ECONOMIC DYNAMICS IN THE MALTHUSIAN ERA: EVIDENCE FROM THE 1609 SPANISH EXPULSION OF THE MORISCOS*

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We investigate economic dynamics in the Malthusian era using the 1609 expulsion of Moriscos from Spain. Sharp population declines in former-Morisco districts were accompanied by decreased output and increased *per capita* output. While these short-run results are consistent with standard Malthusian predictions, Malthusian convergence was delayed up to 1786 in former-Morisco districts. Archival sources and historical accounts suggest extractive institutions and cultural differences may have contributed to delayed convergence in population and output *per capita*. This historic episode provides an unusually rich setting to examine Malthusian dynamics, highlighting the potential for sustained differences in *per capita* output in the Malthusian era.

For the millennia prior to the demographic transition, models of economic growth focus on capturing 'Malthusian dynamics'. In this Malthusian era, technological growth or population declines are predicted to cause temporary increases in output *per capita* that dissipate as population grows and the land-to-labour ratio declines.

Scholars have generally found empirical support for the traditional Malthusian predictions. In a recent contribution, Ashraf and Galor (2011) show that both land productivity and technology were historically related to population density rather than income *per capita*. Impacts of the European Black Death are also consistent with this framework (Phelps-Brown and Hopkins, 1981; Hatcher, 1996; Clark, 2005), although population and wages appear to converge slowly following this large population shock.

However, the Malthusian era can be more nuanced. Many historical civilisations sustained incomes significantly above subsistence, at least for an elite subset of the population. In addition, recent research has argued that large population shocks could lead to sustained increases in incomes by changing the demographic regime (Voigtlander and Voth, 2009, 2013*a*, *b*). Although such nuance can be reconciled with an augmented Malthusian framework, empirical identification of deviations from the canonical model can be challenging. Such identification issues have often limited empirical analysis in the Malthusian era more generally. For example, efforts to identify the effects of population shocks have generally been hampered by the tendency for disease-driven population shocks to affect entire regions and often

reoccur, making it difficult to quantify how the area would have changed in the absence of a one-time population shock.[1]

In this article, we use the expulsion of Spain's converted Muslims (Moriscos) to estimate dynamic responses to a population shock in the Malthusian era. In 1609, the Spanish Crown suddenly and unexpectedly expelled Spain's roughly 300,000 Moriscos. Our empirical analysis focuses on the Kingdom of Valencia, which lost 130,000 Moriscos or roughly one-third of its pre-expulsion population. This loss of population is roughly similar in magnitude to the Black Death in Europe. Importantly, however, there was substantial local variation in the severity of the population shock that allows us to use an identification strategy similar to that used in estimating labour market dynamics in the modern economy (Card, 1990; Hunt, 1992; Carrington and de Lima, 1996; Friedberg, 2001). To our knowledge, the Moriscos' expulsion provides advantages for empirical estimation that are unprecedented in a Malthusian setting.

We begin by estimating relative changes in population, output and output *per capita* for districts with a greater initial population share of Moriscos, controlling for differential changes associated with districts' geographic characteristics (distance to the City of Valencia, distance to the coast, terrain ruggedness, latitude and longitude, average rainfall and agricultural suitability). By comparing changes in former-Morisco areas to changes in nearby areas, the identification assumption is that these areas would have changed similarly if not for the Moriscos' expulsion.

Our regression estimates provide additional empirical support for the short-run predictions of the Malthusian model: the Moriscos' expulsion led to a sharp relative decline in population and an increase in output *per capita* in former-Morisco areas. The long-run response in former-Morisco areas, however, may deviate from textbook Malthusian predictions in the sense that output *per capita* and population remain differentially higher and lower, respectively, for 177 years through to the end of our sample.

We then investigate whether our results simply reflect slow general convergence rates in the Malthusian era. Indeed, following the Black Death, population levels in England had not fully recovered over a similar time frame (Clark, 2005, 2010). To investigate this possibility, we exploit our district-level panel data to estimate convergence rates for population, output and *per capita* output (*à la* Barro and Sala-i-Martin, 1992). These regressions provide direct evidence that population and *per capita* output converged abnormally slowly in former-Morisco areas following the expulsion, relative to former-Christian areas in our sample.

Finally, we consider why the expulsion of the Moriscos may have had such long-lasting impacts on population levels and output *per capita*. The existing literature suggests two main possibilities, although we briefly explore others. A first interpretation emphasises the role of institutions. Prior to the expulsion, Morisco populations were subject to a harsh institutional framework. This institutional framework is generally thought to have persisted in former-Morisco areas, and may have become harsher in some respects (Casey, 1971, p. 32). These institutions may have restricted population growth and maintained higher pre-tax *per capita* output, both by

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[1] For example, in the canonical case of the Black Death, the initial population shock was followed by many subsequent plague outbreaks (Voigtlander and Voth, 2013*b*).

discouraging further Christian in-migration and by preventing in-migrants from retaining surplus income.

A second interpretation emphasises the role of cultural differences between Christians and Moriscos (Ardit, 2009a). Prior to the Moriscos' expulsion, Christian contemporaries claimed that Moriscos survived on less, married younger and had more children than their Christian counterparts. This interpretation attributes the results to a cultural shift toward smaller families and increased incomes following the expulsion.

We do not formally distinguish these interpretations and both may have been in play simultaneously, although we do provide new quantitative evidence on the persistence of extractive institutions. We gather data on the institutional framework in 1786 and document that former-Morisco areas were more likely to be controlled by the nobility (and, in Valencia, noble control was associated with a harsher institutional framework). Similarly, data on a revolt against the nobility in 1693 show that all rebel leaders were from former-Morisco areas. Historical depictions of the poverty of Christian in-migrants and nobles' efforts to restrict their mobility suggest that high tax rates had a role in discouraging population growth and maintaining higher pre-tax output *per capita* in former-Morisco districts.

Of independent interest is the persistence of extractive institutions in former-Morisco areas, despite the scarcity of labour in the aftermath of the Morisco's expulsion. Acemoglu and Wolitzky (2011) develop a theoretical framework to understand how coercive labour institutions respond to labour scarcity. A key feature is how much initial institutions allow workers to leverage their improved outside options during periods of labour scarcity (North and Thomas, 1971), compared to how much labour scarcity raises landowners' returns from labour coercion (Domar, 1970). We discuss how the Valencian nobility, their creditors and the Spanish Crown worked together at the expense of peasants to restrict subsequent labour mobility and support the extractive institutional framework. In this sense, institutional responses in Valencia had more in common with the increases in coercion in Eastern Europe following the Black Death (Brenner, 1976) rather than the declines in serfdom in Western Europe following the Black Death (Habakkuk, 1958; Le Roy Ladurie, 1977). This historical case of sudden labour scarcity created an historical 'critical juncture' that pushed institutions in one of two directions, depending on the initial institutions and the distribution of political power (Acemoglu and Robinson, 2012). This episode helps to understand how conditions in the Malthusian era can influence the historical development of institutions, which can impact institutions and economic outcomes even today (Engerman and Sokoloff, 1997; Acemoglu *et al.*, 2001, 2002; Banerjee and Iyer, 2005; Dell, 2010).

The main empirical results are consistent with accounts of the Moriscos' expulsion having a large and long-lasting impact on Valencia, although they are less consistent with a classical view emphasising the importance of a permanent loss of agricultural human capital following the Moriscos' expulsion (Janer, 1857, pp. 47–8). In particular, our estimated recovery in output suggests that Christian in-migrants were able to return to pre-expulsion levels of output relatively quickly and with fewer workers. This recovery in output might reflect Christian migrants' adaptation to local geography and

their accumulation of location-specific human capital and/or agricultural adaptation to labour scarcity similar to that in the modern growth era (Hornbeck and Naidu, 2014).

Our analysis of delayed Malthusian dynamics relates to theories of the transition from the Malthusian era to the modern growth era (Galor and Weil, 1996, 1999, 2000; Jones, 2001; Galor and Moav, 2002; Hansen and Prescott, 2002; Clark, 2007; Galor, 2011). Many of these theories explore how endogenous shifts in cultural practices, particularly related to fertility behaviour, could cause a transition from the Malthusian era. Others have explored how output *per capita* could increase, even within the Malthusian era, if surpluses encourage elites to wage war and spread disease (Voigtlander and Voth, 2013*b*). Our study complements these literatures, as our results demonstrate that higher output *per capita* can be sustained through the Malthusian era.

1. Historical Background

1.1. *Muslims in the Kingdom of Valencia*

Islamic forces invaded the Iberian Peninsula in 711 CE and, over the following 700 years, Muslim and Christian forces fought for control in a series of wars known collectively as the *Reconquista*. Many areas prospered economically under Muslim rule, however, and the Muslim City of Valencia was one of the largest cities in Western Europe. In 1238, the Muslim City of Valencia surrendered to the army of King Jaume I of Aragón and remained thereafter under Christian control.

Immediately following the conquest of Islamic Valencia, Christian in-migrants were a small minority in much of the Kingdom and were separated by linguistic and cultural barriers from the Muslim majority (Ciscar, 1994, p. 134). During the 50 years after the Christian conquest, Islamic society lost many political and cultural elites through failed rebellions and emigration. There appears to have been limited cultural convergence within Valencia, however, and there remained differences in social structures between the Islamic and Christian communities within the Kingdom. For example, Valencia's Muslim communities were characterised by tribal social structures based on clans and marriage between first cousins (Meyerson, 1991, p. 254).

Institutional changes occurred more quickly in the decades following the conquest, as Islamic governmental structures were replaced by 'feudal' institutional arrangements (Meyerson, 1991, p. 226). Following the conquest, much of the Kingdom was ceded by the King to the nobility as payment for military or financial aid.[2] The King also ceded much legal jurisdiction over those living on the land, allowing nobles to shape the institutional framework in their domains.

Nobles exploited their Muslim vassals, forcing them to provide labour services and a large share of their harvests. Muslims in Valencia had little alternative but to pay these high costs, although labour scarcity following medieval plagues may have improved

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[2] By the end of the Middle Ages, the Crown had alienated roughly three-quarters of the kingdom to the nobility and other elites, such as the church and merchant classes (Febrer Romaguera, 2000, p. 16). The nobility controlled the majority of these alienated lands.

Muslims' outside options and lightened extractive pressure (Meyerson, 1991, pp. 112–13, 179–180).

The nobility were forced to grant relatively favourable conditions to attract Christian migrants to the region, who paid little more than the church tithe and seignorial dues (Febrer Romaguera, 2000, p. 40). These favourable conditions were difficult to modify, once codified, and persisted with the political protection of Christians by the Church and the King. By the sixteenth century, the Christian population had increased from a religious minority to become roughly two-thirds of the Kingdom of Valencia.

Nobles continued to exert considerable influence on local institutions, even after the Spanish monarchy unified the country in the late fifteenth and early sixteenth centuries. Local elites maintained autonomy over municipal-level institutions and influenced the overall management of the Kingdom of Valencia. Although a high-ranking noble from outside Valencia was generally appointed as Viceroy to act on behalf of the King in overseeing the Kingdom of Valencia, he was aided in his task by a tribunal that was staffed by lawyers from Valencia's merchant class (Canet, 1986). In addition, the King had councils of advisers in Madrid, who were drawn from the tribunal of Valencia and other regions (Casey, 2008, p. 189).

