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The effect of settler farming on indigenous agriculture: Evidence from Italian Libya

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Abstract

What effect did the settlement of European farmers have on the indigenous agricultural sector during the colonial period? On the one hand, European immigrants imported skills and capital but, on the other, they took control of local resources. By looking at the short-term effect of Italian farming in colonial Libya, I shed new light on this question. Through regression analysis on a novel village dataset covering the entire country, I show that, in 1939, proximity to Italian farms was associated with significantly lower land productivity relative to distant locations. Lower yields can be explained by the adoption of land-extensive cultivation techniques, implemented by indigenous farmers to counteract a labour drain operated by Italian farms through factor markets. The combined mitigating effect of monetary wages and land-extensive farming only partially compensated for the fall in income linked to reduced land productivity.

KEYWORDS
agricultural development, colonialism, dual economy, settler economy

JEL CLASSIFICATION
N57, O1, O13, O15

African settler colonies, namely those territories with a large population of European immigrants, developed some of the most unequal societies in Africa and across the globe. In Kenya, Zimbabwe, South Africa, and Algeria, just to mention some of the most striking cases, agricultural settlers seized large shares of fertile land and set up political systems intended to keep African peasants in a subordinate position, while often importing new technologies, capital, and skills to boost their own productivity.[1] Affected regions developed dual economies and unprecedented levels of economic and social inequality that persisted well into the post-colonial period.[2] Despite the importance of this phenomenon for the economic history of Africa, the transformative effect of European settlement on the indigenous agricultural sector is poorly understood. To the best of my knowledge, the existing literature has not attempted to identify the effect of European agricultural settlement on indigenous patterns of agricultural production with quantitative methodologies, nor has it tried to disentangle the effect of European settlement and farming from openly discriminatory policies, such as land expropriation and forced labour. By studying the consequences of Italian settlement in Libya in 1939, this article enhances our understanding of the impact of settler farming on indigenous productivity and of its mechanisms, while also shedding new light on a largely understudied colonial setting.

Between 1922 and 1940, roughly 40 000 Italian farmers settled in Libya.[3] These colonists, who relied mostly on private capital until the early 1930s, and increasingly on state-financed settlement projects thereafter, formed a farming elite capable of deploying substantial amounts of capital and new technologies. These features set them apart from traditional Libyan farming and split the country between an Italian commercial sector and a Libyan subsistence one.[4] The Italian authorities committed many atrocities during the process of systematic subjugation of the Libyan population[5] and seized large amounts of land traditionally used for grazing and shifting cultivation.[6] The Libyan sedentary farming sector, however, was preserved, owing to considerations of political convenience and fear of social unrest.[7] The colonists, therefore, were only allowed to settle on land that was not under permanent cultivation before their arrival, which excluded them from the most fertile coastal and pre-desert oases.[8]

This peculiar process of land allocation shaped a distribution of Italian farmers across the country that was largely independent from pre-colonial farming patterns (orthogonal to traditional patterns of Libyan production, that is) and, thus, provides relevant insights for other settings characterised by European settler farming. In fact, when the settlers systematically expropriated, and selected into, the best land, as in the case of South Africa, Algeria, and Kenya, it is difficult to unbundle the composite effect of market forces linked to the presence of the settlers and of discriminatory policies. Disentangling these two mechanisms is key to understanding the economic dynamics at play in settler colonies but is difficult, owing to the lack of

[1] The term 'settler' is used in line with Mosley, *Settler economies*, p. 5 and consistent with the definition given by Cavanagh and Veracini, *Routledge handbook*, p. 4: 'Everyone is a settler if they are part of a collective and sovereign displacement that moves to stay, that moves to establish a permanent homeland by way of displacement'. It indicates all agricultural colonists, both those who invested private capital and those involved in state-managed settlement projects.

[2] Lützelschwab, 'Settler colonialism'.

[3] Fowler, 'Decolonization', p. 493.

[4] Wheatley, *Report to the government*; Theodorou, *Report to the government*.

[5] Del Boca, *Gli italiani in Libia*.

[6] Cresti, *Non desiderare*; Segrè, *Fourth shore,* pp. 50–1.

[7] Segrè, *Fourth shore*, p. 52.

[8] Ibid, pp. 151–3.

counterfactual scenarios where factors of production were not violently taken away from the local population in concurrence with the settlement of the colonists. In Libya, sedentary cultivators were allowed to keep their fields and even received some form of support from the state[9], while forced labour was arguably non-existent.[10] Thus, while significant amounts of grazing land were taken away from pastoralists and tribal groups practising shifting cultivation, permanent farmers were shielded from overt discrimination. The Libyan context, therefore, allows one to shed light on the direct effect of settler farming on indigenous productivity and to isolate its economic mechanisms, thanks to the absence of overt discriminatory policies against sedentary cultivators.

To address this issue empirically, I collect data from the 1938–9 governmental agricultural survey of cereal production, a novel archival source that provides a detailed cross-section of indigenous productivity across the universe of Libyan agricultural villages in 1939. This source informs on cultivated land and total output for barley and wheat – the two main crops at the time – for both Libyan and Italian farmers across 182 villages for the agricultural season of 1938–9. I match these data with the unpublished firm-level agricultural census of 1937, which provides rich information on factors of production on Italian farms, and with village-level population data from the 1936 census of Libya. Regression analysis on this novel dataset reveals how proximity to Italian farmers significantly reduced Libyan nominal ($) and physical (cwt) cereal output per hectare in 1939. Indigenous farmers located within 50 km of Italian villages produced, on average, 80 per cent less nominal output per hectare, compared with more distant ones. The drop in nominal output is fully explained by lower physical output per hectare. Importantly, Libyan labour productivity in districts affected by Italian settlement did not increase significantly relative to the control group, thus dismissing the possibility of structural transformation taking place. While unable to expropriate the best land within these areas, Italian settlers did select into the most productive pre-colonial agricultural districts a notion that, together with a placebo and an instrumental variable exercise, confirms the existence of a causal link between Italian settlement and the drop in land productivity.

The analysis of the mechanisms shows how the drop in yields was associated with higher amounts of cultivated land per capita near Italian villages, relative to the control group. In turn, higher-than-average acreages per unit of labour positively correlate with the number of Libyan farmers permanently employed on Italian farms in a village's surroundings, which suggests labour drain as the main driver behind the adoption of land-extensive techniques and the fall in agricultural productivity. These findings are consistent with a conceptual framework where subsistence output might decline in coincidence with improved market conditions, due to factor market linkages to the commercial sector, which drain inputs away from the subsistence sector.[11] These findings, in turn, raise questions about the net welfare effect of Italian agricultural settlement on the Libyans, as falling yields and wage labour arguably had a counteracting effect on indigenous living standards. Tentative back-of-the-envelope calculations suggest an approximate 26 per cent reduction in yearly per capita income for Libyans near Italian villages, relative to plausible counterfactual scenarios featuring no Italian colonisation and agricultural settlement.

[9] Segrè, *Fourth shore,* p. 148.

[10] While absence of evidence should not necessarily be taken as evidence of absence, no clear proof of systematic employment of forced labour has been identified so far in colonial Libya. The primary sources are either silent on the issue or openly deny the use of forced labour. See Bertizzolo and Pietrantonio, 'A denied reality?' for a review of the literature and, in particular, p. 239.

[11] Dyer, Boucher, and Taylor, 'Subsistence response'.

This article adds to the existing literature by showing a strong and negative effect of European agricultural settlement on indigenous productivity and by highlighting a factor market mechanism. In other words, it shows how, even in the absence of overt discriminatory policies, European agricultural settlement could undermine African welfare through market channels. Thus, my results complement those contributions that have emphasised the negative impact of settler farming through discriminatory policies, but that have not attempted to establish causality, nor identified market re-allocation of inputs as a plausible mechanism.[12] The article also contributes to the literature that has suggested a positive impact of settler farming on the efficiency of the indigenous agricultural sector,[13] by showing that no such positive consequences materialise, at least in the short term, if a sustained re-allocation of labour between subsistence and commercial farms is in place. Second and more broadly, the article relates to the debate on the economic impact of colonialism in Africa and stresses the importance of looking at the micro-level imbalances created by agricultural policies when studying the impact of the colonial phenomenon.[14] Third, with respect to the handful of works on Italian agricultural policies in Africa,[15] my research enhances our understanding of the consequences of settler farming and reveals important economic forces that, to the best of my knowledge, had not been previously identified in the Libyan context. Finally, by pinpointing negative geographical spillovers of skilled farmer presence on indigenous productivity, this paper also adds to the historical literature on the effect of migrations on the productivity of receiving regions,[16] to the growing body of works on agricultural migrations in developing countries,[17] and to the literature on productivity spillovers in agriculture.[18] These works highlight a positive effect of skilled in-migration and beneficial geographical spillovers among neighbours. Instead, this paper shows how, in a dual economy, the expected positive impact may be offset, at least in the short term, by an unequal redistribution of factors of production.

The remainder of the paper proceeds as follows. Section I outlines the most salient facts regarding Italian farming in Libya during the 1930s and sets the stage for the empirical analysis. Section II reviews the literature to provide the conceptual framework for the analysis. Section III presents the sources and the sample. Sections IV and V introduce the empirical strategy and the main results, respectively. Section VI explores the mechanisms, while section VII discusses the welfare implications for the indigenous population. Section VIII concludes.

I | ITALIAN SETTLEMENT IN LIBYA, 1911–40

Libya was a largely agricultural economy before the Italian occupation and remained so throughout the colonial period. Traditional Libyan farming, particularly in coastal oases, was intensive

[12] Arrighi, *Political economy*; Simkins, 'Agricultural production'; Feinstein, *Economic history*.

[13] Mosley, *Settler economies*; Heywood, 'Growth and decline'; Shutt, 'Squatters'.

[14] For a review, see Michalopoulos and Papaioannou, 'Historical legacies'.

