</sup> It shows that the main form of mineral production in Biscay during this period was iron ore, which was mined on a large scale starting in the late 1870s and early 1880s. Moreover, the mines were heavily concentrated in the mid-western parts of the province. As Figure 5 also shows, the minerals extracted in the province other than iron ore were of minor importance, with these mines being more geographically scattered. Furthermore, the production levels of these minerals were less constant over the period, as they were smaller in scale, and therefore were more exposed to changes in international markets or the regional job market.

Even though the steel mills located around the iron mines prospered, as Figure 5 indicates, this geographical advantage did not translate into similar levels of production to the iron mines. This was because the iron-mining sector was export-oriented, as around 80–90 per cent of the iron extracted was exported, and only a small fraction of the minerals was consumed by the Biscay steelworks.<sup>53</sup> This export orientation had a direct impact on the metallurgical development in the province, as 9.1 per cent of the potential steel production in the province was produced by the early 20<sup>th</sup> century.<sup>54</sup>

This focus on the export market was probably due to the significant presence of foreign companies in the mining towns. Out of the 27 municipalities that had an active mine at some point between 1860 and 1910, foreign mining companies were involved as either owners or renters of mining concessions in almost half of them (13). Additionally, in the most productive towns, such as Abanto, San Salvador or Santurce, foreign companies represented the lion's share of the mining production.<sup>55</sup> These foreign companies were subsidiaries of European firms active in the metallurgical sector, which shaped the Biscay mining sector as most of the iron ore they extracted had to be shipped to their parent companies in Europe.<sup>56</sup> Consequently, this export focus directly affected the

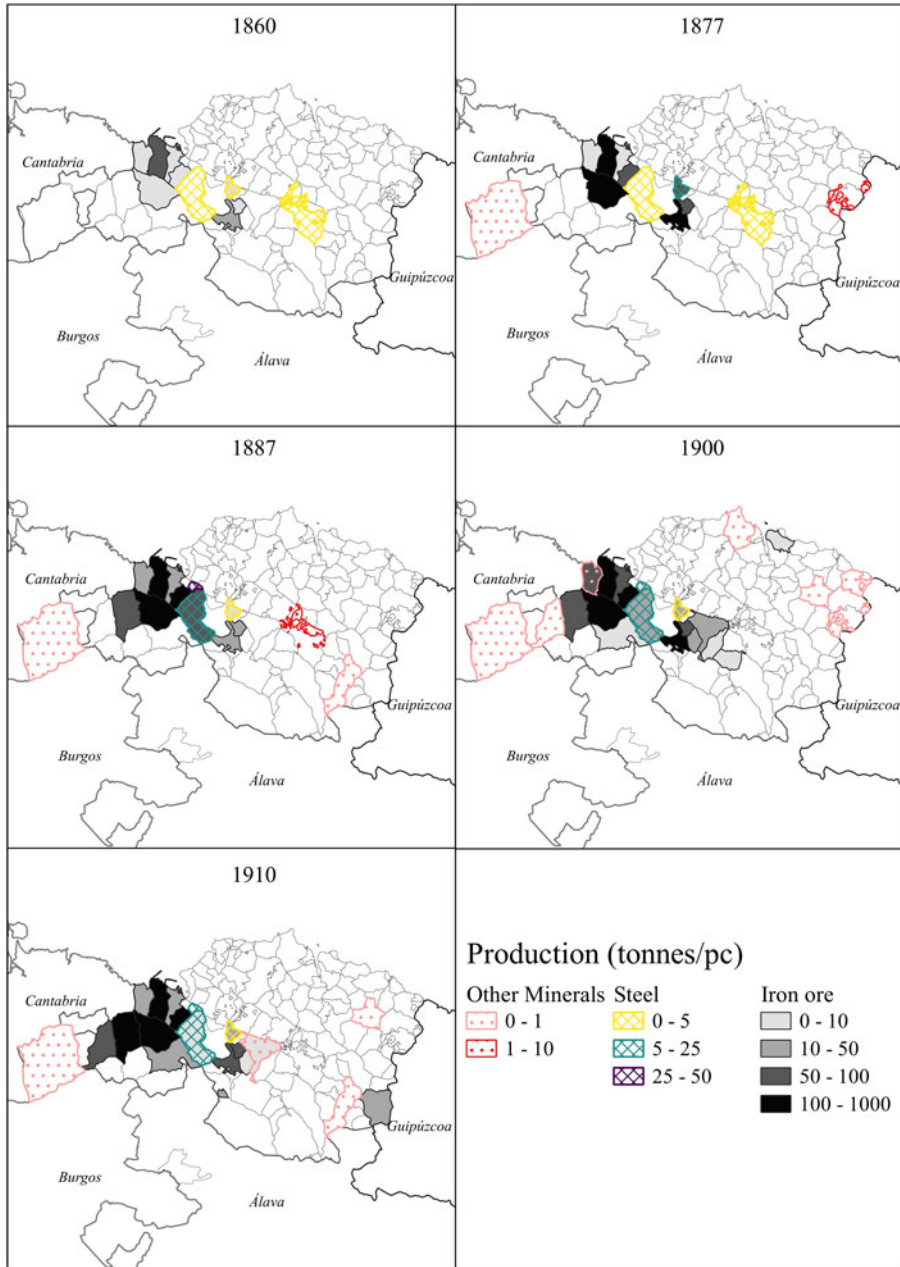
<sup>52</sup> Appendix Figure A.5 provides the names and geographical location of the 27 mining and metallurgy towns during the period under study.