1.2. *Moriscos in the Kingdom of Valencia*

Nobles' exploitation of Muslims persisted through the forced conversion of Valencia's Muslim population to Christianity in 1525. The former-Muslim population became known as Moriscos, who initially hoped that their involuntary conversion would free them of the forced labour services and higher tax rates. These hopes were not realised, however, and contemporaries noted the challenge for Moriscos to 'live like Christians and pay like Muslims' (Ciscar, 1977, p. 122). The Valencian tribunal later recalled that Valencia's Muslims 'were as slaves' prior to their baptism and that 'at the time of their baptism it was agreed that the Moriscos would have to pay the same that they paid when they were Muslims' (ACA, CA, leg. 221, 8/9).[3]

Like their Muslim predecessors, the Morisco population continued to be exploited by the Valencian nobility. Nobles received a share of the Moriscos' harvest that could reach as high as 40%. Moriscos were also required to present annual gifts and free labour services to the nobility, in addition to purchasing items at above-market prices from stores owned by nobles and grinding their grain in nobles' mills (Ciscar, 1977, pp. 228–35). One contemporary noted that 'to say that the Moriscos are slaves of their lords is not appropriate because they are much more than slaves', while another exclaimed that the Moriscos 'drink a jug of water and eat a handful of raisins and everything else is for their lords' (Torres, 1969, p. 135). This extractive relationship was reflected in the popular saying: *quien tiene moro, tiene oro* or 'he who has a Muslim has gold' (Braudel, 1995, p. 789).

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[3] Throughout this article, all archival sources from the Archive of the Crown of Aragón (ACA) are drawn from the *unidad* entitled *Consejo de Aragón* (CA). The number following leg. provides the *legajo*. Following this, the first number after the comma provides the number and that after the slash provides the document within that number.

In comparison, the Moriscos' Christian neighbours generally did not perform labour services and their payments continued to be limited to a tithe and seignorial dues (Ciscar, 1993, p. 200). The Moriscos may have been subject to even harsher conditions than their Muslim ancestors, as population growth in the sixteenth century throughout the Mediterranean appears to have decreased Moriscos' outside options and contributed to more-extractive institutions (Meyerson, 1991, pp. 112–3, 180).

Valencia's nobility strove to maintain local Morisco populations and supported the continuation of Islamic social structures and practices, despite pressures by the Spanish Inquisition to eradicate these differences. The nobility are thought to have undermined these attempts at cultural assimilation because Moriscos' continued covert Islamicism served to justify their economic exploitation (Ciscar, 1977, p. 68). Beginning in the 1570s, Valencia's nobility successfully resisted growing pressure to expel the Morisco population (Benítez, 2001).

The Spanish Crown renewed efforts to expel Moriscos in the early seventeenth century. The King's council noted, however, that 'the greatest difficulty that we might face in this endeavor is the resistance of the lords of morisco vassals due to the losses they will sustain' (Benítez, 2001, pp. 398–9).[4]

Despite the nobles' resistance, the decision to expel the Moriscos was made in secret on 4 April 1609. The King's council initially decided to give the nobles all of the possessions of the Moriscos in their domains (Benítez, 2008, p. 258), as compensation for the nobles' losses and to reduce their opposition to the expulsion. In the months prior to the public announcement of the expulsion, however, the council decided to allow Moriscos to take whatever goods that they could carry to discourage revolt (Benítez, 2008, p. 259). Whatever the Moriscos could not carry would belong to the nobility.

1.3. *The Expulsion of Moriscos in 1609*

In September 1609, the Spanish Navy gathered off the coast of Valencia and rumours circulated that this concentration of naval power would be used to expel the Moriscos. Valencia's nobles convened and sent an embassy on 16 September to King Phillip III to lobby for the cancellation of the expulsion, citing the 'irreparable damages, destruction, affliction and calamities that the Kingdom would inevitably endure following the execution of such a measure' (Salvador, 1998, pp. 129–30). When the nobles' embassy arrived in Madrid, they were informed that the decision was final and that the expulsion had already begun (Halperin, 2008, p. 174). To limit the nobility's resistance to the expulsion, the Viceroy of Valencia was instructed to assure each noble that the King would 'work to repair the damages and discomfort that the expulsion will cause by all possible means' (Benítez, 2008, p. 259).

The Moriscos' expulsion was announced publicly on 22 September. The expulsion order stated that Moriscos could only take what they could carry and that hiding other assets from the nobility was punishable by death (Bleda, 1610, pp. 597–601).

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[4] One potential reason for the Spanish Crown to renew expulsion efforts at this time was to provide a nominal victory after a series of military and political setbacks (Benítez, 2001, p. 430; Furió, 1995, p. 312).

Nobles restricted Moriscos' ability to sell their possessions and there was often little time before Moriscos were forced from their homes (Halperin, 2008, pp. 183–4). Some nobles tolerated the sale of goods to incoming Christian settlers, apparently to forestall revolt, although the surge in supply led to what one contemporary called 'the cheapest fairs the Kingdom had ever seen' (Benítez, 2008, p. 259; Halperin, 2008, p. 179).

Over the following three months, approximately 110,000 Moriscos left Valencia.[5] Many Moriscos were escorted from their homes to exit ports by military force, where the vast majority were taken to North Africa. There were two revolts in October of 1609, although these were limited to mountainous terrain and were quickly subdued (LaPeyre, 1959, pp. 56–7). Some Moriscos continued to hide in the mountains, and the last 15 are reported to have been captured on 2 February 1612 (LaPeyre, 1959, p. 67). Overall, the Kingdom of Valencia lost approximately 130,000 Moriscos or roughly one-third of its total population prior to the expulsion.

The loss of agricultural labourers devastated agricultural production in former-Morisco areas and immediately bankrupted many nobles who relied on high tax revenues to pay their debts.[6] Nobles' creditors began legal proceedings to confiscate former-Morisco lands that had been used as collateral (Benítez, 2008, p. 264). The Spanish Crown faced substantial challenges in allocating the financial losses caused by the Moriscos' expulsion, as both the nobility and their creditors wielded considerable influence.[7] In the years following the Moriscos' expulsion, the Crown worked out a balance between these competing interests: nobles' creditors were forced to take substantial losses on their debt, the nobility agreed to pay a share of their debts, and the nobility agreed to assume the Moriscos' debts in exchange for the ability to impose extractive taxes in former-Morisco areas (Benítez, 2008, p. 296; Reglá, 1964, p. 164).

1.4. *Christian Settlement of Former-Morisco Areas*

Immediately following the expulsion, it seemed that labour scarcity would force the Valencian nobility to relax the extractive conditions in former-Morisco areas. Christian

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[5] The expulsion of Moriscos also affected areas outside the Kingdom of Valencia, although to a much lesser degree (LaPeyre, 1959).

[6] The Valencian nobility had accumulated large debts prior to the expulsion (Casey, 1975, 2008) and may also have used the expulsion as an excuse to default on those debts (Ciscar, 1977, p. 143).

[7] In November 1609, the King had ordered the nobles to encourage repopulation and guaranteed that migrants' harvest would not be confiscated by creditors (a copy of the edict is reproduced in Boronat, 1901 [1992], pp. 564–7). In February 1610, the tribunal of Valencia (which generally defended creditors at this time) wrote to the King with a list of policy recommendations to deal with the effects of the expulsion. They noted that continuation of the extractive institutional framework would delay the repopulation as 'the Christians will not want to pay the services, taxes, labour services and the share of their crops that the Moriscos paid' but nevertheless suggested that nobles be allowed to establish the institutional conditions they saw fit 'even if this included labour services' (ACA, CA, leg. 221, 8/9). In May 1610, the Viceroy of Valencia wrote to the King informing him of the grave financial crisis caused by the expulsion because the Kingdom 'lives off interest which is not being and cannot be paid' (ACA, CA, leg. 221, 8/6). As this interest was not paid, Valencia's creditor classes were forced to withdraw substantial funds from Valencia's central bank, which collapsed in 1613 (Reglá, 1964, p. 176; Torres, 1969, pp. 134–36). The bank was recapitalised following its collapse, although it continued to experience difficulties through the seventeenth century.

migrants began to occupy former-Morisco areas immediately following the expulsion, at times arriving before the Moriscos had left. This initial wave of migration reflected beliefs that Christians would be able to settle former-Morisco areas under the same tax conditions as in former-Christian areas.

It soon became clear that nobles intended to maintain the extractive institutions in former-Morisco areas, however, and many of the Christian migrants left (Halperin, 2008, pp. 205–7).[8] There was initially high turnover in the resettlements as settlers moved to other resettlements where they believed the conditions were more favourable or moved back to their previous homes (Ciscar, 1975, pp. 148–9). The nobility found it difficult to attract and maintain Christian populations under the continued institutional framework (Casey, 2008, p. 124). A high-ranking cleric noted, in a November 1609 letter to the King, that the nobles 'do not want to repopulate their lands despite the fact that there are many potential migrants because they wish to extract from the Christians the same amount that they took from the Moriscos' (cited in Boronat, 1901 [1992], p. 236).

Valencia's nobility made some initial concessions to Christian migrants to encourage them to populate former-Morisco areas. Temporary tax concessions attracted migrants (Lloret, 2002, p. 355), whereby nobles allowed peasants to pay a smaller share of their crop than stipulated in the resettlement conditions. The remaining payments were often retained as a debt to their new lord, which would be paid in the future (Ciscar, 1975).

Temporary tax concessions served to limit labour mobility, however, as peasants could not legally leave seignorial lands prior to settling existing debts with their lords. Indeed, the nobles had previously used similar techniques to limit the mobility of Valencia's Muslim or Morisco populations prior to their expulsion (Meyerson, 1991, pp. 19–23, 326). The Spanish Crown aided the nobility in maintaining extractive institutions in former-Morisco areas (Casey, 2008, p. 115), issuing edicts that limited labour mobility out of former-Morisco areas in the years after the expulsion (Benítez, 2008, pp. 297, 308).[9]

Nobles maintained control of institutions in former-Morisco areas, imposing higher taxes in former-Morisco areas than were required in former-Christian areas. In former-Morisco areas, the peasants had to pay a larger share of the harvest to their lord, the local market was heavily controlled and dominated by seignorial monopolies, and the election of local officials was largely controlled by the lord (Ciscar, 1993, pp. 222–5). In a later Section of the paper, when discussing interpretations of the empirical results, we review additional qualitative and quantitative evidence on the persistence of extractive institutions and their abolition in the early nineteenth century.

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[8] Most immigrants were drawn from surrounding non-Morisco areas, although there are some reports of immigration from outside of Valencia (Torres, 1969). Migrants are thought to have been drawn from Valencia's poorer inhabitants, i.e. those willing to accept an exploitative institutional framework in exchange for land and capital (Torres, 1969, p. 73; Ciscar, 1993, p. 189).

[9] The Spanish Crown continued to protect Christians by prohibiting forced labour services in former-Morisco areas (Casey, 2008, p. 106), but subjected Christian settlers to the high taxes and broad institutional framework established by nobles in former-Morisco areas.

2. Data Construction

2.1. *Agricultural Output and Population Data*

Historical data are available to proxy for the total value of agricultural output by district in Valencia. The Archbishopric of Valencia was entitled to a fixed proportion of approximately 10% of all agricultural output in each administrative tithing district (or *delmari*) under its jurisdiction.[10] Rather than directly collecting agricultural goods, the Archbishopric separately auctioned the right to collect its share of output in each district over the subsequent four years in exchange for upfront fixed cash payments.[11] The Archbishopric of Valencia recorded the value of each winning bid in each tithing district and time period.

Some important assumptions are necessary, however, for percentage changes in district-level tithe auction prices to be roughly equal to percentage changes in the value of agricultural output. First, we assume that there was no collusion amongst risk-neutral bidders who had accurate expectations over the value of agricultural output.[12] Second, we assume that there were minimal changes in the cost of tithe collection. In practice, we need these assumptions to hold conditional on the control variables included in the empirical specifications.