[15] Larebo, *Building of an empire*; Segrè, *Fourth shore*; Cresti, *Non desiderare*.

[16] Hornung, 'Immigration'; Fourie and Von Fintel, 'Settler skills'; Peri, 'Effect of immigration'.

[17] Bazzi et al., 'Skill transferability'; Bharadwaj and Mirza, 'Displacement and development'; Dell and Olken, 'Development effects'.

[18] Parman, 'Good schools'; Conley and Udry, 'Learning about a new technology'; Foster and Rosenzweig, 'Learning by doing'.

and based upon the combination of irrigation, human labour, and animal power.[19] Farmers would pull the water out of shallow wells with rudimentary pumps normally operated by camels. Other than operating the pumps, intensive human labour was necessary for ploughing, sowing, watering (whether done manually with buckets or through small irrigation canals), harvesting, and building artificial protection barriers against the desert winds.[20] Oasis gardens were mainly characterised by the production of palm dates, cereals, and vegetables. Dry-farming cereal and olive tree cultivation were instead widespread in the hinterland, in particular in the hills of the of the Gebel region, while shifting cereal cultivation and animal husbandry was the chief economic activity in the steppe surrounding the coastal oases and in the pre-desert areas.[21] Prior to the Italian occupation of Libya, access to land was regulated by the Ottoman Land Code of 1856. The code recognised two types of property, one for private individuals and one for religious institutions. Oasis gardens in intensive cultivation areas along the coast and of the dry-farming estates on the Gebel normally fell into one of these two categories. Owing to the lack of systematic cadastral registry, however, property rights were often ill-defined across Libya.[22] In fact, the majority of the land fell into the category of public property, a broad concept that encompassed different realities on the ground. Tribal groups had ancestral usufruct rights, for instance for practising grazing and shifting cultivation, on large parts of public land, which they often regarded as full property rights.[23]

The Italian occupation of Libya dates back to the Italian–Turkish war of 1911–2. Local resistance, combined with the sudden outbreak of the First World War (Italy joined the Allies in 1915) and the consequent allocation of resources to the Austrian front, hampered the attempt of imposing an effective territorial control over the colony. By 1922, the year of Mussolini's rise to power, only coastal cities and a few inland strongholds were under stable Italian control, as shown in figure 1. The Eastern region of Cyrenaica was ruled indirectly, through the services of the Emir Idris As-Senussi (who became, in 1951, the first king of the United Kingdom of Libya with the name of Idris I), supported by a council of notables. Virtually no Italian farmer moved to Libya before 1922, with only a few pioneering attempts in the areas surrounding Tripoli and Benghazi.[24] Fascism changed the rules of the game. Under Governor Volpi (1921–5), the army undertook a complete and definitive conquest of Tripolitania, which was followed by the rapid subjugation of the Southern region of Fezzan. The full occupation of Cyrenaica was only achieved in 1931, despite a largesse of means. Fierce local resistance was orchestrated by the religious Senussyya movement, which did not recognise the Italian authority. An ambitious plan to divert part of Italian economic migration to Libya followed the full military occupation of the colony: traditionally, Italy had been a net supplier of low-skilled workers to a variety of countries, including Argentina, Belgium, and the

[19] Segrè, *Fourth shore*, p. 146.

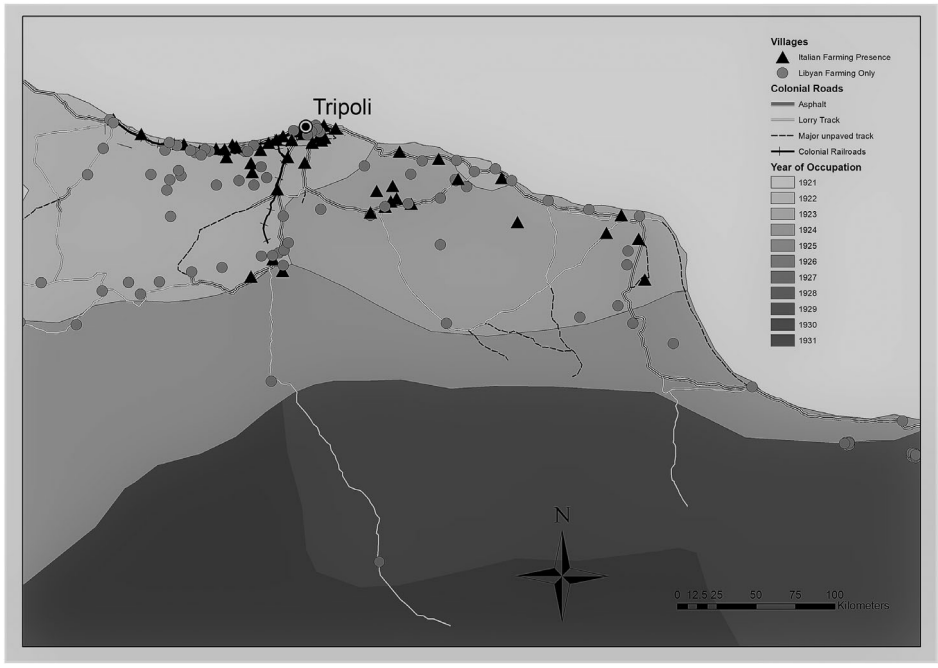
[20] Wheatley, *Report to the government*, p. 33.

[21] Segrè, *Fourth shore*, pp. 146–7.

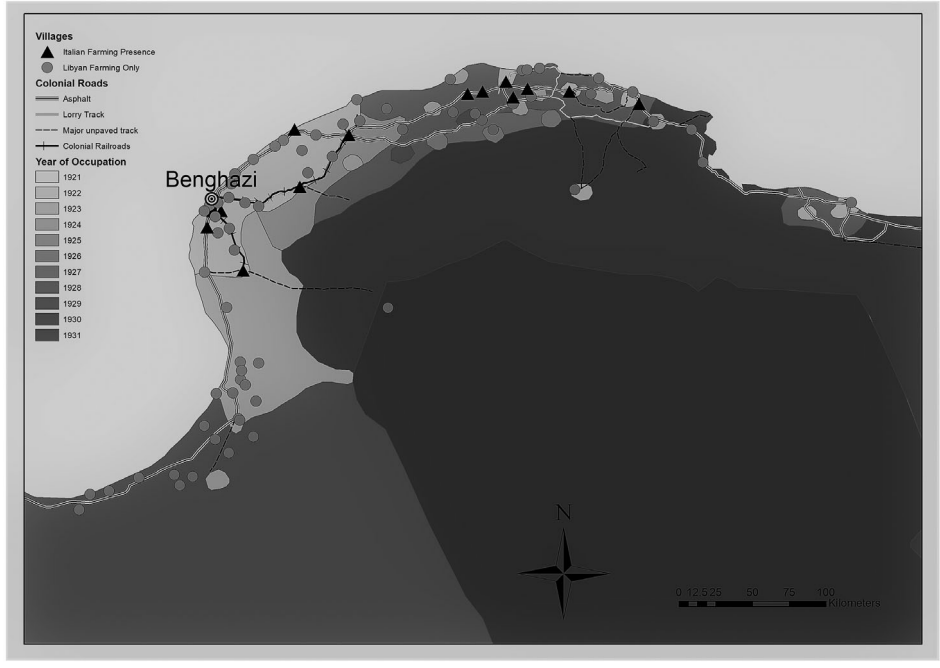
[22] Accurate cadastral surveys were only available in the surroundings of Tripoli and Benghazi and for a handful of other cities before the Italian occupation. See Cresti, *Non desiderare*, p. 65 and Fowler, 'Italian agricultural colonization', p. 101.

[23] Fowler, 'Italian agricultural colonization', p. 102. Obtaining a better understanding of inequality in land distribution in the pre-Italian period is difficult owing to lack of quantitative data. The sources, however, seem to suggest limited inequality, surely inferior to the colonial period when significant land concentration in Italian hands took place. Agricultural plots in the coastal oases were small (around 2 hectares) and uniformly distributed across Libyan families. Larger farms could be found in dry-farming areas in the hinterland. Land access in communal areas was regulated by tribal leaders and customary rights. With the exception of the oases, however, land was abundant relative to the small Libyan population, so land inequality was probably not pronounced. See Segrè, *Fourth shore*, p. 146.

[24] Segrè, *Fourth shore*, p. 46; Cresti, *Non desiderare*, pp. 60–1.



(a) Tripolitania



(b) Cyrenaica

FIGURE 1 Italian occupation and settlement in 1939. *Note*: Libyan and Italian agricultural villages in Tripolitania and Cyrenaica are shown for 1938–9. The maps also show the tendency of Italian farmers to settle in villages that had been under permanent Italian control for longer. *Source*: Villages are from the 1938–9 agricultural survey of Libya, MAI, *Censimento della produzione*. Data on roads, Railroads and territorial changes are from Piccioli, *La nuova Italia*. See section III and the online appendix for details on the data

United States. Mussolini's Fascist government aimed at reducing this outflow of manpower by incentivising agricultural settlement in the colonies.[25]

To achieve this objective, an innovative and highly controversial land reform was implemented in Tripolitania in 1923. According to the new legislation, all land that had not been farmed in the previous 3 years was considered public and available for allotment, rent, and purchase by Italian farmers.[26] By 1937, roughly 840 000 ha were made available thanks to this system, 240 000 of which were in Tripolitania and 600 000 in Cyrenaica.[27] In reality, most of the land that fell into the category 'unused' was public land regulated by usufruct rights, and was traditionally part of a complex tribal system based on shifting cultivations and migrant herding, activities that were severely affected by the new rules.[28] By contrast, intensively farmed land was left virtually untouched, as fear of triggering social unrest and of fuelling anti-Italian opposition, together with concerns regarding the difficulty of removing Libyans from legally owned land, prevailed.[29] While this approach was formally extended to Cyrenaica in 1928 with the same criteria,[30] the Eastern part of the country constitutes a partial exception: because of the large-scale guerrilla war that was fought by the Senusiyya, in fact, some permanently cultivated areas that belonged to the rebels were also expropriated and made available for allotment, most notably the 'Zavie' monasteries.[31] The amount of land that formally belonged to the Senusiyya, however, was fairly limited, and the largest share of land was used for grazing under tribal customary law, similar to Tripolitania.[32]

Political (not all land was available) and military (not all parts of the country were safe) constraints prevented the colonists from selecting the best land. In fact, the Italians were able to settle only within areas under stable Italian control and not already under permanent Libyan cultivation, as is visible in figures 1 and 2. Figure 2 also reflects the tendency of sedentary Libyan farmers to cultivate intensively only those fields located in the proximity of shallow waters in the oases. The encompassing land taken by the Italians was of similar quality but, owing to the deeper location of the water table, more costly to irrigate and to farm.[33] These patterns are confirmed in the balancedness test reported in table A2 in the online appendix, which shows the propensity of settlers to select into the most suitable regions of the country, as mirrored by the 0–50 km coefficient. Crucially, however, the indicator for Italian presence shows that settlement villages were not systematically more suitable for agriculture relative to adjacent ones, and that Italians were excluded from the oases (column 1).[34] This brief discussion of the settlement constraints faced by the settlers highlights a key aspect of Italian land policies in Libya. The political will of an 'autocratic' state that aimed at creating a colony of settlement through a strongly centralised approach, in reality,

[25] Labanca, *Oltremare*, pp. 309–10.