<sup>53</sup> Although the provincial figures for iron exports were not included in the official Mining Statistics, the share of Spanish iron ore that was exported between 1880 and 1920 was more than 90 per cent. This figure would likely be similar in Biscay, as around 80 per cent of the iron ore extracted in Spain came from Biscay, where an average of four million tonnes per year were produced (Escudero Gutierrez 2006).

<sup>54</sup> In 1897, the *Altos Hornos de Bilbao* steel mill in Baracaldo produced one tonne of steel with 2055.1 kg of iron ore, which gives a total of 2,556,805 tonnes of steel with the 5,254,492 tonnes of iron ore extracted that year (González Portilla 1985, p. 120). However, just 232,898 tonnes of steel, or 9.1 per cent of the potential production, were produced (Mining Statistics of 1897, pp. 41 and 54–55).

<sup>55</sup> For instance, out of the 15 mining concessions that were operating in 1900 in San Salvador, five were leased by three foreign companies, who together represented 55.2 per cent of the iron ore extraction capacity in the municipality.

<sup>56</sup> Escudero Gutierrez (1998).



**Figure 5.** Mining and metallurgical tonnes/pc.

development of the metallurgical and industrial sectors in Biscay, which, as described above, in turn affected the demand for skilled labour, and potentially the human capital formation of the province.

Furthermore, the foreign and national mining companies influenced local politics considerably. For instance, using the mining information in the *Boletín* and the annual accounts for the mining town of Abanto, I found that all six individuals who served as



mayor in the municipality between 1886 and 1905 were owners or renters of mines, either in Abanto or in another Biscay mining town.<sup>57</sup> Moreover, in 1914, a coalition of republicans and socialists won the local elections in Abanto, and formed the local government to defend the municipality's interest against the two major foreign mining companies in the province.<sup>58</sup> Although they did not succeed, these foreign firms sent two of Abanto's town councillors to Madrid to ask some members of the parliament about the possibility of declaring Abanto's town council illegal and dismissing the new mayor.<sup>59</sup>

In conclusion, I expect to find that the effects on income and expenditure of mining and metal production were positive. Income would be influenced by the increasing number of wage-earning workers from mines and industries. The reduction in auto-consumption, which would have been more prevalent in rural towns, would increase the number of market transactions that could be taxed by the town council. Therefore, either because of the increasing number of workers or the increasing variety of products purchased, mines and steel mills are expected to have had a positive effect on indirect taxes. Nevertheless, foreign mining companies might have had a negative impact on municipal revenues, as their control over the town council might have prevented the establishment of certain taxes.

In the case of expenditure and educational spending, the effect of mines and steelworks was not so clear. An increasing population would demand more public goods such as sewer systems, schools, or paved roads, and therefore, a positive effect from mines and metallurgy would be expected. Moreover, the potential demand for more technical jobs from mines and steelworks could have fostered investment in education by town councils. Nevertheless, the presence of foreign mining companies could imply a diversion of resources, either from educational or other expenditure. Additionally, an export-oriented mining model might reduce the number of skilled workers, and therefore the demand from the population and firms for education. Finally, education and other expenditure may have been in conflict, as town councils could have faced dilemmas in allocating scarce resources. Thus, urgent expenditures and those that produced faster outcomes than education might have been prioritised over educational spending, revealing a positive effect of mines and steel mills on expenditures other than education.

### 3.3. Control variables

#### 3.3.1 Educational institutions<sup>60</sup>

The first educational institutions variable created is the number of private foundations that were established in each town by private individuals, measuring the general attitudes towards mass education of the past and the contemporaneous elite. The second variable is the number of public and private schools that existed in addition to those that were publicly provided by the town, such as technical schools. This variable attempts to account for the demand from population to be educated, and the pressure that post-primary schools might have exerted on public education expenditure. Finally, the last education measure

<sup>57</sup> Information from *Boletín Oficial de la Provincia de Vizcaya*, years from 1881 to 1906 and *Archivo Foral de Bizkaia, Archivos Municipales, Abanto y Ciervana*, 100/004, 100/007, 102/002, 102/004, 102/001, 102/006, 103/001, 103/002, 103/003, 103/004, 104/001, 104/002, 104/003, 283/002, 283/001, 283/003, 283/004, 284/001, 556/001 and 556/003.