The Moriscos' expulsion may have affected tithe auction prices through channels other than decreased agricultural labour availability, although we expect many of these effects to be concentrated in the immediate aftermath of the expulsion. Tithe valuations in former-Morisco districts may have reflected higher risk in periods following the expulsion, which would understate both output and output *per capita*. Nobles' defaults on loans and the temporary collapse of the Valencian central bank may have caused deviations from friction-free asset pricing, although our first post-expulsion tithe data are drawn after the worst of the post-expulsion financial crisis had passed. While the Spanish Crown was looking for ways to compensate nobles after the expulsion, the tithes were managed independently by the Church.

These tithe auction prices appear to be a reasonable proxy for the value of agricultural output by district, particularly given the typical limitations on output data in the pre-industrial era. We are grateful to Manuel Ardit for providing transcriptions of unpublished district tithe data.[13] Our data contribution has been to define the geographic area of each tithing district, which allows us to assign each tithing district its

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[10] The rate at which agricultural output was taxed by the Church appears to have remained constant over the entire sample period (Ardit, 1987). Prior to our sample period, the Church had transferred a share of its collection rights (usually a third of the tithe) in most areas to the King who in turn eventually transferred these rights to the nobility. The Church's share remained fixed over our sample period, however, and the collection rights were priced and recorded separately by the Church.

[11] Each November, the Archbishopric announced which tithing districts were to be auctioned. On 6 and 7 January of the following year, the collection right for each district was sold to the highest bidder.

[12] Winning bids were usually made by local merchants in that district, as locals were in the best position to forecast the value of collection rights and to collect the taxes (Llibrer, 2011).

[13] These records have survived in a series of books known as the *Llibres d'arrendaments dels delmaris de l'arquebisbat de València*, which are now in the Archive of the Catedral de València. The period from 1501 to 1800 is covered in books 4388 to 4401, which have been used by Manuel Ardit in a series of publications (Ardit, 1987, 2009*b*). Casey (2008) also uses these data and provides some aggregate statistics for the entire Archbishopric of Valencia. We use the auction prices for the tithes known as *pa i vi*, which included all of the tithed crops in most areas (Ardit, 1987, p. 291).

pre-expulsion population of Moriscos, its total population in particular years, and its local geographic characteristics.[14]

We assign each district its towns' population in 1569, 1609, 1622, 1646, 1692, 1712, 1730, 1768 and 1786.[15] For these periods in which population and output data are both available, we calculate the average value of district tithes within a 10-year window.[16]

2.2. *Morisco and Christian Districts*

The main geographic unit of analysis is a tithing district, of which there are 98 in our main sample.[17] Some district borders changed over the analysed time period, but the geographic unit of analysis is held constant by summing tithe auction prices over sub-divided parcels (Ardit, 1987).

Figure 1 maps the tithing districts, shaded to reflect the Morisco population share in 1609 prior to the expulsion.[18] The population is 0% Morisco in 31 districts (shaded white), between 0% and 100% Morisco in 36 districts (shaded light grey), and 100% Morisco in 31 districts (shaded medium grey). In the second category, Morisco population shares are fairly evenly distributed between 0% and 100% with a mean of 50%. The City of Valencia is in the Northeast, in a cross-hashed non-tithing area, and the coastline is to the East.

Crucially, the 1609 population data include the number of Christians and Moriscos prior to the expulsion. Morisco communities had been largely segregated from Christian communities, so it was not difficult to identify and expel the Morisco population. For the few instances of mixed-religion households, the Crown allowed Morisco children under six and their mothers to remain. Morisco fathers were

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[14] In doing this work, we are grateful for the assistance from archivists at the Archive of the Catedral de València and from Manuel Ardit. We created a digitised map of Valencia's historical tithing districts using manuscripts 4440 and 4441 from the Archive of the Catedral de València, which list the population centres in each tithing district, and a 17th century map provided by Ardit that defines the municipal boundaries of the population centres. We then assigned town-level population data to tithing districts based on name and geographic proximity, using the map provided by Ardit and information provided in Badenes and Bernat (1994). The matching procedure and data coverage are imperfect: some towns are missing in particular census years or may be assigned to the wrong district. Measurement error in population (or output) would bias the analysis of convergence rates but the empirical analysis verifies the results' robustness to a GMM approach that would mitigate the bias from measurement error by using instrumental variables.

[15] Town-level population data are available from three sources. First, from a manuscript created between 1565 and 1572, town populations in the Kingdom of Valencia were compiled by Chabás (1890). Second, Badenes and Bernat (1994) provide town-level population data from censuses conducted throughout the Kingdom of Valencia in 1609, 1646, 1692, 1712, 1730, 1768 and 1786. Third, for 1622, we use the population data provided in the *ad limina* visit organised by the Vatican (Cárcel, 1988). Population data initially record the number of households and then record the number of individuals in 1768 and 1786; following standard practice in this historical literature, households are assumed to contain 4.5 individuals.

[16] We assign the auction value in year t to years $t + 1$, $t + 2$, and $t + 3$. For each population census year, we then average tithe data over all periods from five years before to four years after. For 1609, we limit the tithe data to years before the Moriscos' expulsion. Tithe data are available in most years, and no tithe data are available for 0.8% of the final district-year observations.

[17] Of the 102 tithing districts in the Archbishopric of Valencia, three districts (Rambla, Ressalany and Russafa) are omitted because we were unable to identify their geographic boundaries. In addition, we omit the district Riu de Millars because it is non-contiguous.

[18] Mapped boundaries do not each reflect distinct tithing districts, as some districts contain non-contiguous pieces.
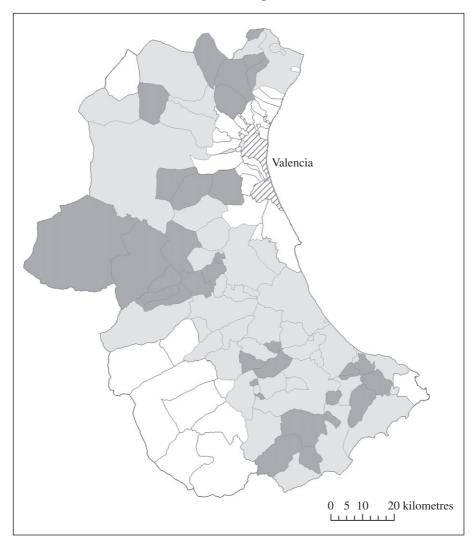
Fig. 1. *Sample Districts, Shaded by Morisco Population Share in 1609*
Notes. The 98 sample districts are defined according to tithing areas of the Archbishopric of Valencia in the 17th century. The thin lines create more than 98 distinct polygons because some sample districts are non-contiguous. The population is 0% Morisco in 31 districts (shaded white), between 0% and 100% Morisco in 36 districts (shaded light grey), and 100% Morisco in 31 districts (shaded medium grey). The City of Valencia is in the Northeast, in a cross-hashed non-tithing area, and the coastline is to the East.

expelled, regardless of the age of the children, along with any older children (Dadson, 2009, p. 216).

2.3. *Pre-expulsion Differences Between Morisco and Christian Districts*

The main empirical analysis compares changes over time in Morisco and Christian districts but we begin by exploring cross-sectional differences between these districts

prior to the Moriscos' expulsion. Table 1 reports estimates from regressing district-level outcomes in 1609 on districts' Morisco population share in 1609. Column 2 reports that population, output and output *per capita* were substantially lower in Morisco districts in 1609.

Part of these observed differences can be attributed to observed geographic differences between Morisco and Christian districts. Column 3 reports smaller estimated differences when controlling for seven observed geographic characteristics of districts: distance to the City of Valencia, distance to the coast, average terrain slope, latitude, longitude, average rainfall and agricultural suitability.[19]

Population was lower in Morisco districts, which could partly reflect the greater tax burden on Moriscos, although the difference is statistically insignificant after controlling for geographic characteristics. Lower measured output and output *per capita* in Morisco districts may partly be a statistical artefact, reflecting the historical management of Church tithes. In the years before Valencia's Muslims were forced to convert to Christianity in 1525, they did not pay tithes directly to the Church (Meyerson, 1991, p. 167). After their conversion to Christianity, the Moriscos (former Muslims) began to pay tithes. It is possible, however, that the Church's share of these tithes was smaller in the Morisco areas than in Christian areas because a larger share

Table 1

Baseline District Characteristics, by Morisco Population Share in 1609

| | | Log Difference by 1609 Morisco share | |
| | | | |
District outcome in 1609:	Pre-expulsion sample mean (1)	Basic difference (2)	With geographic controls (3)
Population per km^2	9.13 [17.6]	−0.496** (0.181)	−0.261 (0.173)
Output per km^2	379 [1,256]	−1.218** (0.238)	−0.787** (0.231)
Output *per capita*	30.3 [19.4]	−0.695** (0.127)	−0.524** (0.121)

Notes. Column (1) reports average district characteristics in 1609 (in levels), and the standard deviation is reported in brackets. Output is measured as the auctioned tithe value (in lliures), multiplied by 10. Column (2) reports the basic difference for each district characteristic (in logs) by the district's Morisco population share in 1609: the co-efficients are estimated by regressing the indicated county characteristic on the district's Morisco population share in 1609 (between 0 and 1). Column (3) reports the estimated difference when controlling also for seven geographic characteristics of districts (distance to the City of Valencia, distance to the coast, terrain ruggedness, latitude and longitude, average rainfall and agricultural suitability). There are 98 districts with population data in 1609 and 96 districts with output data in 1609. Robust standard errors are reported in parentheses: **denotes statistical significance at 1%, *denotes statistical significance at 5%.

[19] Geographic distances are measured from a district's centroid and distance to the coast is calculated using the coastline of Valencia in the seventeenth century. Average slope within a tithing area is calculated from GTOPO30 data on elevation (http://eros.usgs.gov/). Latitude and longitude are measured at a district's centroid. Average rainfall and agricultural suitability are both drawn from the maps provided by the Spanish Ministry of Agriculture (available at http://sig.magrama.es/geoportal). There are two main rainfall values and two main agricultural suitability values in the sample region, so the regressions control for the fraction of each district with lower rainfall or lower agricultural suitability.

was assigned to the lord at the time of the Moriscos' conversion (Halperin, 2008, p. 131). If the Church's share of the tithe was systematically lower in the Morisco areas, this would cause systematically lower tithe auction values in Morisco areas.

The main empirical specifications focus on changes over time in former-Morisco and former-Christian districts, including district fixed effects to absorb cross-sectional differences in geography or the Church's tithe share. Further, as the impact of districts' fixed characteristics may change over time, the empirical analysis focuses on specifications that control for these seven geographic characteristics interacted with each year.[20]

3. Post-expulsion Changes in Morisco and Christian Districts

3.1. *Changes in Morisco and Christian Districts, 1609 to 1622*

For an initial view of the raw data, Figure 2 plots the 1609 to 1622 change in district-level outcomes against the district's Morisco population share in 1609. Panel (*a*) shows that population declined dramatically in districts with a large population share of Moriscos in 1609. Population also declined in entirely Christian districts, reflecting migration to former-Morisco districts. However, migration was insufficient to equalise the percentage population decline across districts.

While the Moriscos' expulsion initially impacted most districts to some degree, the empirical analysis focuses on estimating the relative impact on districts with a greater Morisco population share in 1609. Rather than attempt to recover the aggregate impact of the expulsion, this comparison identifies relative impacts from a plausibly exogenous relative decline in population.[21]

Figure 2, panel (*b*), shows that output also declined relatively from 1609 to 1622 in districts with a larger population share of Moriscos in 1609. Panel (*c*) shows that output *per capita* generally increased relatively in districts that had a larger population share of Moriscos, which is consistent with a declining population and fixed production factors.