[26] Segrè, *Fourth shore*, pp. 47–54.

[27] Ballico, *Brevi note*.

[28] Cresti, *Non desiderare*.

[29] Segrè, *Fourth shore*, p. 52.

[30] Cresti, *Non desiderare*, p. 77.

[31] Del Boca, *Gli italiani in Libia*, pp. 267–9.

[32] Cresti, *Non desiderare*, pp. 95–6; Segrè, *Fourth shore*, pp. 151–2.

[33] Piccioli, *La nuova Italia*.

[34] The statistically significant and positive association between Italian presence and rainfall (column 8) precisely reflects the exclusion of Italians from irrigated oases and their sorting into dry-farming areas in the Gebel, which were wetter and traditionally used for grazing.

FIGURE 2 Example of agricultural settlement in the area of Zavia. *Note*: Example of Italian settlement pattern around traditional Libyan intensive-farming oases in the area of Zavia. *Source*: Patterns of agricultural settlement are digitised from the map 'Zona Occidentale', from the incomplete and unpublished cadastral survey of Tripolitania retrieved at the historical archive at IAO. Villages are from the agricultural survey of Libya 1938–9, MAI, *Censimento della produzione*. Roads and railroads are from Piccioli, *La nuova Italia.* See section III and the online appendix for details on the data

faced severe constraints on the ground. In this sense, while politics undoubtedly tried to influence the pattern of agricultural settlement in Libya, pre-existing conditions shaped the process significantly, to the point where the actual distribution of colonists across the country developed largely independently (without being endogenously determined, that is) of the traditional patterns of Libyan farming.

Throughout the 1920s and early 1930s, agricultural settlement was largely left to the private initiative of capitalistic farmers, who could select the plot they preferred within the aforementioned land availability and safety constraints.[35] The government provided financial and technical support: the *Cassa di Risparmio di Tripoli*, a rural bank established in 1923 with public capital, provided credit at subsidised interest rates. Easier access to credit, in combination with increased technical assistance from governmental agencies, facilitated Italian settlement. The quality of the settlers in this first phase of agricultural colonisation varied significantly but was generally high: the settlers were responsible for capital investments and marketing of the agricultural produce on the free market, as they operated fully commercial enterprises, a feature that separated them from the majority of Libyan cultivators, who were instead producing in a subsistence equilibrium. A few capitalist farmers, attracted by the generous subsidies and the cheap land, set up highly capitalised, large-scale commercial farms, typically managed by skilled managers. Smaller allotments

[35] Segrè, *Fourth shore*, pp. 54–6.

were given to individual families, mostly from Southern Italy and Tunisia. This second group of settlers also moved to Libya at their own risk and had a good understanding of climatic conditions and farming techniques.[36] Thanks to the combination of higher skill level and capital availability, Italian farms overtook adjacent indigenous ones early on in terms of productivity, as reflected by the higher levels of land and labour productivity observed in Italian villages and districts (see section V). This advantage is probably responsible for the gap between salaries paid by Libyan and Italian landowners to wage labourers[37] and, in turn, for the phenomenon of sustained rural-to-rural labour migration.

Despite the subsidies, starting a private farm in Libya was a risky business: thus, notwithstanding an exponential increase after 1923, the total number of private Italian holdings remained modest, totalling only about 135 000 ha across 848 farms in 1940.[38] The modest results of the first phase of 'capitalistic settlement' led the fascist government to launch, from 1932, the 'intensive demographic' settlement scheme. This second strategy was characterised by state-financed initiatives, aimed at creating widespread smallholding Italian farming in Libya. Mostly through the direct intervention of the public pensions and insurances fund (INFPS) and the creation of a specific state corporation (Ente Colonizzazione Libia, ECL), 24 agricultural villages were built between 1932 and 1940 in both Tripolitania and Cyrenaica. This new approach led to a massive increase in the land under active cultivation by the Italians, which reached 375 000 ha in 1940,[39] from about 187 000 ha in 1937. However, it also led to an inevitable deterioration in the colonists' effectiveness, as the latter were increasingly selected by the state in large numbers, on the basis of political and demographic considerations (affiliation to the Fascist party, family size, and age of the children) rather than agricultural skills and capital availability. The incentives to apply for the scheme were strong for poor, landless families as no initial monetary investment was required on the part of the colonists.[40] The level of state control through agricultural technicians was so capillary by this point, however, that most of the newly established agricultural villages managed to achieve relatively high yields and labour productivity levels early on, irrespective of these constraints. While the state settlement schemes relied in principle on Italian labour alone, the size of the seasonal Libyan workforce was large, at least in the first years of settlement.[41] In my analysis, I capture the effect of both waves of agricultural settlement, as I look at Italian farms that were operational by 1938. My sample of farms, however, excludes a large share of state-financed agricultural villages that were established towards the end of the colonial period, while it captures the universe of privately owned farms. Intensive settlement villages created after 1938 are known and used as counterfactual locations in a falsification exercise (see section III for more details on sampling).

II | LITERATURE AND CONCEPTUAL FRAMEWORK

The existing literature offers contrasting predictions on the potential effect of European agricultural settlement. Exposure to educated, market-oriented farmers that employ modern farming

[36] Ibid., pp. 54–6, 73–4.

[37] Ibid. pp. 152–4.

[38] Fowler, 'Decolonization', p. 493.

[39] Ibid., p. 493.

[40] Segrè, *Fourth shore*, pp. 136–43.

[41] Ibid., pp. 153–7.

practices is typically associated with positive geographical spillovers.[42] These externalities are related to the diffusion of practical knowledge, which allows producers to employ the available inputs more efficiently, for instance by adopting new technologies. Several studies that looked at episodes of large-scale migration highlight how, provided that the migrants find favourable conditions,[43] the impact on local productivity can be large and persistent in both agriculture and manufacturing.[44]

Even in settings lacking efficient markets, such as in colonial settler economies, African agriculture has often been shown to perform well in terms of productivity. Mosley, for instance, emphasises the rational response of African peasants to the progressive reduction of farming land in Kenya and Zimbabwe, during the first half of the twentieth century.[45] He shows how, owing to the increasing population pressure, African farmers in the reserves progressively raised their land productivity by increasingly employing labour-intensive techniques and crop rotation, and adopting the plough, consistent with Boserupian dynamics.[46] In the same vein, Shutt portrays a high level of responsiveness of African farmers to new marketing opportunities, offered by the settlement of the colonists and the simultaneous development of transport infrastructure, in the form of increased land productivity and the adoption of commercial crops.[47]

At the other end of the spectrum, the 'underdevelopment school' offers a much more negative view on the effect of European settlement on indigenous productivity. In a pioneering study on colonial Zimbabwe, Arrighi highlighted how the expropriation of the most fertile land by the colonists and the creation of 'native reserves' in marginal lands led to a drop in yields and a worsening of indigenous living standards.[48] He highlights soil exhaustion, due to land overuse, as a central mechanism in accounting for declining yields and, consequently, living standards in the reserves. This line of work mirrored the accounts on French Algeria that also emphasise the land-expropriation channel and the progressive proletarianisation and impoverishment of the peasants.[49] A similar picture of soil exhaustion leading to lower yields is depicted by Heywood for colonial Angola.[50] In his work on South Africa, Feinstein,[51] largely drawing on previous work by Simkins,[52] also points to a progressive fall in agricultural productivity in the native reserves, following a ruthless process of land expropriation[53] that, in the absence of technological improvements, clear property rights, and access to markets, exhausted the available soil.

[42] Parman, 'Good schools'; Conley and Udry, 'Learning about a new technology'; Foster and Rosenzweig, 'Learning by doing'.

[43] Bazzi et al., 'Skill transferability'.

[44] Bharadwaj and Mirza, 'Displacement and development'; Dell and Olken, 'Development effects'; Fourie and Von Fintel, 'Settler skills'.

[45] Mosley, *Settler economies.*

[46] Boserup, *Conditions.*

[47] Shutt, 'Squatters'.

[48] Arrighi, *Political economy.*

[49] Sartre, *Colonialism.*

[50] Heywood, 'Growth and decline'.

[51] Feinstein, *Economic history,* pp. 72–3.

[52] Simkins, 'Agricultural production'.

[53] Feinstein, *Economic history*, p. 44.