<sup>58</sup> A national newspaper in its Biscay edition as a «formation of a group to defend the interests of the municipality against the French-Belgian Company, the Orconera Iron Ore Company Limited and others, that have enjoyed the tolerance and consent of their representative in the town council» (*El Liberal*, Gallarta, Wednesday 21<sup>st</sup> January 1914, p. 3).

<sup>59</sup> *El Liberal, Peticiones de la Franco-Belga*, Thursday 22 January 1914, p. 3. The mayor remained in office until 1916 (*Archivo Foral de Bizkaia, Archivos Municipales, Abanto y Ciervana* 409/004).

<sup>60</sup> A detailed account of the sources of these variables is included in the Appendix Table A.3.

is the percentage of public expenditure that was funded privately. This variable is calculated with the information from the annual accounts (item 5.° *Instrucción Pública* in *Cuenta del Presupuesto de Ingresos*) on the total income from tuition fees that the municipalities collected. Therefore, this variable controls for the commitment of parents to fund education, and the town councils' willingness to publicly support education without resorting to education fees.

Appendix Figure A.6 shows the number of foundations and education institutions that existed through the second half of the 19<sup>th</sup> and early 20<sup>th</sup> centuries. During this period, elites were heavily involved in the education of the population in several municipalities, as education foundations were widespread across the region, although since the 1900s, they were clustered in the north and west of the province. When Figures 5 and A.6 are compared, we can see that this increase in the number of education foundations happened primarily around the industrial areas of the province. It is likely that the Biscay elites became more involved in and concerned about the moral education and discipline of mining and industrial workers when socialist ideas started to take hold.<sup>61</sup> Moreover, Figure A.6 shows that between 1860 and 1887, other educational institutions were only present along the coast and in three inland villages. However, during the 1890s and 1900s, private primary, technical, art, music or nautical schools, and especially *Escuelas de Artes y Oficios*, were opened in several towns. This tide in the creation of educational institutions might have been a response to the considerable population growth experienced by some Biscay towns, and the incapacity of town councils to increase education provision at the same rate as the population grew.<sup>62</sup>

### 3.3.2. Demographic variables

Two variables have been created from the population censuses of 1860, 1877, 1887, 1900 and 1910 and account for the demographic characteristics of the municipalities.<sup>63</sup> The first is four different population thresholds following what the Education Law of 1857 established for the number of schools and the teachers' wages explained above: below 500 inhabitants, from 500 to 2,000, between 2,000 and 10,000 and above 10,000. Thus, besides capturing the potential effects on education of population or agglomeration dynamics, this variable accounts for the potential bias in the municipality's education expenditure due to its population. Moreover, these thresholds are included in the models for incomes and other expenditures in order to be able to compare the results. As income and expenditure are measured per capita, the effect of this threshold might be negative, as smaller towns would have had higher per capita levels.<sup>64</sup> However, as agglomeration dynamics may have positively affected other expenditure and education, a positive effect might also have occurred in more populated municipalities.

The other variable created from the population censuses is the population compound annual growth rate (CAGR), which computes the rate with the census population in year T, in relation to census population in year T-1.<sup>65</sup> This variable accounts for the effect that

<sup>61</sup> Dávila Balsera (1997, pp. 37-41).

<sup>62</sup> See for instance, Pérez-Fuentes Hernández (2004, pp. 119-120).

<sup>63</sup> Although there is information about migration in the censuses, the approaches to recording migration differed between them. For instance, whether people were born in another province was not recorded in 1860, it was recorded in 1887, and it was not recorded again in 1900. Thus, it is not possible to properly measure migration, and population growth is used as an alternative, which could account for migration and natural population growth.

<sup>64</sup> For instance, for education expenditure, according to the law, a municipality with 500 inhabitants had to have an expenditure of 2.5 pesetas per capita, whereas in a town with a population of 2,000 the expenditure required by the law was 1.65 pesetas/pc

<sup>65</sup> 
$$\left( \left( \frac{\text{Population year } \tau}{\text{Population year } \tau-1} \right)^{1/(\text{year } \tau - \text{year } \tau-1)} - 1 \right) \times 100$$