Figure 3 plots the residual variation in districts' outcome changes against districts' residual Morisco population share in 1609, after controlling for districts' seven observed geographic characteristics. There is now more continuous variation in districts' Morisco population share, which predicts a fairly clear linear impact on relative changes in district outcomes from 1609 to 1622. Conditional on districts' geographic characteristics, districts with a greater Morisco population share have a very large decline in population, a large decline in output and a moderate increase in output *per capita*.

Figure 4 plots the mean change from 1609 to 1622 for three groups of districts and then extends these changes through 1786.[22] The three groups correspond to those in Figure 1: 31 districts with 0% Morisco population in 1609 (dotted line), 36 districts with between 0% and 100% Morisco population in 1609 (dashed line) and 31 districts

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[20] We have seen no indication that the Church permanently sold (or acquired) portions of tithe collection rights in our sample period, from 1569 to 1786 (see also Ardit, 1987).

[21] Because non-Morisco districts were also affected through out-migration, we suspect that the aggregate effects of the Moriscos' expulsion are larger than our estimated relative changes in population, output and output *per capita*.

[22] Outcome values are normalised to zero in 1609.

Panel *(a)* Log Population per square kilometre

Panel *(b)* Log Output (Tithes) per square kilometre

Panel *(c)* Log Output (Tithes) *per capita*

Fig. 2. *Changes in District Outcomes from 1609 to 1622, by Morisco Population Share in 1609. (a) Log Population Per Square Kilometre; (b) Log Output (tithes) Per Square Kilometre; (c) Log Output (Tithes) Per Capita*

Notes. Each panel plots districts' change in the indicated outcome variable (from 1609 to 1622) against districts' Morisco population share in 1609.

with 100% Morisco population in 1609 (solid line). Population declines from 1609 to 1622 largely persisted through the seventeenth century as total population remained similar, and average population in each group increased similarly through the

Panel (a) Log Population per square kilometre

Panel (b) Log Output (Tithes) per square kilometre

Panel (c) Log Output (Tithes) *per capita*

Fig. 3. *Changes from 1609 to 1622, Controlling for District Geographic Characteristics. (a) Log Population Per Square Kilometre; (b) Log Output (tithes) Per Square Kilometre; (c) Log Output (Tithes) Per Capita*
Notes. Each panel plots districts' residual change in the indicated outcome variable (from 1609 to 1622) against districts' residual Morisco population share in 1609, after controlling for districts' seven geographic characteristics.

eighteenth century as total population increased (panel (*a*)). Output declines from 1609 to 1622 also persisted but converged somewhat more over time as total output increased through the eighteenth century (panel (*b*)). By contrast, population and output had been increasing from 1569 to 1609, somewhat more so in districts with a
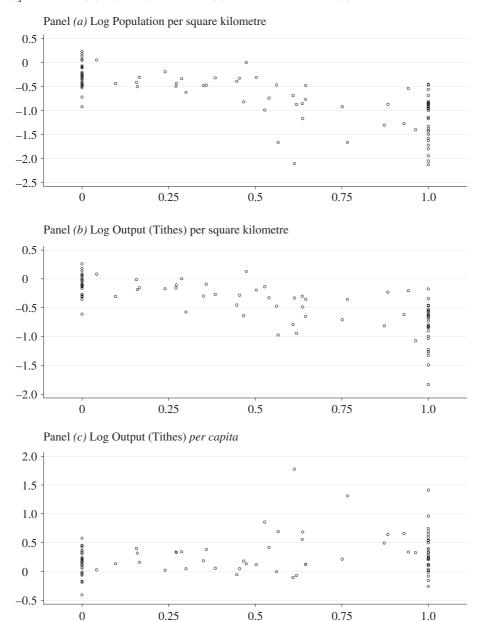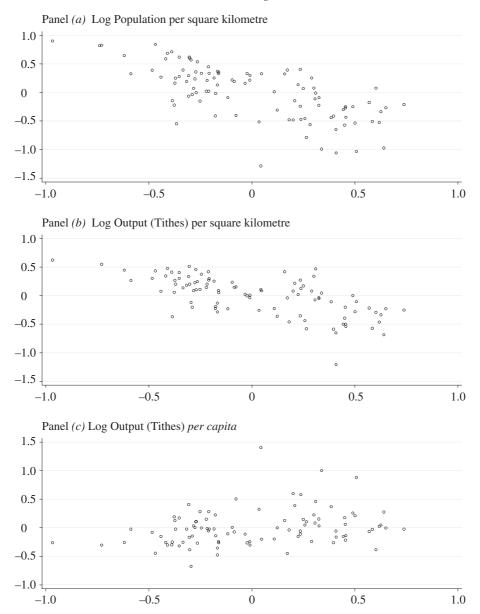
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Fig. 4. *Changes in District Outcomes, Grouped by Morisco Share in 1609. (a) Log Population Per Square Kilometre; (b) Log Output (Tithes) Per Square Kilometre; (c) Log Output (Tithes) Per Capita*
Notes. Each panel plots districts' average change after 1609 in the indicated outcome variable, grouped by districts' Morisco population share in 1609: 0% (dotted line), between 0% and 100% (dashed line), and 100% (solid line).

greater Morisco population share. Output *per capita* increased after the Moriscos' expulsion and remained higher in former-Morisco districts and was largely unchanged throughout the eighteenth century in districts that had no Moriscos in 1609 (panel (*c*)).

The following empirical analysis focuses on estimating relative changes by districts' Morisco population share in 1609.

3.2. *Estimated Relative Changes after the Expulsion*

Preliminary empirical specifications estimate relative changes in districts with a greater Morisco population share in 1609, controlling for districts' geographic characteristics. Outcome Y in district d and year t is regressed on the district's Morisco population share in 1609, year fixed effects, district fixed effects and districts' geographic characteristics:

$$\ln(Y_{d,t}) = \beta_t Morisco_d + \alpha_t + \alpha_d + \gamma_t \mathbf{X}_d + \epsilon_{d,t}. \tag{1}$$

Note that β is allowed to vary by year, so each estimated β is interpreted as the average difference between 100% Morisco districts and 0% Morisco districts in that year relative to the omitted base year of 1609. Note also that γ is allowed to vary by year, so the impact of districts' geographic characteristics is allowed to change in each time period.

   The main identification assumption is that districts with a greater Morisco population share in 1609 would have changed similarly to other districts, if not for the Moriscos' expulsion. In practice, this assumption must only hold after controlling for differential changes associated with districts' geographic characteristics. For example, an empirical concern is that changes in agricultural prices might vary by district, perhaps due to changes in transportation costs to Valencia or other markets. To the extent that changes in agricultural prices are correlated with Morisco population share, the hope is that these changes are absorbed by controlling for distance to Valencia and distance to the coast (each interacted with year). Similarly, while changes in agricultural technology may have differential impacts by district, the specifications control for districts' terrain ruggedness, longitude, latitude, average rainfall and agricultural suitability (each interacted with year). For the statistical inference in all specifications, standard errors are clustered at the district level to adjust for heteroscedasticity and within-district correlation over time.

   From estimating (1), Figure 5 (panel (*a*)) reports estimated changes in log population in a formerly 100% Morisco district relative to changes in a formerly 0% Morisco district. The solid circles indicate the point estimates in each year, relative to the omitted base year of 1609, and the vertical lines indicate 95% confidence intervals.

   From 1609 to 1622, former-Morisco districts experienced an 85 log point or 57% relative decline in population. Post-expulsion declines in population are statistically significant in each time period. Population in former-Morisco districts had partially recovered by 1786, although Morisco districts' population had been increasing relatively from 1569 to 1609.

   Figure 5, panel (*b*), reports estimated relative changes in the log value of agricultural tithes, as a proxy for the log value of agricultural output. From 1609 to 1622, output declined relatively by 61 log points in former-Morisco districts. The relative decline in output is similar through 1646 but then output recovers in former-Morisco districts although population remained lower. Output had been increasing relatively from 1569 to 1609 in Morisco districts, although at a somewhat lower rate than population.

Panel *(a)* Log Population

Panel *(b)* Log Output (Tithes)

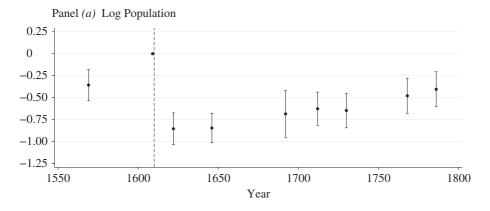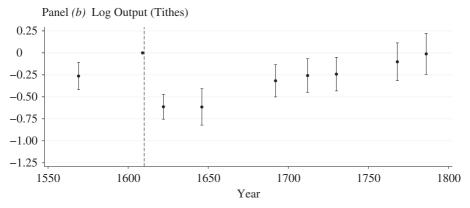Panel *(c)* Log Output (Tithes) *per capita*

Fig. 5. *Estimated Changes in District Outcomes, by 1609 Morisco Population Share. (a) Log Population*; (*b*) *Log Output (Tithes)*; (*c*) *Log Output (Tithes) Per Capita*

Notes. For the indicated outcome variable: each panel reports estimated changes in a formerly 100% Morisco district, relative to changes in a formerly 0% Morisco district. Estimates are from (1) in the text, which controls for fixed effects by district and year and seven geographic characteristics interacted with year. Vertical lines report 95% confidence intervals, aside from in 1609 which is the omitted year normalised to zero.

Figure 5, panel (*c*), reports estimated relative changes in the log value of tithes *per capita*. From 1609 to 1622, this proxy for output *per capita* increased relatively by 25 log points in former-Morisco districts. Output *per capita* remained higher and increased further over the next 164 years. By contrast, there had been statistically insignificant declines in output *per capita* in former-Morisco districts from 1569 to 1609.

Research on the Malthusian era sometimes focuses on estimating the elasticity of wages with respect to population. There are substantial empirical challenges in estimating this relationship, in the absence of a natural experiment, and estimates are generally 'too large' in the range of -1 to -2.7 (Weir, 1991; Lee and Anderson, 2002).[23] The estimated increase in output *per capita* from 1609 to 1622, as a fraction of the estimated decline in population, implies an elasticity of -0.29 (and a standard error of 0.066). This elasticity is consistent with a Cobb–Douglas production function with a land share of 0.29. Similarly, the estimated decline in output from 1609 to 1622, as a fraction of the estimated decline in population, implies a Cobb-Douglas production function with a land share of 0.28 (and a standard error of 0.072).[24] This land share is within the 0–0.40 range considered by Hayami and Ruttan (1985) and would not reject the 0.19 value calculated by Caselli and Coleman (2001).

Table 2 reports the estimated coefficients from Figure 5, along with the estimated standard errors. Table 2 also reports estimates when excluding the geographic controls. The geographic controls capture some of the cross-sectional differences between Morisco and Christian areas prior to the expulsion, yet the results are not particularly sensitive to the inclusion of these geographic controls.

Overall, following the Moriscos' expulsion in 1609, these preliminary estimates indicate that former-Morisco districts experienced relative declines in population and output and a relative increase in output *per capita*. Population remained persistently lower, output recovered more quickly, and there were sustained increases in output *per capita*.

However, there are some important limitations to this preliminary analysis. Malthusian theory implies an explicit dynamic relationship in economic outcomes, where districts' growth rate depends on their initial outcome value. Because Morisco and Christian districts had different economic outcomes prior to the expulsion, these districts might be expected to experience differential growth after the expulsion. The later empirical analysis explicitly models growth rates as a function of initial outcome values.

Based on this preliminary analysis, it is also difficult to quantify whether convergence in former-Morisco districts was slower than might be expected. After the Black Death, population responses were also slow and 'far removed from the immediacy of the response suggested by Malthus himself' (Hatcher, 1996, p. 76). It is difficult to quantify

[23] This elasticity should correspond to the strength of decreasing returns in the production function (Weir, 1991; Lee and Anderson, 2002). For a Cobb-Douglas production function in which land is the only fixed factor, the elasticity should equal the negative of the land share (which cannot be >1). These estimates might be reconciled using a CES production function but the required elasticity of substitution between land and labour is generally below plausible values.