Open violence against indigenous peasants could, of course, worsen agricultural performance and living standards. In his vivid account on South Africa, Feinstein shows how the level of insecurity linked to a permanent state of warfare between independent African polities and settler communities damaged, through raiding and fighting, the African agricultural sector and impoverished the indigenous population.[54] Other than war-related destruction, warfare also reduced agricultural output by pushing farmers to adopt factor-saving, risk-mitigating cultivation techniques, in line with Austin's findings.[55] The negative effect of coercive policies and violence is also stressed in various colonial settings by several contributions, which emphasise how the violent practices could have long-lasting effects on economic performance.[56]

Finally, a drop in agricultural productivity in the proximity of commercial farms could be consistent with a model featuring relocation of factors of production from the subsistence to the commercial sector, similar to Dyer, Boucher, and Taylor.[57] In this model, commercial farms' output responds to market prices, while subsistence farmers rationally decide to supply labour to the commercial sector when market wages exceed subsistence ones. In these conditions, subsistence households with a limited stock of labour will reduce their own agricultural output to maximise consumption through market wages. This underlying mechanism explains the seemingly paradoxical outcome of falling subsistence production in periods of high market prices.

III | DATA AND SAMPLE

To explore the effect of Italian settlement on Libyan agriculture, I assembled a novel village level database containing information on cereal production for both Italians and Libyans at the end of the colonial period. Table A1 in the online appendix presents the descriptive statistics for the variables employed in the empirical analysis, while section III in the online appendix provides a more detailed description of the sources and of data collection.

The dataset is built around the 1938–9 agricultural survey of Libya.[58] This source provides village-level information on cereal production for the agricultural year 1938–9 and includes a total of 258 locations. I created a shapefile of villages in GIS by geo-referencing the localities reported in the survey through coeval maps and contemporary gazetteers. The survey provides information on the extension of barley and wheat cultivations (cultivated land)[59] for both Libyan and Italian farmers, as well as on the harvested quantities of each crop. The unpublished village-level survey is preserved in the Ministero dell'Africa Italiana collections at the Archivio Centrale dello Stato in Rome. For each surveyed location, four different sheets exist: two for Italian farmers and two for Libyan ones, one for sowing (dating from late 1938 and early 1939) and one for harvesting (dating from spring–summer 1939). While a total of 258 villages were surveyed, when those with no recorded output and the few with mismatching harvest and sowing information

[54] Ibid. pp. 37–43.

[55] Austin, 'Resources'.

[56] Bruhn and Gallego, 'Good, bad and ugly'; Lowes and Montero, 'Concessions'.

[57] Dyer, Boucher and Taylor, 'Subsistence response'.

[58] Ministero dell'Africa Italiana (MAI), *Censimento della produzione cerealicola Libica*, 1939, MAI collection, folder 685, Archivio Centrale dello Stato, Rome.

[59] For Italian farmers only, the survey also include data on oats.

are excluded, 182 villages with measured land productivity remain, which constitute my baseline sample.[60] As reported in table A7 in the online appendix, of these 182 villages, 60 experienced Italian agricultural settlement by 1938–9.

In terms of representativeness, the baseline sample is uniformly distributed across Libya and evenly covers all parts of the country (see figure 1 and figure A1 in the online appendix). The geographical coverage of the villages reflects the distribution of the population at the time, which, similarly to the present, was concentrated along the coast. Importantly for my analysis, the selected sample includes all major centres of agricultural production. In fact, the total barley output across all villages in my baseline sample is approximately 249 805 cwt in 1939, which represents about 90 per cent of the colony's total (see table A8 in the online appendix for total agricultural output). Similarly, the sample's total wheat output, at 235 349 cwt, is close to 100 per cent of total reported by official production statistics. In terms of economic size, 70 per cent of Libyan residents in 1936 lived in villages of the baseline sample.[61] Therefore, my sample is highly representative of the overall Libyan economy and closely approximates the universe of cereal producers in 1939.

Cultivated land in 1938–9 is employed to define Italian villages in my main specification. This variable may underestimate the total amount of Italian land cultivated with cereals in 1940, at the very end of the colonial period, as fascist activism in land development significantly increased the total land formally granted to Italian farmers between 1938 and 1940.[62] However, this discrepancy is hardly problematic for my analysis. First, the estimated effect of Italian farming should be interpreted as a lower-bound estimate of the true effect that would have been observed in 1940 when settler farming was at its peak. Second, although land was formally granted, new settlers could not significantly extend cultivations by the start of the war in 1940. Finally, virtually the entire increase in Italian agricultural land observed in 1938, 1939, and 1940 took place in 17 villages that were part of the intensive demographic settlement programme. As the location and foundation dates of these villages are well documented, I was able to map these and use them in a placebo exercise (see section II in the online appendix).

The second crucial data source for this paper is the 1937 agricultural census of Italian farms in Libya, which reports detailed information on the 839 non-indigenous farms that existed in Tripolitania and Cyrenaica at the time.[63] This source, which is preserved in a box at the historical archive of the Istituto Agronomico per l'Oltremare in Florence, provides very granular data on inputs at the farm level and thus informs, among other things, about the number of Italian and Libyan workers, the size of the buildings, the irrigation facilities, the machinery, and the animal stock on each holding. I aggregate farms' data at the 1938–9 agricultural survey's village level. The two sources match almost perfectly despite the small chronological discrepancy. Out of the 60 villages

[60] To be precise, the count is 186. In the baseline regression, I conservatively exclude two villages with a measured cereal productivity above 20 cwt/ha, which is likely a measurement error. I also exclude two villages that I could not geo-locate. This leaves a total of 182 villages. If land-productivity data are not available in a village with both Libyan and Italian farmers for one of the two groups, land productivity data of the other ethnic group are used. This was the case only for the villages of Zanzur, Msellata, and Saiad, where Italian cultivated land data are available, but no output is recorded.

[61] Seventy per cent is an approximation, as only 129 out of 182 villages could be matched with census data. Sixty-six per cent is the lower-bound estimate when unmatched villages are counted as zeros. With a plausible interpolation, the figure increases to 82 per cent.

[62] This figure roughly increased from about 187 000 ha in April 1937 (see MAI, *Censimento delle aziende agrarie della Libia*, 1937, Archivio Storico dell'Istituto Agronomico per l'Oltremare (IAO), Florence) to around 375 000 ha in 1940 (see Fowler, 'Decolonization', p. 493).

[63] MAI, *Censimento delle aziende*.

that record some amount of land under Italian cultivation in 1938–9, the 1937 census records Italian farms in 54 of them.[64]

Third, to obtain reliable data on population, I have digitised the 1936 population census.[65] Other than several important aggregate demographic statistics, the census informs about the total number of Libyan and Italian residents in each village by sex. Owing to discrepancies at the administrative level of data collection between the agricultural survey and the census, only 129 out of the 182 villages that form the baseline sample could be matched. Data for the missing villages were interpolated through the reconstructed 1940 population estimates from the History Database of the Global Environment (HYDE) project[66] (see online appendix). The census also provides district-level information on the employment structure of the Libyan population. The location of colonial transport infrastructure (namely paved roads, lorry tracks, and railroads), the boundaries of the administrative districts (municipalities and provinces) and the location of water wells were digitised from different primary sources, as described in the online appendix. Finally, land suitability for intermediate input irrigated barley was added from the Global Agro-Ecological Zones (GAEZ) database.[67]

The archival nature of the bulk of my data presents both advantages and disadvantages: the 1938–9 agricultural survey is often handwritten and patchy. It is sometimes difficult to determine whether missing sheets and reported zeros were due to negligible agricultural production in those locations, imprecise data collection in the field, or poor preservation of the materials. Furthermore, the source is subject to errors by the Italian civil servants, who had limited knowledge of the territory and of Libyan farming practices. Yet, despite these caveats, the level of detail is impressive for the region and the period, which makes it the best (and only) source to investigate agricultural dynamics in colonial Libya at such a disaggregated level. The fact that this source has remained unpublished at the village level and been only kept for internal use suggests that no systematic attempt was made by the authorities to alter the reported figures on the original sheets.

IV | EMPIRICAL STRATEGY

To identify the impact of Italian agricultural settlement on the Libyan farming sector, I estimate equation (1) through ordinary least squares (OLS):

$$\begin{aligned}\ln(y_{i,1939}) = \alpha &+ \beta_1 \text{ItalianProximity(yes/no)}_{0-50\text{ km},i,1938} \\ &+ \beta_2 \text{ItalianPresence(yes/no)}_{i,1938} \\ &+ x_i'\gamma + \delta_p + \varepsilon_i \end{aligned} \quad (1)$$

[64] Six villages (Battisti, Bir Fergian, El Asaaba, Giordani, Hammam, Msellata) for which Italian cultivated land is reported in 1938–9 report no settler farms in the census, which likely reflects settlement taking place in 1937–8. By contrast, the census suggests Italian presence in eight villages where no Italian farming was recorded in 1938. This is likely a case of mismatch in the location of farms in one of the two sources, or alternatively of inactive farmers. The only exception is Misurata, where Italian output is recorded in 1939, but no cultivated land information is available for 1938.

[65] Regno d'Italia, *VIII censimento*.

[66] Klein Goldewijk et al., 'The HYDE 3.1'.