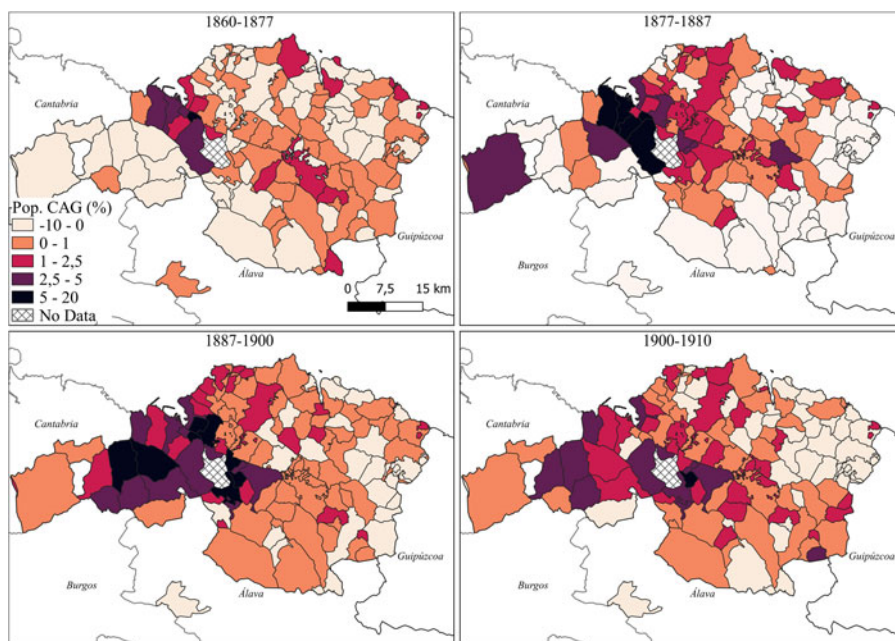


Figure 6. Population compound annual growth.

increases in population might have had on revenues and expenditures. Figure 6 depicts the CAGR for the four different periods. When comparing this figure with Figure 5, it can be seen that population in mining towns exploded between 1877 and 1900, with annual growth rates above 5 per cent. This important population growth in mining and industrial towns is confirmed in Appendix Table A.1, as the CAGR in these towns more than doubled the average for the whole province. Similar to the effect of population thresholds, population growth is expected to be negatively related to expenditure. Unexpected short-term growth could lead to a lagged increase in expenditure as hiring new teachers or the construction of new sewer systems could take longer than the sudden increases in population. However, population growth might have had a positive effect on revenues, as it would have increased the number of transactions and consumption, and henceforth indirect taxes.

#### 4. Methodology and results

The effect of the mining and metallurgy industries on revenues and spending is estimated using the following specification:

$$\begin{aligned}
 Inc.&Exp_{.it} = \alpha_{it} + \beta_E Inc.&Exp_{.it-1} + \beta_1 Mining \& Metallurgy_{it-1} \\
 &+ \beta_X X_{it} + \delta_{PoP} Thresholds + \delta_{CT} Country \times Year_i + \delta_Y Year + m_i + \epsilon_{it}
 \end{aligned}
 \tag{1}$$

where the  $Inc.&Exp_{.it}$  is the indirect taxes, expenditure and educational expenditure of each municipality  $i$  in year  $t$ . The influence of the mining and metallurgical variables (production per capita and presence of foreign firms) is captured in  $Mining \& Metallurgy$ . Moreover, given that revenues and allocating funds take time, these variables are introduced with one period lag in order to explore whether these mining and industrial

resources eventually translate into incomes and expenditures. Therefore, the model is limited to the period between 1877 and 1910. Additionally, the dependent variable is introduced with a year lag to control for previous trends in incomes and spending. While the baseline specification only uses the lagged education expenditure and *Mining & Metallurgy* as explanatory variables, additional specifications include the demographic variables as controls. Moreover,  $X_{it}$  includes the indirect taxes/pc for other expenditure and educational spending to see how revenues affected the town's spending and whether *Mining & Metallurgy* were acting through revenues. For educational expenditure the educational control variables are also included in  $X_{it}$ . Moreover, year fixed effects and county-time specific effects are also included. The former addresses the potential time trends that could appear in the model. The latter ( $County \times Year$ ) refers to the specific time events that could occur in the five regional administrative divisions or *partidos judiciales* of Biscay. Similarly,  $m_i$  refers to the municipality fixed effects included in the specification. Therefore, the variation explored here represents the effect within the municipality over time. Finally, the error term is clustered at the *partido judicial* level.

#### 4.1. Income

Table 1 presents the results of equation (1) for indirect taxes per capita. While the year and county-year dummies are introduced as controls in columns (3) and (4), from column (2) to (4) demography and income controls are included, with the introduction of the lagged dependent variable in the last column. The results show that the iron mines positively impacted towns' incomes. However, the mines of other minerals and foreign mining companies, despite having a positive and negative impact respectively, do not present statistically significant results. Column (5) shows that if the production of an iron-mining town rose by one standard deviation (46.2 iron tons/pc), the indirect taxes in the next decade would increase by 12 per cent above the average.