[24] While the estimated changes between 1609 and 1622 may reflect temporary disruption of production after the expulsion, these estimated ratios are similar to those using estimated changes between 1609 and 1646.

Table 2

Estimated Differences in Morisco Districts, Relative to Differences in 1609

	Population per km^2		Output per km^2		Output *per capita*	
	(1)	(2)	(3)	(4)	(5)	(6)
1569 × Morisco	−0.358**	−0.302**	−0.263**	−0.302**	0.088	0.010
	(0.091)	(0.076)	(0.079)	(0.078)	(0.123)	(0.109)
1609 × Morisco	0	0	0	0	0	0
1622 × Morisco	−0.854**	−0.935**	−0.613**	−0.707**	0.248**	0.248**
	(0.092)	(0.092)	(0.072)	(0.075)	(0.076)	(0.075)
1646 × Morisco	−0.845**	−0.889**	−0.615**	−0.673**	0.215*	0.220**
	(0.085)	(0.094)	(0.105)	(0.106)	(0.094)	(0.083)
1692 × Morisco	−0.684**	−0.691**	−0.318**	−0.442**	0.344**	0.247*
	(0.136)	(0.105)	(0.094)	(0.094)	(0.129)	(0.110)
1712 × Morisco	−0.625**	−0.701**	−0.258**	−0.414**	0.370**	0.319**
	(0.096)	(0.100)	(0.098)	(0.100)	(0.113)	(0.104)
1730 × Morisco	−0.646**	−0.772**	−0.241*	−0.414**	0.404**	0.383**
	(0.101)	(0.100)	(0.097)	(0.095)	(0.126)	(0.108)
1768 × Morisco	−0.478**	−0.600**	−0.102	−0.265**	0.370**	0.345*
	(0.102)	(0.115)	(0.110)	(0.100)	(0.131)	(0.133)
1786 × Morisco	−0.404**	−0.497**	−0.012	−0.175	0.398**	0.349*
	(0.101)	(0.108)	(0.119)	(0.111)	(0.124)	(0.133)
Geography controls	Yes	No	Yes	No	Yes	No
Observations	864	864	875	875	858	858
Districts	98	98	98	98	98	98
R^2	0.945	0.933	0.975	0.969	0.831	0.783

Notes. Columns (1), (3), and (5) report estimates from regressing the indicated outcome variable on a district's Morisco population share in 1609 interacted with year, district fixed effects, year fixed effects and seven district geographic characteristics interacted with each year (distance to the City of Valencia, distance to the coast, terrain ruggedness, latitude and longitude, average rainfall and agricultural suitability). Columns (2), (4) and (6) omit the geography-by-year controls. All estimates are interpreted as the difference between Morisco districts and non-Morisco districts in that year, relative to the difference in 1609. Robust standard errors clustered by district are reported in parentheses: **denotes statistical significance at the 1% level, *at the 5% level.

convergence rates following the Black Death, in the absence of a clear counterfactual, but it is natural to consider whether these preliminary results simply reflect slow rates of convergence in the Malthusian era. The following empirical analysis estimates the rate of convergence in the sample, and then reports estimated impacts on former-Morisco areas after adjusting for the expected rate of convergence. Thus, the following analysis formalises whether population growth in former-Morisco districts was slower than would be expected given their lower levels of population following the expulsion.

3.3. *Estimated Convergence after the Expulsion*

To quantify economic dynamics in the aftermath of the Moriscos' expulsion, better we now explicitly model districts as converging to steady-state outcome values (*à la* Barro and Sala-i-Martin, 1992). For each district *d*, the annual growth rate in outcome *Y* from period $t - \tau$ to period t will then depend on the difference between that district's steady-state outcome value and that district's outcome value in period $t - \tau$. The district's steady-state outcome value is unobserved but is allowed to vary by district with the inclusion of district fixed effects (α_d). Districts' steady-state is also allowed to

change over time with the inclusion of year fixed effects (α_t). Further, the changes in steady-state are allowed to vary with districts' geographic characteristics by including year-interacted controls for the previously used seven geographic characteristics ($\gamma_t \mathbf{X}_d$). Conditional on the above controls, we can then directly estimate whether former-Morisco areas experienced differential growth by including a district's Morisco population share in 1609:

$$\frac{\ln(Y_{d,t}) - \ln(Y_{d,t-\tau})}{\tau} = \delta ln(Y_{d,t-\tau}) + \alpha_d + \alpha_t + \gamma_t \mathbf{X}_d + \beta_t Morisco_d + \epsilon_{d,t}. \tag{2}$$

Note that β is allowed to vary by year, so each estimated β is interpreted as the average change after the expulsion in former-Morisco areas' annual rate of growth between period t and the prior period. We sometimes pool the estimated βs, or constrain them to be equal across periods, to report the average impact of the expulsion.[25]

There are some known challenges in estimating equations of this form (Caselli *et al.*, 1996; Barro, 2012). First, growth regressions often include endogenous variables as controls, although we restrict our attention to time-varying controls for districts' fixed geographic characteristics. Second, estimates of δ are mechanically biased by the inclusion of district fixed effects (Hurwicz, 1950), although this bias becomes small in datasets over a long time horizon (Nickell, 1981; Barro, 2012). This bias is likely to be small in our setting, for which it is relevant that the data span 217 years rather than include nine time periods. We report some estimates from specifications that omit district fixed effects, although the resulting omitted variables bias will generally attenuate the estimated convergence rate and bias the estimates.[26]

For dynamic panel settings such as this, Arellano and Bond (1991) develop a potential solution to this second econometric concern. After differencing (2) over time to eliminate the district fixed effect, the lagged dependent variable term $[\ln(Y_{d,t-\tau}) - \ln(Y_{d,t-2\tau})]$ is mechanically correlated with the error term ($\epsilon_{d,t} - \epsilon_{d,t-\tau}$) because $\epsilon_{d,t-\tau}$ is a component of $\ln(Y_{d,t-\tau})$. However, in the absence of serial correlation in $\epsilon_{d,t}$ (or second-order serial correlation in $\epsilon_{d,t} - \epsilon_{d,t-\tau}$), $\ln(Y_{d,t-2\tau})$ is a valid instrument for $[\ln(Y_{d,t-\tau}) - \ln(Y_{d,t-2\tau})]$ (Anderson and Hsiao, 1982). A more efficient GMM estimator makes additional use of all further lagged values as instruments, which also permits tests for overidentifying restrictions and for serial correlation in $\epsilon_{d,t}$ (Arellano and Bond, 1991).

This GMM estimator would also mitigate bias arising from classical measurement error in the lagged dependent variable. Measurement error could also be non-classical, such as if there were persistent differences across districts between the measured tithe auction prices and unmeasured output. Fixed percentage differences in measurement would be absorbed by district fixed effects, and the hope is that any varying differences

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[25] In theory, the estimated δ is predicted to vary non-linearly with the time between periods (τ). In practice, estimating (2) using non-linear least squares introduces undesirable properties from including fixed effects and many controls. This is only an issue when the time between periods varies over the sample period; as the predicted δ would only vary slightly with the differences in sample periods, we do not allow δ to vary with τ.

[26] Districts with higher outcome values may have higher unobserved steady-states, so those districts may not grow much slower than districts with lower outcome values.

in measurement (that are correlated with Morisco population shares in 1609) would be absorbed by the inclusion of year-interacted geographic controls.

Given that our empirical focus is on dynamic responses to the Moriscos' expulsion, rather than estimating convergence rates, we can also assume a value of δ and verify the robustness of β_t. Previous research has also struggled to estimate convergence rates (δ), however, so a secondary contribution of our article is to provide new estimates of Malthusian convergence rates using our data and preferred econometric specifications.[27]

Table 3, column (1), reports estimated impacts on population from our preferred econometric specification. The estimated impact of lagged population (δ), which is reported in the first row, implies that population convergence is generally fast in the sample region and has a half-life of 21 years (ln(2)/0.033). Districts with 1% lower population, all else equal, are predicted to experience a 0.033 percentage point faster annual growth rate of population. This control variable captures the sense in which former-Morisco districts would be expected to experience faster population growth because their population had declined below their district steady-state, such that the subsequent rows report whether former-Morisco areas grew differently than expected. Districts' expected growth rates are also allowed to vary over time, using the former-Christian areas as a comparison group, and in a manner that varies with districts' geographic characteristics.

Population growth was substantially lower in former-Morisco areas from 1609 to 1622 (Table 3, column (1), row 2), which reflects the immediate decline in population following the Moriscos' expulsion. The annual population growth rate remained 2.5 to 1 percentage points lower than expected in former-Morisco districts from 1622 to 1786 (Table 3, column (1), rows 3–8). That is, while former-Morisco areas would be expected to grow faster after a large decline in population, the rate of population growth was slower than expected in all periods up to 1786.

Pooling the six estimated coefficients from 1646 to 1786, the bottom of column (1) reports that the annual growth rate was roughly 1.7 percentage points lower on average.[28] This estimate implies that the steady-state population would be 40% lower in former-Morisco areas, which roughly coincides with estimates from Table 2.[29] An F-test rejects the equality of the individual coefficients from this period; however, as the co-efficients are estimated to increase by roughly 1 percentage point over 100 years.[30] Still, population growth rates remain below expectation in former-Morisco districts in each observed period.

Column (2) reports estimates when omitting district fixed effects. The estimated convergence rate is substantially lower, consistent with the anticipated omitted

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[27] Our estimated rates of convergence would not only reflect the typical Malthusian channels of fertility and mortality to the extent that labour was mobile across districts, although our sense from the historical literature is that cross-district labour mobility was fairly restricted in periods other than the immediate aftermath of the Moriscos' expulsion.

[28] The pooled effect is found by estimating (2), replacing the year-specific Morisco variables with an interaction between districts' Morisco share and an indicator variable for the 1646–1786 period.

[29] Setting the growth rates equal to zero in both former-Morisco and former-Christian areas, the log ratio of these districts' steady-state population is equal to $-\beta/\delta$.

[30] The 100 year trend is found by estimating (2), replacing the year-specific Morisco variables with an average effect (as in the previous footnote) and a trend effect (in units of 100 years).