[67] Food and Agriculture Organization of the United Nations (FAO), *Global Agro-Ecological Zones database (GAEZ v4),* available at https://gaez.fao.org/, last accessed on 21st of April 2016.

where y represents two complementary measures of agricultural productivity for village i in 1939. First, I employ combined Italian and Libyan cereal (wheat, barley, and oats) nominal output per hectare ($) in 1939.[68] Second, I report yields (hundredweights of produce per hectare, that is) to be able to disentangle price and quantity effects. In both cases, I take the natural logarithm. The 1938–9 agricultural survey only records information on cereals. Cereal crops, however, represented by far the largest share of agricultural output, totalling about 55 per cent of both Libyan and Italian production (see figure A4b in the online appendix). Therefore, these crops provide a fairly accurate picture of productivity differences in agriculture across the country. While neither nominal nor physical output per hectare is a perfect measure of agricultural productivity,[69] their use is dictated by data limitations. Information on labour and capital that would allow one to calculate labour or total factor productivity is, to the best of my knowledge, unavailable at the village level for Libyan farms. The selected outcome variables, however, are good proxies for efficiency in agriculture and, as such, are commonly used in the economic history and development literature.[70] This is particularly true for Libya, where indigenous cultivators across the country performed subsistence farming that was uniformly characterised by low levels of capital and technology.[71]

$\text{ItalianProximity(yes/no)}_{0-50\ km,i,1938}$ is the explanatory variable of interest. This is a dummy variable that equals 1 if a village is located within 50 km from an Italian one, which is in turn defined as a location where at least 1 ha of land was cultivated by Italian farmers in 1938–9. This distance variable is designed to capture spatial spillovers around observations that experienced Italian farming. β_1 will be positive ($\beta_1 > 0$) if Italian presence increased land productivity in the surrounding areas and smaller than 0 ($\beta_1 < 0$) if Italian farming affected Libyan productivity negatively. While results are robust to a variety of distance functional forms (linear distance, logged distance, and a set of smaller distance cut-off bins; see section II in the online appendix), the 0–50 km cut-off is employed in the baseline regression as it best captures the zone where spatial spillovers from Italian clusters materialised (see table A3 in the online appendix).

$\text{ItalianPresence(yes/no)}_{i,1938}$ is a dummy designed to identify Italian villages. This is equal to 1 if the 1938–9 agricultural survey reports at least 1 ha as being cultivated by Italians and identifies those villages located within the 50 km cut-off, where Italian farmers were active in 1938–9 (distance to the nearest Italian village equals 0). As such, the latter should be interpreted as an interaction between Italian presence and proximity to Italian villages. β_2 will capture differences in productivity between Italian and Libyan villages within the 50 km cut-off. β_2 will be positive ($\beta_2 > 0$) if Italian presence was locally correlated with higher productivity, negative otherwise. Italian villages can be of two types: those where only Italian farmers were present and those where both ethnicities were actively farming.

x_i' is a vector of controls. First, I include a standard set of village-level geographical covariates, designed to capture potentially confounding environmental factors that could have affected both agricultural productivity and settlement patterns.[72] Second, I include key pre-colonial controls,

[68] Nominal output is calculated at 1939 prices. The employed prices of wheat, barley, and oats were 121 LIT, 70 LIT, and 60.9 LIT per cwt, respectively. Italian lire are converted to dollars at the official 1939 exchange rate of 1$ = 20 LIT. See online appendix for data sources.

[69] Federico, *Feeding the world*, p. 69.

[70] Bazzi et al., 'Skill transferability'; Bharadwaj and Mirza, 'Displacement and development'.

[71] Wheatley, *Report to the government.*

[72] These are latitude, longitude, land suitability (FAO intermediate-input irrigated barley suitability), distance to the coast, altitude, temperature, monthly precipitation, and distance to the nearest river. All distance variables are included in their logarithmic form $\ln(0.1+x)$ to allow for non-linearities.

in an attempt to capture the potentially confounding effect of pre-1922 factors. In particular, I include logged (reconstructed) population count in 1900 and distance to the nearest nineteenth-century caravan track, two proxies for pre-colonial market access. Furthermore, through a map showing pre-1922 land use across Libya, I am also able to control for two important proxies for pre-1922 differences in productivity: a dummy variable indicating traditional areas of intensive irrigated agriculture (mostly oases) and the logged distance between each village and the closest area of pre-1922 intensive agriculture. Third, as agricultural settlement during the colonial period was only one aspect of Italian economic activism in the 1930s, I also control for other colonial factors that might have affected Libyan agriculture. I include the logged distance from Tripoli and Benghazi (the two regional capitals), the logged distance from 1941 wells, and logged 1936 village population. I also include controls for colonial transport infrastructure, namely three cut-off dummies for being located within 10 km of railways, paved roads, and lorry tracks.[73]

All specifications include a baseline set of provincial fixed effects (δ_p) (the five Italian provinces in which Libya was partitioned in the 1930s) to capture unobservables at the provincial level. Finally, as I am concerned that, owing to the archival nature of the 1939 survey, the data might show systematic measurement error at the municipal level (the level of data collection), I cluster the standard errors (ε_i) for the 27 municipalities in which Italian Libya was divided under colonial rule, which also addresses potential problems of spatial correlation.[74]

V | MAIN RESULTS

Table 1 displays the main set of results. Panel A reports the estimates using combined Italian and Libyan productivity as the dependent variable, while panel B shows results for Libyan productivity only. In columns 1–4 and 6, the dependent variable is the natural logarithm of nominal cereal output per hectare in 1939 dollars. Column 5 employs the logarithm of physical output per hectare as the dependent variable (hundredweights per hectare).

The estimates highlight two counteracting dynamics. On the one hand, villages located within the 50 km radius of Italian farms in 1938–9 were significantly less productive in 1939 compared with their more distant counterparts. On the other hand, Italian locations show a significant productivity advantage relative to nearby Libyan villages within the 0–50 km radius. Panel B, however, shows that the positive relationship between Italian presence and the local advantage in land productivity only reflected the higher efficiency of the Italian settlers. In fact, Libyan farmers in Italian villages do not show a productivity advantage relative to their neighbours. The unrestricted model in column 1 suggests sizeable effects. In fact, switching from the control to the treatment group of villages leads to a rough 60 per cent[75] reduction in nominal output per hectare. On average, Italian villages appear to be approximately 160 per cent more productive compared with their Libyan neighbours within the 50 km cut-off. In other words, these findings suggest that Italian settlers were relatively successful locally, but also that they somehow negatively impacted indigenous productivity in their surroundings.

[73] Owing to collinearity, all three controls cannot be included in their continuous logged form. Results do not change if all possible combinations of pairs are included separately in their logged form.

[74] Owing to the small number of clusters, I replicate the main table using a standard bootstrapping procedure in table A11 of the online appendix.

[75] $100 \times [e^{\beta} - 1]$.

TABLE 1 Italian farming and Libyan productivity

Panel A: Combined Italian and Libyan productivity	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Log cereal $/ha 1939				**Log cereal cwt/ha 1939**	**Log cereal $/ha 1939**
Dummy Italian proximity, 0–50 km	−0.978***	−1.366***	−1.515***	−1.550***	−1.513***	−0.016
	(0.248)	(0.277)	(0.315)	(0.316)	(0.306)	(0.032)
Dummy Italian presence, 1938	0.975***	0.866***	0.828***	0.806***	0.662**	0.135***
	(0.231)	(0.237)	(0.222)	(0.261)	(0.257)	(0.041)
Log cereal cwt/ha, 1939						1.014***
						(0.010)
Observations	182	182	182	182	182	182
R^2	0.34	0.41	0.44	0.45	0.44	0.99
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Panel B: Libyan productivity only	**Log Libyan cereal $/ha 1939**				**Log Libyan cereal cwt/ha 1939**	**Log Libyan cereal $/ha 1939**
Dummy Italian proximity, 0−50 km	−0.957***	−1.381***	−1.516***	−1.580***	−1.581***	0.026
	(0.247)	(0.285)	(0.314)	(0.293)	(0.284)	(0.027)
Dummy Italian presence, 1938	0.466*	0.316	0.236	0.279	0.282	−0.007
	(0.230)	(0.274)	(0.254)	(0.249)	(0.230)	(0.038)
Log Libyan cereal cwt/ha						1.016***
						(0.009)
Observations	144	144	144	144	144	144
R^2	0.38	0.44	0.46	0.50	0.50	1.00
Provincial fixed effects	YES	YES	YES	YES	YES	YES
Geographical controls	NO	YES	YES	YES	YES	YES
Precolonial controls	NO	NO	YES	YES	YES	YES
Colonial controls	NO	NO	NO	YES	YES	YES

Panel A: The logarithm of the combined Italian and Libyan cereal nominal output in 1939 dollars per hectare is employed as the dependent variable in columns 1–4 and 6. The logarithm of the physical cereal output in hundredweights per hectare is the dependent variable in column 5. Panel B: The outcome variables are the same as for panel A, but for Libyan farmers only. Both panels: OLS regressions in columns 1–6. Geographical controls include longitude, latitude, and altitude, average annual temperature, average rainfall, intermediate inputs, irrigated barley suitability, distance from the coast, and distance from the closest river. Pre-colonial controls include: a dummy for being located in a traditional intensive agriculture area before 1922, distance from such oases, reconstructed population count for 1900, and distance from 1884 tracks. Colonial controls include: distances from Tripoli and Benghazi, distance from wells in 1941, population count in 1936, and a set of dummy variables for being located within 10 km of colonial infrastructure, namely railroads, paved roads, and lorry tracks. All continuous variables are logged as $\ln(0.01+x)$. Provincial fixed effects for the five provinces are included in all columns. Robust standard errors clustered for the 27 Libyan municipalities in 1939 are reported in brackets. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. See section III for details on the data.

These results are not only robust to the introduction of the full set of controls for geographical, pre-colonial, and colonial factors in columns 2, 3, and 4, respectively. The fully restricted model in column 4 indicates even stronger negative spillover effects compared with column 1, which suggests attenuation bias in the unrestricted model. In fact, column 4 pinpoints a reduction in

Libyan productivity of roughly 80 per cent relative to more distant locations. This finding likely mirrors the fact that the surroundings of Italian clusters were the most suitable for agricultural production across a variety of factors (for instance barley suitability) and is consistent with the notion of a positive selection of Italian settlers into farming areas (see figure 2 and section I). Thus, the 0–50 km coefficient arguably represents a lower-bound estimate of the true effect of Italian farming, while attenuation bias in the unrestricted model reassures about endogeneity and reinforces the idea of the existence of a causal relationship.