This growth in municipal income derived from iron mines occurred even when population growth or population levels are included. This might rule out the increasing taxes effect through more miners or population, indicating a more complex relationship between mines and municipal revenues. Although the Biscay municipalities relied heavily on alcohol taxes and the amount received was fixed annually, mining towns were able to take advantage of the consumption variety of wage-earning miners. For instance, in 1910, at the end of the period, and as explained in section 3.1.1, the taxation structure of San Salvador's indirect taxes, one of the most important mining towns in the sample, was significantly complex. Although wine, vermouth, beer or cider were still the products with the highest tax rates, lemonade, olive oil, petroleum, meat, candles or soap started to be incorporated into the list of taxed goods.<sup>66</sup> Therefore, landless miners had to purchase all of these products, increasing the transactions and enhancing the way in which town councils were able to increase the number and rate of goods that could be taxed. This complexity could also be seen in the early 1920s, although this year is not included in the analysis presented here. In Abanto, in 1923, the town council taxed the opening of taverns, bars, grocery stores or barbershops and the ownership of cinemas and the organisation of plays in theatres.<sup>67</sup>

Contrary to the iron mines, steelworks had a significant negative effect on towns' revenues. Nevertheless, the impact was only a decrease of 3.3 per cent in incomes when there was an increase in one standard deviation in steel production (2.6 tons/pc). This result is the opposite of what could be expected, as metallurgy towns should have displayed a

<sup>66</sup> Archivo Foral de Bizkaia, Archivos Municipales, Valle de Trapaga-Trapagaran, 1193/005.

<sup>67</sup> Archivo Foral de Bizkaia, Archivos Administrativo, R-00605/03.

**Table 1.** Indirect taxes pesetas<sub>1913</sub>/pc

Variables	(1)	(2)	(3)	(4)	(5)
<b>Mining and metal lagged</b>					
Iron tons/pc	0.022*** (0.001)	0.022*** (0.004)	0.018* (0.007)	0.019** (0.006)	0.020** (0.006)
Other minerals tons/pc	0.483*** (0.018)	0.502*** (0.049)	0.144 (0.115)	0.193* (0.078)	0.252* (0.116)
Metal/pc	0.076** (0.017)	-0.131 (0.067)	-0.102*** (0.017)	-0.090*** (0.005)	-0.097*** (0.003)
Presence of foreign mining company (dummy)	2.181 (1.124)	0.897 (0.931)	-0.293 (0.524)	-0.208 (0.720)	-0.858* (0.359)
Indirect taxes lagged					0.118 (0.145)
<b>Demography</b>					
Reference var. threshold 1 (500 inhabitants)					
Threshold 2 (500-2,000)		6.331** (1.818)	3.944** (1.395)	3.589** (1.242)	3.503** (1.105)
Threshold 3 (2,000-10,000)		8.015* (3.400)	3.846 (2.178)	3.337 (1.739)	3.206* (1.471)
Threshold 4 (<10,000)		16.480*** (5.224)	8.464*** (2.368)	7.920*** (1.744)	7.911*** (1.523)
Population growth		0.173 (0.298)	0.015 (0.156)	-0.074 (0.137)	-0.078 (0.140)
Observations	465	465	465	465	462
Number of towns	117	117	117	117	117
Adjusted R <sup>2</sup>	0.059	0.159	0.498	0.527	0.533
Year FE	No	No	Yes	Yes	Yes
County-time FE	No	No	No	Yes	Yes

Robust standard errors in parentheses \*\*\*P < 0.01, \*\*P < 0.05, \*P < 0.1.

similar wage-earning workers consumption pattern as mining towns. However, metal production was concentrated in a few steelworks whereas there were more than 100 active mines in the period. Therefore, the owners of these steel mills could have had more economic and political power, controlling the industrial town councils and preventing higher indirect taxes.

In terms of population growth, the absence of an effect seems to indicate that the impact of iron mines generated a qualitative rather than a quantitative expansion of the population. As the town councils increased their bureaucratic power throughout the period, each year they were able to tax more efficiently. Moreover, the increasing

expansion of the market, either in industrial or rural towns, broadened the variety of products and transactions that could be taxed. Thus, both efficiency and the market economy effect could enhance the indirect taxes seen in [Figure 2](#), independently of quantitative increases in population growth.

#### 4.2. Expenditure

[Table 2](#) depicts the results for municipal expenditure without educational spending, emulating [Table 1](#), although column (6) adds indirect taxes/pc. Similar to the results for incomes, the only statistically significant mining and metal production variable is iron mines. However, in this case, the inclusion of towns' incomes shows an interesting result in comparison with column (5). While iron mines had the effect of increasing the towns' expenditure, when indirect taxes are included, the effect disappears. This indicates that the positive effect seen in municipal spending in columns (1) to (5) was through the positive effect of iron mines on incomes seen in [Table 1](#). For instance, an increase in iron ore production of one standard deviation (46.2 iron tons/pc) would increase indirect taxes by 0.9 pesetas<sub>1913</sub> ([Table 1](#) column (5)). This would be translated through the coefficient of indirect taxes in [Table 2](#), into a rise of 7.3 per cent above the average in the town's expenditure. This result indicates that as the wealth came from the iron mines through indirect taxes, the town councils spent part of these revenues on new sewer systems, police, paved roads or streetlights.