Table 3

Estimated Impacts on Population Growth from the Moriscos' Expulsion

	OLS		Arellano–Bond GMM		Constrained regression
	(1)	(2)	(3)	(4)	(5)
Log population$_{t-1}$	−0.0330**	−0.0045**	−0.0304**	0.0031	−0.01
	(0.0026)	(0.0009)	(0.0045)	(0.0075)	(−)
1622 × Morisco	−0.0627**	−0.0729**	−0.0654**	−0.0771**	−0.0709**
	(0.0074)	(0.0071)	(0.0069)	(0.0080)	(0.0076)
1646 × Morisco	−0.0249**	−0.0107**	−0.0253**	−0.0084	−0.0134**
	(0.0034)	(0.0029)	(0.0032)	(0.0050)	(0.0028)
1692 × Morisco	−0.0213**	−0.0072*	−0.0211**	−0.0040	−0.0095**
	(0.0041)	(0.0030)	(0.0040)	(0.0057)	(0.0030)
1712 × Morisco	−0.0169**	−0.0082	−0.0175**	−0.0069	−0.0097*
	(0.0041)	(0.0045)	(0.0035)	(0.0051)	(0.0044)
1730 × Morisco	−0.0188**	−0.0111**	−0.0194**	−0.0107*	−0.0128**
	(0.0043)	(0.0032)	(0.0039)	(0.0047)	(0.0033)
1768 × Morisco	−0.0132**	−0.0049	−0.0137**	−0.0044	−0.0067*
	(0.0035)	(0.0028)	(0.0033)	(0.0046)	(0.0027)
1786 × Morisco	−0.0093*	−0.0066*	−0.0103**	−0.0075	−0.0073**
	(0.0038)	(0.0026)	(0.0038)	(0.0036)	(0.0026)
District FE	Yes	No	N/A	N/A	Yes
Hansen J test			[0.061]	[0.415]	
AR(2) test			[0.007]		
AR(3) test				[0.264]	
Observations	757	757	653	653	757
Districts	98	98	98	98	98
R^2	0.859	0.782			
Pooled effect (1646–1786)	−0.0170**	−0.0081**	−0.0177**	−0.0076*	−0.0099**
	(0.0030)	(0.0018)	(0.0027)	(0.0034)	(0.0017)
F-test: Equality of coefficients (1646–1786)	[0.007]	[0.456]	[0.002]	[0.457]	[0.316]
100-year trend (1646–1786)	0.0106**	0.0030	0.0103**	0.0018	0.0042
	(0.0029)	(0.0023)	(0.0027)	(0.0023)	(0.0022)

Notes. Except as noted below, each column reports estimates from regressing the annualised growth rate in population on the lagged level of population, the district's Morisco population share in 1609 interacted with year, district fixed effects, year fixed effects and seven district geographic characteristics interacted with each year (distance to the City of Valencia, distance to the coast, terrain ruggedness, latitude and longitude, average rainfall and agricultural suitability). Column (1) is our baseline specification, whereas Column (2) omits distict fixed effects. Column (3) implements an Arellano–Bond GMM estimator using all further lagged values of population as instruments and Column (4) omits the twice-lagged values as instruments. Column (5) constrains the impact of lagged population to be −0.01. Robust standard errors clustered by district are reported in parentheses: **denotes statistical significance at the 1% level, *at the 5% level. For the six-year-specific Morisco coefficients between 1646 and 1786, the Table reports: the estimated average coefficient; a F-test on these coefficients' equality; and the estimated 100-year change in coefficients.

variables bias, and the estimated half-life increases to 154 years (row 1). Population growth remains below expectation after the expulsion, although the coefficients are no longer statistically significant in each period (rows 3–8). The annual population growth rate is lower by a statistically significant 0.8 percentage points from 1622 through 1786, on average and an F-test does not reject the equality of the year-specific coefficients.

Columns 3 and 4 report the results when estimating (2) using GMM (Arellano and Bond, 1991). Column (3) reports similar estimates as column (1), although there are indications of second-order serial correlation that would violate the exclusion

restriction for some of the instrumental variables. As an adjustment, Column (4) reports estimates when restricting the instruments to be third-order (or greater) lagged values of population. There is no indication of third-order serial correlation, but the lagged impact of population is imprecisely estimated and has the 'wrong sign'. Despite there being no estimated expectation of convergence, population growth still remains lower than expected in former-Morisco districts up to 1786. The individual estimates are mostly not statistically significant but the pooled estimate is more precise and statistically significant and we do not reject the equality of the estimated coefficients.

Column 5 reports estimates when constraining the impact of lagged population to be −0.01 (row 1), which reflects a convergence half-life of roughly 70 years. This parameter value reflects a typical estimate of population convergence rates in the Malthusian era (Lee, 1973 1987, 1993; Lee and Anderson, 2002), with other values ranging between −0.0065 and −0.0136. When constraining the half-life of convergence to be roughly 70 years, the former-Morisco areas have depressed population growth rates between 1622 and 1786. The estimated magnitudes are between those in columns (1) and (2), and closer to the estimates in column (2).

Table 4, column (1), reports estimated impacts on output from our preferred specification, where district output is proxied by the recorded value of Church tithe auctions. In general, output is estimated to converge with a half-life of roughly 32 years. The annual growth rate of output is substantially lower in Morisco areas from 1609 to 1622, which reflects the initial impact of the Moriscos' expulsion. Output continues to grow at a lower rate than expected for some time, although former-Morisco areas are mostly converging along the expected growth path through the eighteenth century. There is a positive trend in these coefficients, for periods from 1646 to 1786, that is of the same magnitude as the positive trend in the population coefficients from column 1 of Table 3.

Columns (2) to (4) report estimates from alternative empirical specifications, which generally continue to show slowed initial output growth and convergence in later periods. Column (2) reports estimates when omitting district fixed effects, which increases the estimated half-life of convergence to 578 years and is likely to reflect omitted variables that influence districts' steady-state output.[31] Column (3) reports results when estimating (2) using GMM and there is no indication of second-order serial correlation that might invalidate the instrumental variables used. Column (4) reports estimates when constraining the convergence rate for output, as in Table 3.

The estimated declines in output are generally smaller in magnitude than the estimated declines in population, comparing the estimates in column (1) of Tables 3 and 4. Column (5) reports the difference in these coefficients, and their standard error, from estimating both regressions in a seemingly unrelated regression framework. Output recovers faster than population in each period, relative to the expected convergence in output and population.

Table 5 reports results from directly estimating changes in output *per capita*, which is a more restricted specification than comparing the separately estimated impacts on output and population. Column (1) reports that output *per capita* grew substantially in

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[31] With substantial variation in districts' steady-state output, there will generally appear to be slow convergence when low-output districts do not grow faster than high-output districts.

Table 4

Estimated Impacts on Output Growth from the Moriscos' Expulsion

| | OLS | | Arellano–Bond GMM | Constrained regression | SUR: T4c1–T3c1 |
	(1)	(2)	(3)	(4)	(5)
Log output$_{t-1}$	−0.0214**	−0.0012**	−0.0099*	−0.01	
	(0.0022)	(0.0004)	(0.0045)	(−)	
1622 × Morisco	−0.0483**	−0.0540**	−0.0515**	−0.0516**	0.0144*
	(0.0056)	(0.0056)	(0.0054)	(0.0058)	(0.0058)
1646 × Morisco	−0.0141**	−0.0076*	−0.0106**	−0.0104**	0.0107**
	(0.0036)	(0.0030)	(0.0032)	(0.0032)	(0.0036)
1692 × Morisco	−0.0081**	−0.0012	−0.0044	−0.0043	0.0132**
	(0.0023)	(0.0028)	(0.0023)	(0.0022)	(0.0034)
1712 × Morisco	−0.0052	−0.0042	−0.0048	−0.0048	0.0117**
	(0.0030)	(0.0029)	(0.0025)	(0.0029)	(0.0042)
1730 × Morisco	−0.0060*	−0.0062*	−0.0063*	−0.0062*	0.0128**
	(0.0028)	(0.0029)	(0.0024)	(0.0027)	(0.0044)
1768 × Morisco	−0.0029	−0.0035	−0.0034	−0.0033	0.0103**
	(0.0025)	(0.0021)	(0.0019)	(0.0021)	(0.0033)
1786 × Morisco	0.0014	−0.0020	−0.0007	−0.0006	0.0107**
	(0.0038)	(0.0036)	(0.0034)	(0.0036)	(0.0039)
District FE	Yes	No	N/A	Yes	
Hansen J test			[0.212]		
AR(2) test			[0.809]		
Observations	773	773	674	773	
Districts	98	98	98	98	
R^2	0.852	0.792			
Pooled effect (1646–1786)	−0.0057**	−0.0041*	−0.0045*	−0.0049**	
	(0.0022)	(0.0020)	(0.0018)	(0.0019)	
F-test: Equality of coefficients (1646–1786)	[0.005]	[0.282]	[0.088]	[0.086]	
100-year Trend (1646–1786)	0.0099**	0.0025	0.0063*	0.0056**	
	(0.0025)	(0.0019)	(0.0025)	(0.0021)	

Notes. Except as noted below, each column reports estimates from regressing the annualised growth rate in output per km^2 on the lagged level of output, the district's Morisco population share in 1609 interacted with year, district fixed effects, year fixed effects and seven district geographic characteristics interacted with each year (distance to the City of Valencia, distance to the coast, terrain ruggedness, latitude and longitude, average rainfall and agricultural suitability). Column (1) is our baseline specification, whereas Column (2) omits distict fixed effects. Column (3) implements an Arellano–Bond GMM estimator using all further lagged values of output as instruments. Column (4) constrains the impact of lagged output to be −0.01 Robust standard errors clustered by district are reported in parentheses: **denotes statistical significance at the 1% level, *at the 5% level. For the six-year-specific Morisco coefficients between 1646 and 1786, the Table reports: the estimated average coefficient; a F-test on these coefficients' equality; and the estimated 100-year change in coefficients. Column (5) reports the difference between Morisco coefficients in column (1) of this Table and Table 3.

former-Morisco areas immediately following the Moriscos' expulsion. The estimated impact of lagged output *per capita* implies that areas experiencing higher output *per capita* should converge to steady-state fairly quickly, yet former-Morisco areas experienced lower convergence (or higher growth) than expected up to 1786. Column (2) omits district fixed effects, which reduces the estimated convergence rate and the persistence of higher output *per capita* growth in former-Morisco areas. Column (3) constrains the convergence rate, which also reduces the estimated magnitudes in later periods.[32]

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[32] If we assumed a faster convergence rate, such as the 2% rate of convergence often estimated in the modern era, the persistent impacts on output *per capita* would be larger.

Table 5

Estimated Impacts on Output Per Capita Growth from the Moriscos' Expulsion

	OLS		Constrained regression	Arellano–Bond GMM	
	(1)	(2)	(3)	(4)	(5)
Log output *per capita*$_{t-1}$	−0.0324**	−0.0085**	−0.01	−0.0374**	−0.0354**
	(0.0025)	(0.0017)	(−)	(0.0034)	(0.0035)
1622 × Morisco	0.0175**	0.0204**	0.0189**	0.0170**	0.0181**
	(0.0060)	(0.0063)	(0.0069)	(0.0053)	(0.0054)
1646 × Morisco	0.0053	0.0018	0.0022	0.0055	0.0068
	(0.0039)	(0.0037)	(0.0039)	(0.0037)	(0.0039)
1692 × Morisco	0.0079*	0.0057	0.0053	0.0081*	0.0098**
	(0.0035)	(0.0035)	(0.0040)	(0.0034)	(0.0035)
1712 × Morisco	0.0099*	0.0047	0.0048	0.0106*	0.0120**
	(0.0048)	(0.0049)	(0.0055)	(0.0045)	(0.0046)
1730 × Morisco	0.0119*	0.0059	0.0056	0.0131**	0.0146**
	(0.0050)	(0.0044)	(0.0047)	(0.0051)	(0.0054)
1768 × Morisco	0.0097*	0.0028	0.0039	0.0110*	0.0125**
	(0.0040)	(0.0034)	(0.0034)	(0.0043)	(0.0047)
1786 × Morisco	0.0122**	0.0066	0.0073	0.0132**	0.0148**
	(0.0046)	(0.0039)	(0.0042)	(0.0045)	(0.0047)
District FE	Yes	No	Yes	N/A	N/A
Hansen J test				[0.131]	[0.390]
AR(2) test				[0.668]	[0.406]
Observations	747	747	747	642	642
Districts	98	98	98	98	98
R^2	0.671	0.481			
Pooled effect (1646–1786)	0.0094**	0.0046	0.0048	0.0094**	0.0107**
	(0.0033)	(0.0025)	(0.0026)	(0.0033)	(0.0035)
F-test: Equality of coefficients (1646–1786)	[0.728]	[0.847]	[0.943]	[0.551]	[0.498]
100-year trend (1646–1786)	0.0043	0.0019	0.0024	0.0049	0.0050
	(0.0030)	(0.0023)	(0.0025)	(0.0030)	(0.0029)

Notes. Except as noted below, each column reports estimates from regressing the annualised growth rate in output *per capita* on the lagged level of output per capita, the district's Morisco population share in 1609 interacted with year, district fixed effects, year fixed effects and seven district geographic characteristics interacted with each year (distance to the City of Valencia, distance to the coast, terrain ruggedness, latitude and longitude, average rainfall and agricultural suitability). Column (1) is our baseline specification, whereas Column (2) omits distict fixed effects. Column (3) constrains the impact of lagged output *per capita* to be −0.01. Column (4) implements an Arellano–Bond GMM estimator using all further lagged values of output *per capita* as instruments, and Column (5) constrains the further lagged values of output *per capita* to have the same impact in each year. Robust standard errors clustered by district are reported in parentheses: **denotes statistical significance at the 1% level, * at the 5% level. For the per year-specific Morisco coefficients between 1646 and 1786, the Table reports: the estimated average coefficient; a F-test on these coefficients equality; and the estimated 100-year change in coefficients.