A similar picture emerges if one looks at the effect of Italian farming on the logarithm of harvested cereal quantity (cwt) per hectare in column 5. The 0–50 km dummy shows that Libyan villages surrounding Italian ones experienced lower yields, as well as a lower nominal output per unit of land. On average, Libyan cultivators in the proximity of Italian settlements were able to produce 77 per cent less cereals per hectare compared with more remote farmers. Column 6 shows that the measured negative association between nominal output and proximity to Italian farms is largely explained by a drop in yields. When introducing the latter variable as a control in column 4, the negative spillovers disappear, thus suggesting that the measured drop in nominal output is fully explained by a reduction in yields, rather than by the cultivation of less valuable grains. While the local advantage measured for Italian villages survives this control, its size drops significantly relative to column 4, indicating how the local Italian advantage was also chiefly linked to higher yields. These patterns are robust to using the logarithm of the linear distance from the closest Italian village, and to the computation of bootstrapped standard errors (see tables A4 and A11 in the online appendix).

The observed productivity gap between Italian and Libyan villages is consistent with information collected during the period of British Military Administration (1942–51). The Sources suggest an average 1.5- and 5-point difference, for barley and wheat yields, respectively, between Libyan and Italian farms during the early post-war period.[76] By contrast, both the primary and secondary literatures are silent about the productivity gulf between Libyan villages near Italian farms and the rest of the country (see table A7 in the online appendix), which is an interesting and puzzling result.

In section I of the online appendix, I address the main concerns regarding the robustness of the results. First, I implement placebo and instrumental variable exercises to address potential endogeneity, in particular in relation to omitted variable bias. The placebo exercise compares the effect of proximity to agricultural villages that were established immediately after the year of observation of the outcome variable (in 1939 and 1940) with the ones already operational before that date. As I employ plausible counterfactual locations to infer causality, my identification strategy echoes that of Dell and Olken,[77] who construct counterfactual locations for sugar factories in colonial Java on the basis of the suitability for sugar manufacturing. Second, I exploit cross-sectional variation in the timing of the Italian occupation to instrument proximity to Italian villages. This second approach relies on the idea that the areas controlled by the Italian army at the onset of the fascist dictatorship, in 1922, were selected on the basis of strategic considerations and war facts.[78] Early Italian strongholds later influenced the distribution of Italian settlers in the 1920s and 1930s owing to security constraints, but were arguably orthogonal to pre-existing farming patterns. Both tests reassure about the existence of a causal relationship between Italian settlement and the described

[76] British Military Administration, *Survey of land resources*, pp. 129–30.

[77] Dell and Olken, 'Development effects'.

[78] Fowler, 'Italian agricultural colonization', p. 150.

drop in agricultural productivity. Second, on the basis of figure A4 in the online appendix, I discuss how the employed data cross-section is likely representative of the average agricultural year in colonial Libya. Third, I show that the drop in cereal yields was not related to an increased diversification of agricultural output or commercialisation. Fourth, I provide evidence that the drop in output per unit of land was not matched by an increase in labour productivity, thus dismissing the possibility that the observed effect was linked to a phenomenon of increased agricultural efficiency and structural transformation. Finally, I check the robustness of the results to different sets of fixed effects and restrictions of the sample (table A6), thus selecting control groups that may constitute better counterfactuals. Most notably, I restrict the sample to villages located within 100 and 50 km of the coast and 100 km of Italian villages.

VI | MECHANISMS

What mechanisms explain the drop in land productivity in the proximity of Italian farms? The observed drop in yields can be explained by either a fall in output per unit of labour or by an increase in cultivated land per worker. In table 2, I start by disentangling these two effects. Column 1 shows the baseline estimates for the sub-sample of 122 Libyan villages using combined cereal yields as the dependent variable. Column 2 shows a statistically significant increase in cultivated land near Italian villages. By contrast, no significant association between proximity to Italian villages and total cereal output emerges in column 3. While agricultural workers on Libyan farms are unobserved, the size of the village population provides a reasonable approximation of agricultural labour. Thus, as I include the latter as a control in all regressions, the estimates can be interpreted as an approximation of the effect of Italian farming presence on cultivated land and cereal output per worker. In other words, a village located within 50 km of an Italian farm shows, on average, a higher amount of cultivated land compared with a village with the same population in the control group but roughly the same amount of cereal output. Thus, the estimates suggest how land-extensive cultivation in the proximity of Italian clusters largely determined the observed drop in land productivity. This factor-saving, land-extensive dynamic has been identified across different African contexts as a form of risk mitigation and profit maximisation, in the face of relative scarcity of labour and capital, and land abundance.[79]

Why, then, did proximity to Italian farms lead to the crystallisation of a land-extensive, low-yields equilibrium? Based on the survey of the literature in section II and the historical pattern of land distribution in colonial Libya described in section I, only soil exhaustion linked to an overuse of the available land, and factor markets, related to a drain of productive inputs out of traditional agricultural areas, emerge as potential drivers of the effect. Soil exhaustion, however, does not seem a plausible explanation, considering the higher-than average acreage in the treatment group (column 2) and the lack of a statistically significant difference in physical output per capita between treatment and control (column 3). A land-extensive strategy, instead, would be consistent with a drain of productive inputs hypothesis. Ideally, one would test directly for this possibility by looking at differences in labour and capital endowment across villages, but the sources do not provide micro-level information on Libyan factors of production. Therefore, I explore this mechanism indirectly by looking at heterogeneity in the concentration of factors in Italian villages. Assuming, owing to transportation costs, that the settlers would have mainly sourced inputs from their surroundings, a positive correlation between Libyan cultivated land and concentration of

[79] Austin, 'Resources'; Fenske, 'Land abundance'.

TABLE 2 Explaining the negative spillover effects on Libyan productivity in 1939

Dependent variable	(1) Log cereal cwt/ha	(2) Log cult ha Libyan	(3) Log grains cwt Libyan	(4)	(5)	(6)	(7)	(8)
				Log cult ha Libyan				
Dummy Italian proximity, 0–50 km	−1.574***	1.542***	−0.032					
	(0.344)	(0.350)	(0.434)					
Log population, 1936	−0.035	0.393***	0.358***	0.346***	0.367***	0.379***	0.387***	0.363***
	(0.077)	(0.068)	(0.079)	(0.095)	(0.092)	(0.090)	(0.092)	(0.096)
Log Libyan workers 50 km buffer				0.240***				0.479***
				(0.087)				(0.162)
Log camels 50 km buffer					0.117			−0.046
					(0.079)			(0.144)
Log irrigated ha 50 km buffer						0.124**		−0.036
						(0.060)		(0.071)
Log ovines 50 km buffer							0.066	−0.295*
							(0.110)	(0.156)
Observations	122	122	122	122	122	122	122	122
R^2	0.51	0.77	0.61	0.75	0.73	0.73	0.72	0.76
Provincial fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Geographical controls	YES	YES	YES	YES	YES	YES	YES	YES
Precolonial controls	YES	YES	YES	YES	YES	YES	YES	YES
Colonial controls	YES	YES	YES	YES	YES	YES	YES	YES

OLS regression estimates for the sub-sample of 122 Libyan villages (no Italian settlement) are reported in columns 1–8. All specifications include the full set of controls described in table 1. See text for variables definition. Provincial fixed effects for the five provinces are included in all columns. Robust standard errors clustered for the 27 Libyan municipalities in 1939 are reported in brackets. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. See section III for details on the data.

inputs in nearby Italian villages would offer suggestive evidence in the direction of a drain of factors of production explaining the negative effect on productivity. I operationalise this intuition in columns 3–8 of table 2, where I estimate a model similar to 1, this time using the logarithm of cultivated land in 1938–9 as dependent variable for the subsample of 122 Libyan villages. For each observation, I calculate the total units of different agricultural inputs employed by Italian farmers within a 50 km radius, based on information from the 1937 agricultural census.[80] As I am interested in the intensive margin of factors drain, rather than the extensive one of being located close to an Italian farm, I control, similarly to equation (1), for whether a Libyan village was located within 50 km of an Italian one in 1937.

As discussed in section I, traditional intensive agriculture in Libya relied heavily on specific inputs, namely labour, camels, and water. A reduction in the availability of any of these factors would have potentially forced farmers to adopt land-extensive techniques. Column 4 of table 2 shows that the total number of Libyan workers, employed in Italian villages nearby, positively and significantly correlates with the amount of cultivated land. Conditional on being located near an

[80] MAI, *Censimento delle aziende*.

Italian farm in 1937, a 1 per cent increase in the number of indigenous workers employed within 50 km of a Libyan village corresponds to a 0.25 per cent increase in the amount of land under cultivation in 1938–9. This result is consistent with the idea that the migration of farmers away from traditional farming areas might have been harmful for indigenous productivity, as suggested by Arrighi[81] for Zimbabwe and by Segrè[82] for Italian Libya. By contrast, the total number of camels employed by Italian farmers in the 50 km radius does not significantly correlate with total cultivated land in Libyan villages (column 5). Total number of irrigated hectares in Italian farms (a proxy for the amount of underground water drained by the settlers), instead, shows a positive and significant coefficient (column 6), which in turn would suggest that increased pressure on the scarce water resources (Italians and Libyans were pumping water out of the same underground reserves) might have negatively affected Libyan agriculture. Finally, column 7 tests whether larger numbers of sheep and goats purchased by Italian farmers are significantly associated with larger amounts of cultivated land. The farming of these animals was the main economic activity in the primary sector alternative to intensive cereal agriculture.[83] If, owing to large purchases of these animals by the Italians, shepherds had to supplement their income through land-extensive cereal cultivation, this could explain part of the observed drop in yields. The coefficient, however, is small and statistically insignificant. In column 8, I perform a 'horse race' between the four measures of inputs' drain, which reinforces the idea of labour scarcity being the main driver of land-extensive farming in the proximity of Italian settlements, as labour drain is the only coefficient to remain large and significant.