Despite this positive effect from the iron mines, the presence of foreign mining companies had a significant negative impact on expenditure, with a decrease in 12 per cent if there was a foreign firm in the previous decade. Similarly to the previous section, where we saw that there was no clear negative impact on incomes from these companies, this negative effect on expenditure seems to be derived from another source. For instance, as these firms may have played an important role in the town council, some expenditure could have been diverted to spending not included here. The representatives of the foreign mines or other mining elite could have been the holders of the municipality's debt; therefore, its payment together with the interest may have been a priority above other expenditure. Thus, the presence of these firms and their local political power could even counter the positive effect of iron mines, as a greater part of the expenditure than that increased by the positive effect of iron mines could have been diverted to other spending.

Regarding population growth, the coefficient is statistically insignificant, although negative. This independence between expenditure and population growth may indicate that during the decade between the two expenditure/pc measures, the municipality was able to meet the demands of the population growth rate in order to maintain the per capita level of spending. Another explanation could be that ideas or innovation, such as better sewer systems or electric streetlights were implemented independently of the demand for public goods due to population growth.

The results presented in this section show that municipal expenditure can largely be explained by the capacity of the towns to tax, as could be expected. Therefore, town councils invested these new revenues derived from industrialisation in public goods such as sewer systems to improve living standards, although police and other related expenditures may also have been increased to control the more complex societies created by industrialisation. Consequently, as seen in the previous section, industrialisation enhanced the fiscal capacity of towns, which helped to improve their bureaucracy. Therefore, these town councils had more capacity to address pressing matters such as social control or sanitation problems, expanding the quantity of public services provided, or at least their expenditure.

**Table 2.** Expenditure pesetas<sub>1913</sub>/pc

Variables	(1)	(2)	(3)	(4)	(5)	(6)
<b>Mining and metal lagged</b>						
Iron tons/pc	0.010*** (0.002)	0.010*** (0.001)	0.009*** (0.002)	0.009*** (0.001)	0.009*** (0.002)	0.001 (0.001)
Other minerals tons/pc	-0.040 (0.081)	-0.062 (0.066)	-0.115 (0.086)	-0.177** (0.057)	-0.070 (0.147)	-0.107 (0.169)
Metal/pc	0.049** (0.012)	-0.096* (0.042)	-0.054 (0.027)	-0.031 (0.023)	-0.032 (0.025)	0.002 (0.014)
Presence of foreign mining company (dummy)	0.229 (1.131)	-0.611 (0.518)	-0.677*** (0.109)	-0.704*** (0.055)	-0.645** (0.165)	-0.569*** (0.043)
Expenditure lagged					-0.131 (0.135)	-0.180 (0.125)
<b>Demography</b>						
Reference var. threshold 1 (500 inhabitants)						
Threshold 2 (500-2,000)		2.905** (0.995)	1.676 (0.956)	1.781 (0.960)	1.032* (0.422)	-0.156 (0.242)
Threshold 3 (2,000-10,000)		4.657* (1.732)	2.258 (1.293)	2.421 (1.424)	1.714* (0.796)	0.711 (0.369)
Threshold 4 (<10,000)		9.054** (2.381)	4.602* (1.787)	4.404* (1.977)	3.897* (1.512)	1.184 (0.594)
Population growth		-0.198	-0.172	-0.143	-0.104	-0.079

(Continued)

**Table 2.** (Continued.)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
		(0.166)	(0.097)	(0.119)	(0.104)	(0.084)
Incomes						
Indirect taxes/pc						0.372*** (0.063)
Observations	462	462	462	462	452	451
Number of towns	117	117	117	117	117	117
Adjusted $R^2$	0.013	0.064	0.247	0.254	0.257	0.408
Year FE	No	No	Yes	Yes	Yes	Yes
County-time FE	No	No	No	Yes	Yes	Yes

Robust standard errors in parentheses \*\*\* $P < 0.01$ , \*\* $P < 0.05$ , \* $P < 0.1$ .



### 4.3. Educational expenditure

Finally, [Table 3](#) shows the regression results for educational expenditure per capita.<sup>68</sup> In this case, the three educational variables (private foundations, other educational facilities and per cent of private funding) are included when the rest of the non-mining variables are introduced from column (2) to (6). In line with the results for incomes and expenditures, iron mines presented a positive and statistically significant impact on educational spending. For instance, a town increasing its iron ore extraction from 0 to 46.2 iron tons/pc increased its educational spending by 5.4 per cent above the average. However, as in the case of other expenditures, this effect disappears when indirect taxes are included.