Pooling the estimates from 1646 to 1786, in columns (2) or (3), the continued growth in output *per capita* is marginally statistically greater in former-Morisco areas.

Columns (4) and (5) report similar estimates to column 1, based on GMM estimates of (2). Column (4) reports estimates using all further lagged values of output *per capita* as instruments for the lagged value of output *per capita* (Arellano and Bond, 1991), although the Hansen J test marginally indicates potential bias from some of the included instruments. Column (5) restricts the included instruments to have the same impact in each sample year, which yields very similar results and less indication of bias.

Overall, these dynamic panel regressions indicate the Moriscos' expulsion had large initial impacts that were often persistent. Population declined greatly in former-Morisco areas and, in contrast to the average fast convergence rate, population growth in former-Morisco areas remained slower than expected up to 1786. Output also declined in former-Morisco areas, although output more quickly grew along the expected growth path. Comparing the estimated impacts on population growth and output growth, or directly estimating the impacts on growth of output *per capita*, output *per capita* increased immediately after the Moriscos' expulsion and continued to increase more than expected (or converge slower than expected) through 1786.

4. Historical Interpretations

The empirical results indicate that the Moriscos' expulsion had long-lasting impacts on former-Morisco areas. The estimated decline in population is persistent in former-Morisco areas, conditional on the estimated convergence rate for population generally in the sample region. In the Malthusian era, a decline in population and a corresponding increase in output *per capita* are typically associated with convergence in population through migration, increased fertility and decreased mortality, leading to convergence in output *per capita*. By contrast, following the Moriscos' expulsion, there were sustained increases in *per capita* output in former-Morisco areas. Below, we discuss some potential explanations for this estimated persistence.

4.1. *Persistence of Extractive Institutions*

One contributing factor may have been a persistence of extractive institutions in former-Morisco areas, which may have slowed population convergence by limiting labour income. While output *per capita* was higher in former-Morisco districts, the imposition of high tax rates on Christians in these areas would discourage further migration and demographic responses through fertility and mortality. Casey (2008, p. 24) notes that birth rates remained low in former-Morisco areas, despite a relatively high land-to-labour ratio after the expulsion. The population in these areas also may have suffered 'nutritional deficiencies', perhaps increasing mortality rates. Casey (2008, pp. 24, 44) attributes these phenomena, in part, to 'the low level of economic development' due to the 'harshness of the new [post-expulsion] seigneurial rent terms'.

We do not have direct evidence that extractive institutions delayed population convergence through these Malthusian channels but we have brought together some historical accounts and new data that suggest there was indeed a persistence of extractive institutions in former-Morisco areas. We discuss this institutional persistence at some length, as it is also of independent interest that extractive institutions persisted in former-Morisco areas despite increased labour scarcity following the Moriscos' expulsion. This historical episode provides an interesting example in which labour scarcity created an historical 'critical juncture' (Acemoglu and Robinson, 2012), after which institutions remained extractive due to heightened financial incentives and elites' ability to restrict workers' outside options (Acemoglu and Wolitzky, 2011). We

discuss some qualitative and quantitative indications that, for 200 years after the Moriscos' expulsion, Christians faced very different institutional regimes depending on whether their areas were settled earlier by Moriscos.

4.1.1. *The peasant revolt of 1693*

There was a Christian peasant uprising in 1693, which appears to have been in response to the continued harshness of extractive institutions in former-Morisco areas. There were reports in 1689 that some peasants in former-Morisco areas had begun to 'conspire to not pay the dues that they had always paid to their lord' (ACA, CA, leg. 579, 53/2), and formal legal proceedings were initiated to evaluate peasants' claims that peasants' historical privileges had rendered illegal the extractive institutions imposed after the expulsion of the Moriscos. The peasants' claims were rejected in February 1693, and the extractive institutions were upheld, on the grounds that King Philip III had allowed the nobility to impose high taxes in former-Morisco areas in exchange for assuming the Moriscos' debts.[33] The peasants appealed the case to the King, although the case was referred back to a tribunal in Valencia that was likely to rule against the peasants (García Martínez, 1991, p. 268).

On 9 July 1693, a peasant revolt began with the arrest of four peasants who refused to supply their noble's share of the crops. The revolt spread to include between 4,000 and 6,000 peasants, culminating in a battle on the 15 July in which the peasants were defeated (García Martínez, 1991, pp. 270–72). A list of the names and homes of 36 leaders of this revolt (ACA, CA, leg. 579, 50/2) provides some quantitative evidence that the extractive institutions were relatively harsh in former-Morisco areas: all of the revolt leaders are recorded as being from former-Morisco areas.[34] Given this stark relationship in the data, an actual regression analysis is unnecessary.

4.1.2. *Spanish war of succession, 1700–14*

Peasant discontent continued in former-Morisco areas after the suppression of the revolt. During the Spanish war of succession, peasants from former-Morisco areas supported the Austrian archduke's claim to the Spanish throne. Supporters of the archduke sent one of the 1693 rebellion leaders to gain peasant support in Valencia, promising freedom from oppressive taxes (Kamen, 2001, p. 45). The archduke lost the war, however, and the extractive institutional framework remained in place.

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[33] The document providing the legal decision states that the areas of Valencia 'newly populated after the expulsion of the Moriscos wished to become free of the many charges and taxes that they pay their lords' (ACA, CA, leg. 579, 53/3). It continues by summarising the five legal arguments made by the peasants' appointed legal representatives, and provides a detailed refutation of each argument. The peasants' general argument is that when King Philip III ceded the Moriscos' belongings to the nobles, this was done on the condition that the nobles charge taxes comparable to those in former-Christian areas. The council rejected this claim, as King Philip III had also obliged the nobles to assume the Moriscos debts and in exchange 'the nobles legitimately established the [harsh] conditions of repopulation with the agreement of the new vassals'. Furthermore, the council noted that had Philip III not allowed the nobility to impose higher extraction rates following the expulsion 'the King would have not given the nobles anything, rather he would have only loaded them with the community and individual debts of the Moriscos'.

[34] After merging this list with districts' Morisco population share in 1609, all of the merged leaders are from districts with a large population share of Moriscos.

Additional testimony from the seventeenth and eighteenth centuries suggest that the former-Morisco areas retained a relatively harsh institutional framework. One historian sums up this evidence by noting that peasants in former-Morisco areas who were '[u]nable to pay the high rents introduced after the expulsion', sometimes became 'recruits for the bandit gangs which were so active in the kingdom' (Casey, 2008, p. 101). An observer in the early eighteenth century noted that the nobles in Valencia 'enjoy such exorbitant taxes and dues from many of their vassals that they turn them from free men into slaves, or else into desperadoes, who take to robbing on the highways and stirring up trouble rather than work in the fields' (cited in Casey, 2008, p. 114). Another contemporary in the eighteenth century noted that inhabitants of former-Morisco areas 'are loaded with seignorial tributes and appear to only work to fill the coffers of their lords' (Cavanilles, 1958, p. 202).

4.1.3. *Institutional control in 1786*

As a proxy for the geographic distribution of extractive institutions, we have obtained data on whether particular areas were under the control of a secular noble in 1786.[35] The institutional framework in Valencia is thought to have been harsher (on average) in areas controlled by the nobility (Halperin, 2008, p. 59), although we do not have direct data on the persistence of extractive institutions themselves.

The Census of Floridablanca indicates whether particular towns were under the jurisdiction of a secular noble ('señorío secular') (Instituto Nacional de Estadística, 1991). We merge these data to our geographic tithing districts and assign each district the fraction of towns under the control of nobles.[36]

Districts with a higher Morisco population share in 1609 are substantially more likely to be under noble control in 1786. The estimated percentage of towns under noble control in 1786 rises from 56% in former-Christian districts to 98% in former-Morisco districts, and this difference is highly statistically significant with a standard error of 8%.[37] This result suggests that the institutional framework continued to be harsher in former-Morisco areas following the expulsion.[38] It is important to note here, however, that historians have generally posited a two-tiered seignorial regime in Valencia. In contrast to the extractive framework suffered in former-Morisco areas, noble areas that

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[35] Here, we assume that the Census of Floridablanca measured institutions the same year it measured population.

[36] The Census of Floridablanca provides the modern-day municipality for each population centre, as of 1990. We reconstructed these municipal boundaries using the 2012 boundaries (http://www.arcgis.com/home/item.html?id=2e47bb12686d4b4b9d4c179c75d4eb78) and information on municipal splits from the Spanish Institute of Statistics (http://www.ine.es/intercensal/?L=0). We assigned a town centre to a tithing district if the centroid of its modern municipality falls within the boundary of that tithing district. One tithing district (Canet de Berenguer) has no 1786 data within its boundaries and so that district is dropped from the sample.

[37] These estimates are from regressing the fraction of towns under noble control on the district's Morisco population share in 1609. The estimated constant is 0.561 and the estimated impact of Morisco population share is 0.414 with a robust standard error of 0.078. Controlling for districts' geographic characteristics, the estimated difference is 0.379 with a robust standard error of 0.086.

[38] We have also experimented with including ecclesiastical lordships and areas controlled by military orders in our definition of lands controlled by the nobility, such that the omitted group is land controlled by the Crown. In this case, the estimated constant is 0.82 and the estimated impact of Morisco population share is 0.17 with a robust standard error of 0.049. Controlling for districts' geographic characteristics, the estimated difference is 0.14 with a robust standard error of 0.050.

had been inhabited by Christians prior to the expulsion are thought to have had a more benign institutional framework that was closer to that prevailing on royal lands (Ciscar, 1993, pp. 185–6).[39] Thus, we expect that the difference in the fraction of lands under noble control is an understatement of the institutional differences between former-Christian and former-Morisco areas.

4.1.4. *Abolition of extractive institutions, 1808–13*

Popular opposition to this institutional framework appears to have intensified in the late eighteenth century, although Napoleon's invasion of Spain in 1808 marked the beginning of the end of the Spanish Ancien Regime. In 1808, Napoleon declared the abolition of the Spanish seignorial regime (De Moxó, 1965, p. 16). The independent Spanish government made a similar pronouncement in 1811. In 1811, one Valencian representative cited the Moriscos' expulsion as when 'all the evils that Valencia suffers today began' (Ardit, 1977, p. 181) and noted in 1813 that those who repopulated the formerly Morisco areas 'substituted the expelled in their slavery' and sarcastically asked whether 'after receiving illegal and exorbitant tributes for over two centuries have the nobility finally been compensated for the losses that they claimed [following the expulsion]?' (De Moxó, 1965, pp. 206–7).

Notably, the application of the 1811 declaration was delayed in Valencia until the final evacuation of French troops in 1813. French forces appear to have found the existing seignorial regime useful to fund military actions and to ensure support from Valencia's nobility (Ardit, 1977, pp. 157–8, 202, 204–5).