Is labour drain a plausible explanation for the observed drop in productivity in proximity of Italian farms? This hypothesis would be consistent with the notion of Libya being relatively land-abundant and labour-scarce, similarly to other settler colonies[84] and African countries more generally.[85] At first inspection, however, the number of Libyans registered as full-time labourers on Italian farms may seem too small to justify a shift in the modes of production and a sizeable drop in yields, with the 1937 census reporting a mere 4200 Libyan wage workers on Italian farms. Libya, however, had a small indigenous population of about 733 000 individuals and 380 000 males,[86] of which only roughly 50 per cent were aged between 15 and 59 years. This provides a rough estimate of the male active population at about 190 000,[87] which would still imply that Italian farms employed only about 2.2 per cent of the total adult male population. However, only 65 per cent of these 190 000 active adult males were employed in agriculture, or 123 500[88] and, importantly, full-time workers were the minority of the Libyan labour force. Segrè estimates that, in peak season, the Ente farms alone employed roughly 2000 seasonal workers in Cyrenaica, which constitutes an 11-fold increase compared with the 180 Libyans officially reported in the 1937 agricultural census.[89] If this 11-fold increase is representative of the general pattern

[81] Arrighi, *Political economy*.

[82] Segrè, *Fourth shore,* p. 154.

[83] Ibid., pp. 145–6.

[84] Lützelschwab, 'Settler colonialism', p. 155.

[85] Herbst, *States and power.*

[86] Regno d'Italia, *VIII censimento*, p. 21*.

[87] Ibid, p. 25*.

[88] Ibid., p. 31*.

[89] Segrè, *Fourth shore,* p. 154. This figure refers to the five villages operated by the Ente per la colonizzazione della Libia in Cyrenaica in 1937, namely Maddalena, Beda Littoria, Razza, Savoia, and Berta.

across the country, I can tentatively conclude that Italians might have employed, in peak season, roughly 46 200 (4200×11) indigenous agricultural labourers across the country, or up to 37 per cent[90] of the total male adult population active in agriculture. These figures give a sense of the magnitude of the phenomenon and of its potential impact on the Libyan farming sector. It should be noted that rural-to-urban migration and employment of Libyan workers in the army and for public works was also widespread, and that these different sources of employment surely exacerbated the drain of labour out of areas of traditional farming. The correlation between employment on Italian farms and lower productivity levels, however, is robust to several controls for proximity to cities and colonial infrastructure, which suggests a central role of rural-to-rural migration in explaining the measured effect. According to the available evidence, the drafting of these workers was largely voluntary and performed in return for monetary wages.[91]

VII | LIBYAN WELFARE

I now turn my attention to the issue of Libyan welfare. From the analysis performed so far, in fact, it is difficult to understand whether the observed drop in productivity was associated with a worsening of indigenous living standards. Italians paid relatively high wages, which possibly mitigated the negative impact of falling yields. Gaining a sense of the relative importance of these counteracting forces is paramount in providing an evaluation of the welfare effect of Italian agricultural settlement. Owing to data limitations, I here take a more aggregate approach and use the available information on wages, cultivated land, and yields to compute, through back-of-the-envelope calculations, an income range for Libyan farmers in 1939 in villages in the treatment group, which I subsequently compare with plausible counterfactual scenarios.

First, it is important to gain some historical perspective on the patterns of change in Libyan agriculture. In fact, the notion of low Libyan yields in the proximity of Italian farms is based on a comparison with the control group in 1939. Benchmarking agricultural productivity in 1939 with the period preceding Italian settlement would help me validate the cross-sectional findings and, at the same time, gauge an understanding of the magnitude of the actual drop. Two technical reports, dating back to the early days of the Italian military presence in Libya, offer some information on indigenous agricultural production in Tripolitania for selected villages, after Italian occupation but before agricultural settlement took off.[92]

The 1913 villages that I could match with the 1938–9 survey data are reported in table 3, and are all locations that fall within a 50 km radius of Italian farms in 1938–9. As discussed above, Libyan villages located near Italian ones were undoubtedly the least productive in 1939, with average cereal yields across the indigenous villages in the treatment group of about 1.4 cwt/ha, against 4.8 ctw/ha in the control group (see table A7 in the online appendix). Yields varied between irrigated and dry farms across 1913 villages, but the comparison in panel A of table 3 suggests a striking reversal of fortunes. If one looks at the average of irrigated and dry farming yields,[93] all recorded

[90] (46 200/123 500) × 100. If I were to focus on the 0–50 km group of villages alone, which accommodates roughly 80 000 male adults employed in agriculture, and from where most of the Libyan workers came owing to transport costs, the figure increases to about 55 per cent.

[91] Segrè, *Fourth shore,* pp. 153–4; Bertizzolo and Pietrantonio, 'A denied reality?'.

[92] Commissione Bertolini, *La Tripolitania*; Missione Franchetti, *La missione Franchetti.*

[93] Most cultivations were based on labour-intensive, semi-irrigated farming (see Missione Franchetti, *La missione Franchetti*, pp. 295–7).

TABLE 3 Libyan barley yields (cwt/ha) and cultivated land in 1913 and 1939

Panel A: source for 1913	**Commissione Bertolini (1913)**			**Missione Franchetti (1914)**			
Village	**Misurata (1)**	**Zliten (2)**	**Homs (3)**	**Msellata (4)**	**Garian (5)**	**Tarhuna (6)**	**Avg (7)**
Barley yields (cwt/ha)							
1913							
Dry farming	3.1	10	6.4	4	4.2	8	5.95
Irrigated (2*x*)	6.2	20	12.8	8	8.4	16	11.9
Avg dry – irrigated	4.65	15	9.6	6	6.3	12	8.9
1939	0.35	3.2	0.35	1.1	0.47	1.4	1.2
Delta 1939 – 1913%	−92	−79	−96	−82	−93	−88	−88

Panel B: source for 1913	**Commissione Bertolini (1913)**						
Village	**Misurata (1)**	**Zliten (2)**	**Tagiura (3)**	**Zanzur (4)**	**Gargaresc (5)**	**Gurgi (6)**	**Avg (7)**
Cultivated land (ha)							
1913	2000	15 000	2109	940	80	68	3366
1938	2810	3600	1269	67	275	242	1377
Delta 1938 – 1913%	41	−76	−40	−93	244	256	55

Panel A compares barley yields cwt/ha for the same village in 1913 and 1939. 1939 data are from the 1939 agricultural survey (see section III for details), and locations correspond to those reported in the table, apart from Homs, Garian, and Tarhuna, which are district capitals and only feature Libyan cultivation in smaller nearby villages in 1939. In these cases, Libyan barley productivity of the closest Libyan village for which the information was reported is used instead. These are Suk el Kemis (Homs), Beni Daud (Garian), and Ulad Maarref (Tarhuna). The 1913 data come from two surveys collected by Italian technical experts after the occupation of Libya. The data points are collected from text and tables. If multiple figures or a range of figures are provided for the same village, the most conservative (lowest) figure of barley yields is reported. All villages reported in the table are located within 50 km of an Italian village in 1938–9, so they all belong to the treatment group. All productivity figures should be doubled if irrigated farming was practised (see Commissione Bertolini, *Tripolitania* and Missione Franchetti, *La missione Franchetti*). Panel B reports total cultivated land for the few villages for which information is available in both years. In all cases, the name of the village coincides between 1913 and 1939 sources. All six villages in panel B fall within 50 km of Italian farms in 1938–9. Of these villages, Tagiura, Zanzur, and Gurgi are coded as Italian villages in my analysis as they experienced Italian farming in 1938–9. See section III for details on the data.

villages were roughly between 5 and 20 times more productive before Italian settlement than they were in 1939, at levels that we could consider high by international standards.[94] On average, barley productivity in these six villages dropped by about 88 per cent between 1913 and 1939. Assuming these figures are reliable and representative of the general pattern across the country, villages in the treatment group would have been significantly more productive than control group ones in 1939, in the absence of Italian settlement.

As shown in panel B of table 3, the picture for cultivated land was more varied. While the average growth rate across the six sampled villages is +55 per cent (column 7), half of the villages

[94] Federico, *Feeding the world,* pp. 70–1.

experienced a drop in the recorded size of cultivated land. It should be noted, however, that while cereals were by far the main crop in 1913 (and specifically barley), the figures reported for 1913 include an estimate of land under cultivation for all types of crop, which makes the +55 per cent growth rate a lower-bound estimate of the average increase in cultivated land. Relative to such a significant increase in acreage, the massive drop in yields highlighted in panel A appears more plausible. These figures, in turn, confirm that treated villages in 1939 adopted land-extensive agriculture, albeit with significant heterogeneity.

To shed light on the impact of Italian farming on Libyan welfare, I start by performing a back-of-the-envelope calculation to establish an income range for Libyans living within 50 km of Italian villages in 1939. I then compare this range with alternative counterfactuals where Libyan subsistence households would have experienced neither a drop in yields nor extra income from wage labour.

To provide a conceptual framework for this exercise, I define the yearly income of subsistence Libyan households as $I = Y + W$, where Y is total nominal agricultural output and W is the total wage earned by indigenous cultivators on commercial farms, similarly to Dyer, Boucher, and Taylor.[95] For simplicity, W equals $n \times w$, where n is the total number of workers employed by Italian farmers and w is the annual salary of each worker. Total agricultural output Y for subsistence households can be defined in a standard Cobb–Douglas form as $Y = ATLC$, where A is the available technology, T the cultivated land, L the labour, and C capital. As discussed in sections I and IV, differences in technology and capital across Libyan villages were minimal. No substantial changes in the modes of indigenous production seem to have taken place differentially across groups, between 1913 and 1939.[96] We can therefore simply define subsistence output as a function of land and labour, or $Y = TL$, which in turn suggests how total agricultural output is determined by land productivity and total cultivated land, or $Y = (Y/T) \times T$. As discussed above, land was abundant relative to the small Libyan population, and farmers could alter the amount of land under cultivation by exploiting more marginal areas without experiencing a significant reduction in land suitability.