However, the non-statistical significance of indirect taxes in the model casts doubt on the indirect transmission of the revenues earned in mining towns towards education. This points to a differentiated treatment of educational expenditures in comparison to other town council spending, which could be linked to the scenario depicted in [Figures 2](#) and [3](#). As town councils reached the mandatory educational provision level during the 1880s, spending on education was not further increased. This could be linked to the absence of an effect from indirect taxes. More revenues for the town were not linked to more spending on education, which contrasts with the important effect on other expenditure. This could be explained by the fact that investment in education might not have produced a similar short-term result as spending on sewer system or streetlights. As new neighbourhoods were created to house new workers, overcrowded houses, deficient sanitation or water systems might have been more urgent issues to address than creating new schools. Thus, town councils prioritised the decrease in death rates either through investments in sewer systems or water supply with the increases in indirect taxes, rather than investing in the improvement of literacy rates.

Moreover, the results for towns with other mineral mines and steel mills show that industrialisation had important negative externalities for educational spending. Although the decrease in both cases with one standard deviation would not represent an important decline (0.6 per cent for other minerals, and 2.3 per cent for steel), this result contrasts with the null effect of these variables on other spending. As the regression controls for potential population dynamics, revenues or educational factors, the allocation of resources may explain this result. Thus, in those towns with other mineral mines, and especially those with steelworks, the town councils were not able to obtain more revenues from these industries (results in [Table 1](#)). Hence, they had to divert their resources to more demanding expenditure. Therefore, in order to maintain the same per capita level in other expenditure, seen in the absence of effect of other minerals and steel mills in [Table 2](#), town councils reduced the allocation of resources in education, diverting it to sewer systems, or police officers, which in towns with polluting industries or social unrest due to inequality might have been more urgent than schools. These results, then, show that, despite the fact that the literature stresses the importance of the metallurgical sector on industrialisation in Biscay, it was not able to incentivise families to demand more educational expenditure from town councils, thus casting doubts on the transformative role of this sector regarding capital and technological investment and its links with skilled and educated local workers.

With respect to the presence of foreign mining companies, the effect was a reduction of 11.1 per cent in terms of the average educational expenditure in the next decade after the appearance of these firms. Foreign mining companies might have seen mining towns as

<sup>68</sup> The same analysis excluding the municipalities that had no education expenditure produced the same results. Moreover, due to the stagnation of educational expenditure since 1887, an analysis was carried out dividing the sample in 1877-1887 and 1887-1910, obtaining the same results.

**Table 3.** Expenditure pesetas<sub>1913</sub>/pc

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Mining and metal lagged						
Iron tons/pc	0.003 (0.001)	0.004** (0.001)	0.001** (0.000)	0.002** (0.000)	0.002** (0.000)	0.001 (0.001)
Other minerals tons/pc	0.030** (0.007)	0.032** (0.011)	-0.035* (0.014)	-0.037*** (0.007)	-0.036*** (0.008)	-0.040** (0.009)
Metal/pc	0.022*** (0.002)	-0.024** (0.006)	-0.025*** (0.002)	-0.017*** (0.002)	-0.017*** (0.002)	-0.015*** (0.001)
Presence of foreign mining company (dummy)	0.477 (0.482)	0.120 (0.204)	-0.253 (0.126)	-0.248*** (0.038)	-0.250*** (0.049)	-0.190** (0.062)
Educ. Exp. lagged					0.022 (0.012)	0.018 (0.012)
Education						
Educ. Priv. Foundation		-0.038 (0.089)	-0.096 (0.065)	-0.109 (0.079)	-0.108 (0.077)	-0.098 (0.073)
Other Educ. Facilities		0.175** (0.048)	0.027** (0.008)	0.027** (0.008)	0.028** (0.007)	0.019* (0.008)
Percentage of private funding		-0.874*** (0.126)	-1.503*** (0.264)	-1.487*** (0.273)	-1.466*** (0.260)	-1.460*** (0.284)
Demography						
Reference var. threshold 1 (500 inhabitants)						
Threshold 2 (500-2,000)		-0.031	-0.415	-0.399	-0.386	-0.461

		(0.341)	(0.273)	(0.260)	(0.265)	(0.297)
Threshold 3 (2,000-10,000)		-0.026	-0.570	-0.551	-0.514	-0.574
		(0.408)	(0.370)	(0.383)	(0.370)	(0.412)
Threshold 4 (<10,000)		1.686***	0.519	0.401	0.473	0.329
		(0.295)	(0.468)	(0.503)	(0.476)	(0.524)
Population growth		0.001	-0.078***	-0.059***	-0.061***	-0.054***
		(0.033)	(0.012)	(0.012)	(0.011)	(0.009)
Incomes						
Indirect taxes/pc						0.017
						(0.012)
Observations	468	468	468	468	468	465
Number of towns	117	117	117	117	117	117
Adjusted R <sup>2</sup>	0.022	0.082	0.637	0.650	0.650	0.646
Year FE	No	No	Yes	Yes	Yes	Yes
County-time FE	No	No	No	Yes	Yes	Yes