The final dismantling of Valencia's seignorial regime stretched over the following decades. During this period, the former-Morisco areas of Valencia experienced some of the 'greatest conflict' in Spain, including 'violent confrontations' between nobles and their vassals (Artola, 1978, pp. 172–3). As the differential treatment of former-Morisco areas was removed, observers decried the impoverished state of inhabitants in former-Morisco areas (Ardit, 1968, p. 37). The extractive institutional framework in former-Morisco areas may have had long-term effects even after its final dissolution, contributing to the delay in Valencian industrialisation (García, 1974).

4.2. *Cultural and Demographic Differences Between Moriscos and Christians*

Extractive institutions in former-Morisco areas are however, only one potential factor, which might have contributed to the sustained decreases in population and increases in output *per capita* in former-Morisco areas. This institutional interpretation stresses that high tax rates discouraged in-migration of Christians and prevented high output *per capita* from translating into high consumption *per capita* and impacting mortality and birth rates. If the institutional framework remained roughly constant before and after the expulsion, however, then it is difficult to understand why the steady-state population should remain significantly lower in former-Morisco areas in the absence of

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[39] While a substantial fraction of towns continued to be under the control of secular nobles in former-Christian districts, the nobility was substantially restricted in their ability to extract resources in areas populated by Christians following the reconquest.

other factors.[40] One potential explanation is that some authors, most prominently Ciscar (1977, 1993), have argued that the institutional framework eventually imposed even higher monetary costs on Christians than on the Moriscos. The historical evidence is less clear on how the degree of extraction changed in Morisco areas following the expulsion, however, as compared to the general persistence of extractive institutions in some form.

Another potential interpretation stresses the importance of systematic differences in the demographic equilibrium across Morisco and non-Morisco areas prior to the expulsion. Some contemporaries believed there were systematic differences between Moriscos and Christians that, all else equal, would lead to higher population density in Morisco areas. Drawing on the previous historical background, it seems plausible that the Morisco population retained distinctive practices after its forced conversion to Christianity. Relevant differences could include different preferences for child quality *versus* child quantity (Galor and Moav, 2002), differences in fertility or mortality (Galor and Weil, 1996; Voigtlander and Voth, 2009, 2013*a*, *b*), or differences in subsistence consumption levels (Abdus and Rangazas, 2011).

For example, contemporaries claimed that the age of marriage of Morisco girls was much lower than among Christians (Casey, 1971, p. 30). To the extent that this claim is true, it would generally be associated with higher lifetime fertility in the Morisco population.[41]

In another example, contemporary observers stressed that Morisco populations survived on less than their Christian counterparts.[42] Indeed, in the decades prior to the Moriscos' expulsion, observers claimed that the Morisco populations were growing at a faster rate than Christian populations and routinely attributed this differential growth to the fact that Moriscos consumed less than their Christian counterparts.[43]

Overall, a shift in cultural and demographic characteristics may have resulted in a change in the Malthusian equilibrium following the Moriscos' expulsion, contributing to the persistent decrease in population and increase in *per capita* output. Some caution is required in interpreting these historical accounts, however, as Casey (1971, p. 30) argues that contemporary testimony regarding demographic and cultural differences between Moriscos and Christians was generally provided by Christian writers whose views were often biased. Furthermore, an interpretation based only on shifting cultural and demographic characteristics is less consistent with poverty-induced impacts on mortality and fertility that have been associated with former-Morisco areas (Casey,

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[40] Note also, that the imposition of more-extractive institutions on Moriscos should have depressed population density and raised *per capita* output in former-Morisco areas prior to the expulsion. As we note above, however, it is difficult to use cross-sectional variation to test these predictions prior to the expulsion due to confounding geographic factors and potential differences in the Church's share of the tithe across districts.

[41] It is worth noting, however, that more recent analysis of archival data has shown a similar female age at marriage in Christian and Morisco communities (Casey, 2008, p. 18).

[42] One seigniorial agent noted that prior to the expulsion Moriscos could subsist on less than 1/7th the land needed by the Christian resettlers (Casey, 2008, p. 43). Another ecclesiastical official noted in 1582 that Christians needed twice what Moriscos needed to subsist (Ardit, 2009*a*, p. 67).

[43] One characteristic quote comes from a bishop in 1587 who claimed that 'in a very few years [the Moriscos] will multiply in such a way that they will surpass [the Christians because the Moriscos] collect everything and do not spend as they neither eat, nor drink, nor wear clothes or shoes' (Ardit, 2009*a*, p. 68).

2008, p. 24). We expect that some combination of many of these factors contributed to the persistent decrease in population and increase in *per capita* output.

4.3. *Technological Adaptation*

In contrast to the estimated persistent declines in population, output recovered more quickly in former-Morisco areas. Initial increases in output *per capita* should, in principle, have been sufficient to encourage population convergence but it is interesting to consider what factors might have driven the comparatively faster convergence in output.

One potential explanation is that Christian migrants reacquired location-specific human capital that had been lost with the expulsion of the Moriscos, or otherwise adapted to agricultural production in former-Morisco areas. The empirical results are not sensitive to controlling for geographic characteristics, interacted with time, which suggests a limited direct role for geographic differences between former-Morisco and former-Christian areas. Christian migrants might have overcome temporary challenges, however, in adapting to geographically different former-Morisco areas.

Indeed, there are some indications that Moriscos and Christians had differential economic performance in geographically different areas. Prior to the expulsion, population and output are more sensitive to rainfall and agricultural suitability in Morisco districts: in districts with a greater Morisco population share, population and output increase by more in districts with higher rainfall and agricultural suitability. Moriscos may have taken better advantage of better geographic conditions or, equivalently, were more negatively impacted by worse geographic conditions.[44] If Christians learned over time to exploit better geography and continued to be hurt less by worse geography, that would contribute to higher output over time.

Former-Morisco and former-Christian areas had similar fractions of lands with higher rainfall and higher agricultural suitability, however, so Christian migrants may not have been entirely unfamiliar with former-Morisco lands.[45] Instead, the estimated interaction effects could reflect unobserved land quality in former-Morisco districts varying more with our measured geographic characteristics. Unobserved differences in land quality would be absorbed by district fixed effects in the main analysis but could confound the estimation of these cross-sectional differences in the pre-expulsion period.

Another potential explanation for the recovery in output is that persistent labour scarcity encouraged labour-saving agricultural adaptation. Labour-saving technological adaptation is not typically associated with the Malthusian era because population itself responds to labour scarcity. If this population response is slow, however, then there remains substantial incentive for labour-saving technological adaptation in the Malthusian era. Adaptation to labour scarcity in the Malthusian era may then not be

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[44] In particular, from a regression interacting the Morisco population share with rainfall or agricultural suitability, there is generally a more positive impact of better geography in districts with more Moriscos. We include only rainfall or agricultural suitability, as the two measures of geographic productivity are highly correlated and the estimates are unstable when both are included.

[45] From a regression of districts' Morisco population share in 1609 on districts' geographic characteristics, rainfall and agricultural suitability do not substantively or statistically predict Morisco population share.

entirely distinct from adaptation in the modern growth era (Habakkuk, 1962; Allen, 2009; Acemoglu, 2010), with particular parallels between the Spanish Moriscos' expulsion and the decrease in black population following the 1927 Mississippi flood (Hornbeck and Naidu, 2014).

Systematic district-level data are unavailable for a formal analysis of production adjustments in former-Morisco areas relative to former-Christian areas, although some historical accounts are consistent with labour-saving production adjustments. Ardit (2009*a*, *b*) describes former-Morisco areas shifting from the cultivation of cereals to the production of cash crops in the century following the expulsion.[46] These areas also experienced a shift in the distribution and management of agrarian property toward larger farm sizes, which is generally associated with decreased labour intensity.

Labour-saving technological adaptation could simply have taken the form of recovering capital stocks, although the Moriscos' expulsion does not appear to have substantially decreased capital stocks below steady-state levels. While Moriscos were able to take whatever goods they could carry, the rest of the capital stock remained in former-Morisco areas. In areas with substantially lower population after the expulsion, there may even have been too much capital relative to the optimal long-run steady-state. Shortly after the expulsion, capital stocks appear to have been allowed to depreciate in former-Morisco areas. By the 1640s, a seignorial administrator attempted to incentivise the upkeep of physical structures that were in 'ruin and a terrible state' (Ciscar, 1975, p. 159).

5. Conclusion

Depictions of the Malthusian era generally focus on the long-run constancy of output *per capita*, as population growth dissipates increases in output *per capita* from technological advance or population decline. Empirical analysis of the Malthusian era is generally constrained, however, by data limitations and the absence of natural experiments. Most large population shocks, such as the Black Death, affected broad regions and it is difficult to identify impacts over subsequent decades and centuries.

The Moriscos' expulsion offers a uniquely detailed empirical view of population and output dynamics in the Malthusian era, combining district-level data with a large population shock that is geographically differentiated. The empirical analysis compares districts with a greater Morisco population share to a plausible historical counterfactual, represented by districts with a smaller initial Morisco population share. Furthermore, the analysis is able to control for other changes that might differ with local geographic characteristics. We first consider relative changes in population, output and *per capita* output, and then explicitly estimate convergence rates and impacts of the expulsion on the growth rate of each outcome.

After the Moriscos' expulsion in 1609, districts with a greater Morisco population share experienced a substantial relative decline in population. Population convergence was generally fast in the sample region but population convergence was delayed until 1786 in former-Morisco districts. Output declined in former-Morisco areas after the

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[46] In particular, one former-Morisco area shifted 50% of irrigated land from cereals to mulberry trees, whose leaves were used to feed silk worms.

expulsion but converged more quickly than population. Output *per capita* increased immediately after the expulsion and remained higher until 1786. While increases in output *per capita* typically resulted in convergence across the sample region, there were sustained higher rates of growth in output *per capita* in former-Morisco districts.

Our empirical analysis focuses on the relative effects of the Moriscos' expulsion, comparing former-Morisco and former-Christian areas. The aggregate effects of the expulsion would differ if there were spillover effects from the expulsion on former-Christian areas and we expect that labour outflows from former-Christian areas would decrease those areas' output such that aggregate economic losses were greater than the relative losses in former-Morisco areas. Indeed, one line of the historical literature considers the Moriscos' expulsion to have contributed to the economic decline of Spain in the seventeenth century (Hamilton, 1938).

The Moriscos' expulsion generated substantial and persistent labour scarcity in former-Morisco districts, and it is also interesting to consider how this affected the evolution of extractive institutions. Labour scarcity might have encouraged the relaxation of extractive institutions but these extractive institutions were perpetuated due to the co-ordinated financial incentives of powerful elites. Nobles and their creditors were heavily dependent on revenue streams from Morisco peasants and the Moriscos' expulsion threatened to collapse the socio-economic system. The King helped to co-ordinate a settlement that maintained high rates of extraction in former-Morisco areas, rather than risk radical social changes along with the widespread confiscation of nobles' landholdings. Extractive institutions were supported by restrictions on worker mobility and accumulated debt obligations and only collapsed with Napoleon's invasion of Spain. These institutional responses illustrate how labour scarcity might empower workers but how labour scarcity encourages elites to co-ordinate and strengthen efforts to coerce workers. Previous research has demonstrated that historical institutions impact modern economic growth and this historical episode provides some insights into how historical institutions might persist and evolve.

In a Malthusian era perhaps best known for long-run convergence in population and output *per capita*, the Moriscos' expulsion had long-lasting impacts on population and output *per capita*. There are some fundamental limitations to our ability to identify which factors are driving this persistence, although we discuss several potential contributing factors related to local extractive institutions, cultural differences and technological adaptation. This historic episode does provide an unusually rich empirical setting to examine Malthusian dynamics, however, highlighting that there can be sustained differences in *per capita* output in the Malthusian era.

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Additional Supporting Information may be found in the online version of this article:

Data S1.

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