Robust standard errors in parentheses \*\*\*P < 0.01, \*\*P < 0.05, \*P < 0.1.

mere extraction locations and did not have an interest in developing further industrial ties related to the mining industry. Moreover, this framework of the Biscay mining town could be implemented because of the political control these companies had over local politics. Thus, a policy of limited investment in education could be set in motion as export-oriented iron open pits were labour-intensive in unskilled workers, and therefore educated workers would not be demanded for these mines. Nevertheless, the previous section shows that other spending was also hampered by the presence of foreign mining companies, indicating that a low-spending policy was implemented in towns where these firms operated. However, the negative effect on indirect taxes is not statistically significantly robust, which may rule out an explanation of lower expenditure due to lower municipal revenues.

Finally, the non-mining and metal variables produce interesting results. Educational foundations had no effect on educational expenditure, showing that there was a disconnection between the elite classes' willingness to fund education and public expenditure. As might be expected, the percentage of private funding was linked to less public educational expenditure, as part of that spending came from tuition fees. In the case of other educational institutions, the presence of post-primary education enhanced the investment in primary education. Regarding population growth, the result is negative and statistically significant, contrary to its non-significance for incomes and other expenditures. This reinforces the idea of the lagged investment in schools described by Rauscher (2016), as town councils might not have been able to keep up with the fast increase in population or may have preferred to invest in other more urgent infrastructures. Furthermore, the negative role of private schools indicates that as town councils were not able or willing to invest in education, private educators might have filled the gap.

In conclusion, and following the result for population, Table 3 shows an interesting scenario in comparison with the two previous sections. Educational spending was affected by elements of the industrialisation process such as population growth or the presence of industries and mines, although the effect was rather small. The allocation of resources within the town council, together with the disincentives to invest beyond the Law's mandatory expenditure, meant that mines and steel mills had a limited effect on education expenditure. The profits from industrialisation were clearly transferred to other expenditures such as sanitation or security problems which could be more easily and quickly addressed. However, increasing literacy levels required not only investments in schools and teachers but also the willingness of families to send their children to schools and subject them to long periods of schooling. This could disincentivise town councils from spending more than they were required to by law, especially if foreign companies implemented an unskilled-labour-intensive pattern, and steelworks were unable to increase the demand for educated workers in the local job market.

## 5. Concluding remarks

As Lindert (2004) and Magnusson (2009) point out, during the 19<sup>th</sup> and early 20<sup>th</sup> centuries, state capacity and the provision of public goods significantly increased together with industrialisation. Thus, this study expands this framework by focusing on the role of industrialisation in the local administration, a key element of state bureaucracy and the provision of public goods in the 19<sup>th</sup> and early 20<sup>th</sup> centuries in Europe. In this regard, this paper analyses, for the first time in Spanish historiography, the effect of industrialisation on local revenues and expenditure. Using Biscay municipalities as a unit of analysis between 1860 and 1910 allows us to see how the important industrialisation process in this Spanish province shaped revenues and expenditures. The results show that mining industrialisation fostered local income levels and this positively affected municipal

expenditure. This indicates that local administrations expanded and benefited from this process, as they were able to spend more on public services such as more police officers, new sewer systems or more parks.

Moreover, the literature stresses that the evolution of education provision during the 19<sup>th</sup> and early 20<sup>th</sup> centuries was affected by factors such as living standards, inequality, the role of the elites or institutions. Therefore, the analysis conducted for educational spending is particularly relevant, as it sheds light on the relationship between human capital and industrialisation. In contrast with the positive effect on other local expenditures, the new industrialising sectors that mushroomed in Biscay (mining and metallurgy) did not support an increase in education spending, and in some cases may have even hindered it. This different treatment of education expenditure from the local authorities could be due to the absence of immediate results from this public investment. Social control could be easier to address with more police officers, instead of teaching future workers how to behave, or sanitation problems might be more urgent than low literacy rates. Additionally, the need for the families' participation in the schooling process might have disincentivised town councils from investing in public schools above the threshold mandated by the Law. Moreover, unskilled-labour-intensive mines, especially when foreign companies were present, together with a weak demand for skilled workers from the metallurgical sector might disincentive families from educating their children, lowering the demand for schooling infrastructures, and thus decreasing the need for town councils to spend on education.

In conclusion, mining and metallurgy industrialisation did not drive a higher educational expenditure in northern Spanish provinces, casting some doubt on the role of industrialisation in education supply. Nevertheless, a further analysis should be carried out on other industrial sectors such as textiles, the chemical industry or the service sector in order to determine whether they promoted public education expenditure. Additionally, the role of private educators during industrialisation should be further explored, as the results show that private schooling acted as a substitute in the absence of public provision.

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