Table 4 reports the results of this exercise. Panel A provides five alternative estimates for the yearly income per capita for Libyans living in the sub-sample of 57 Libyan villages located within 50 km of an Italian farm (the treatment group expunged of Italian villages). Calculations and details are reported in section III of the online appendix. For 1939, column 6 suggests an average yearly per capita income ranging between 87 and 161 LIT. My preferred estimate is OIII (average daily salary from the salary range suggested by Segrè[97] and a conservative total number of migrant workers at 23 100), which places income at around 103 LIT per capita, while the median estimate is slightly higher at 119 LIT/PC.

Panel B shows the first set of counterfactual calculations. Had the Italians never settled, and no agricultural salaries could be earned on colonial commercial farms, what would be the per capita income? The intuition underlying this exercise is that, in the absence of labour drain, Libyans would have been able to implement traditional labour-intensive cultivation, thus achieving higher land productivity. To find plausible counterfactual yields, in CI, I use the average for the control group in 1939 while, in CII, I employ the average barley productivity for the six villages reported in table 3 for 1913. As is visible in column 6, both counterfactual calculations

[95] Dyer, Boucher and Taylor, 'Subsistence response'.

[96] Missione Franchetti, *La missione Franchetti*; Segrè, *Fourth shore.*

[97] Segrè, *Fourth shore*, p. 154.

TABLE 4 Estimated and counterfactual Libyan income in the treatment group

	T (ha) (1)	*y* (Y/ha) (2)	*Y* millions LIT (3)	*W* millions LIT (4)	*Y+W* millions LIT (5)	LIT/PC (6)
Panel A: Libyan per capita income in the treatment group in 1939						
Observed (OI)	149 332	0.9	9.9	9.2	19.1	**87.4**
Observed (OII)	149 332	0.9	9.9	16.2	26.0	**119.1**
Observed (OIII)	149 332	0.9	9.9	12.7	22.6	**103.3**
Observed (OIV)	149 332	0.9	9.9	19.1	28.9	**132.3**
Observed (OV)	149 332	0.9	9.9	25.4	35.3	**161.4**
Panel B: counterfactual land-extensive response | no labour drain						
Counterfactual (CI)	149 332	4.1	42.9	0.0	42.9	**196.0**
Counterfactual (CII)	149 332	8.9	93.0	0.0	93.0	**425.5**
Panel C: counterfactual no land-extensive response | no labour drain						
Counterfactual (CIII)	43 732	4.1	12.6	0.0	12.6	**57.4**
Counterfactual (CIV)	43 732	8.9	27.2	0.0	27.2	**124.6**
Counterfactual (CV)	96 343.2	4.1	27.7	0.0	27.7	**126.5**
Counterfactual (CVI)	96 343.2	8.9	60.0	0.0	60.0	**274.5**

The table reports the estimated income per capita in 1939 and plausible counterfactual calculations for the 57 villages of the control group that were not affected by Italian settlement. Column 1 is cultivated land in hectares, column 2 is yields (cwt) per hectare, column 3 is cereal output in millions of Italian Lire (price is 70 LIT/cwt), column 4 is the total agricultural salary in millions of Italian Lire, column 5 is total income in millions of Italian lire (the sum of 3 and 4), and column 6 reports the per capita income in Italian Lire for the observed total population of 218 660 individuals in 1936. Panel A reports different plausible estimates of the average income from cereal cultivation and wage labour. Cultivated land and yields are observed. Different total wages in OI to OV depend on different combinations of the approximated daily wages, number of workers, and working days. Panel B reports the first set of counterfactual estimates without adjusting for the land-extensive cultivation response. Both CI and CII employ the measured 1938–9 cultivated land. CI employs average yields in the >50 km control group in 1939 as the counterfactual yield, while CII uses the 1913 average (see table 3). Panel C provides counterfactual amounts of cultivated land, and uses the same counterfactuals yields as in CI and CII. CIII and CIV use per capita cultivated land in the >50 km control group in 1938–9 to compute the counterfactual amount of cultivated land, while CV and CVI build a counterfactual amount of cultivated land based on the 1913–39 average growth rate of 55 per cent shown in table 3. See text and the online appendix for the employed sources and details about the calculations. All figures are rounded to the first decimal, while the calculations are performed with the un-approximated figure, hence some small discrepancies in the calculation. See section III for details on the data.

show levels of per capita income far larger than the upper-bound estimated range for 1939 in panel A.

One limitation of CI and CII is that both calculations use total cultivated land in 1938–9. As discussed in section VI, however, such an amount might have been in itself the result of Italian settlement and labour drain. In panel C, I provide four alternative calculations incorporating, for different potential yields, counterfactual amounts of cultivated land. In CIII and CIV, I create a

counterfactual cultivated land scenario that applies the observed 1938–9 land-to-population ratio in the 62 Libyan villages of the control group to treated villages. The total population in control locations was 96 788 with a total acreage of 19 066 ha, which gives an average cultivated land per capita of roughly 0.2 ha/PC. CV and CVI probably offer better counterfactuals by using a total figure of 96 343 ha of cultivated land, obtained by rescaling the observed total acreage by the average growth rate between 1913 and 1939 of 55 per cent (see panel B, table 3). Panel C provides counterfactual per capita incomes ranging between 57 and 323 LIT, with the employed counterfactual acreage of CV and CVI being the most plausible.

Overall, the counterfactual exercise in table 4 paints a negative picture of the effect of Italian agricultural activity on Libyan welfare. In fact, comparing the median 1939 estimate of Libyan per capita income of LIT 119 (OI to OV) with the counterfactual median of LIT 161 (CI to CVI) suggests a staggering 26 per cent reduction in Libyan welfare in the proximity of Italian farms. My preferred estimate of per capita income in treated villages of LIT 103 would suggest an even larger decrease of roughly 40 per cent. Agricultural wages, therefore, seem to have only partially compensated for the negative effect of the Italian presence on land productivity in the 0–50 km radius. This is true despite not considering lost income for pastoralists, which was possibly even more significant owing to land expropriation outside areas of permanent farming.[98] Trying to precisely establish the extent to which the observed land-extensive response was successful in mitigating the drop in yields is difficult, as a less pronounced acreage extension would have also possibly attenuated the drop in yields to somewhere above the observed 0.9 cwt/ha. However, if I take CV's cultivated land as a conservative counterfactual acreage in combination with observed 0.9 average yield for the treatment group, I can tentatively conclude that the average income per capita in the treatment group would have been about 27 per cent lower than the median estimate for 1939 (87 LIT/PC versus 119 LIT/PC) in the absence of a land-extensive response, which suggests how the latter strategy was, at least partially, successful.

If these results are to be believed, a significant amount of welfare was lost owing to the settlement of Italian farmers. Why, then, did such large labour migration take place and who benefited from these market linkages? The answer to the first part of the question probably lies in the distributional consequences of the phenomenon. Libyan landowners, for instance, would have struggled to find labour after the colonists settled, while landless peasants could take better advantage of the higher monetary wages paid by the Italians. Adult males could choose to migrate, earn higher wages, and increase consumption, while children, women, and the elderly were dependent on agricultural output and remittances for their subsistence. In a setting characterised by general labour scarcity and land abundance, it is thus plausible that a relocation of labour of this magnitude might have had an aggregate negative effect on the indigenous population, while parts of it were made better off. On the demand side of the spectrum, Italian farmers who, thanks to

[98] It should be stressed that this calculation includes only a rough approximation of total wages earned by migrant Libyan labourers and refers to sedentary farmers. Many temporary workers on Italian farms probably earned additional salary in other employments, in urban centres and as construction workers for public works, which may have increased the total salary mass earned by Libyans, thus possibly making the 26 per cent decline in welfare an upper-bound estimate of the true effect. The total number of hours assumed as an average between permanent and temporary workers in my preferred calculation OIII, however, is generous at 100 days per year. Moreover, the assignment of 50 per cent of the estimated total number of Libyan agricultural workers to villages of the treatment group (expunged of villages that experienced Italian settlement from which most of the work arguably came from) only is also likely to be an overestimation. OIV and OV, even bring the total number of working days and percentage of Libyan workers to the treatment group to 150 and 100 per cent, respectively. Thus the 26 per cent reduction in welfare may ultimately be a fair approximation of the drop in income per capita in the treatment group.

larger capital availability and more advanced farming techniques, likely achieved higher labour productivity (see section II.IV of the online appendix), stood to extract a large share of the welfare lost by the Libyans. Finally, it is possible that part of this welfare was lost, at least in the short term, owing to the relocation of the available labour to more marginal lands, which needed time for improvements (for instance ploughing and irrigation works) before achieving higher productivity levels.

VIII | CONCLUSION

In this paper, I have studied the impact of the Italian agricultural settlement on Libyan farming and, specifically, on sedentary cultivators during the colonial period. The results have highlighted how, in the 1930s, Italian farming triggered a substantial drop in land productivity in villages neighbouring Italian farms, likely due to a drain on labour via factor markets. This relocation of workers caused a drop in yields and output that was only partially compensated by the adoption of land-extensive techniques by the locals and monetary wages earned on Italian farms. In fact, a tentative back-of-the-envelope calculation of Libyan income per capita in indigenous villages affected by Italian settlement suggests a roughly 26 per cent decline in welfare relative to plausible counterfactual scenarios.

The paper adds to the related literature in two main ways. First, contrary to the traditional understanding of the economic dynamics shaping agricultural production in African settler colonies[99], the Libyan case study shows how the expropriation of the best land by European elites was not a necessary condition for reducing indigenous productivity and welfare, which could also be affected by a drain on factors of production via factor markets. Second, as opposed to the standard model of positive effects from technological diffusion among neighbours highlighted in the literature,[100] I could find no evidence of positive spatial spillovers from centres of agricultural innovation. This finding suggests how, in a dual economy split between a commercial and a subsistence sector, the latter might not experience productivity gains if the former drains inputs via factor markets.[101]

While the described results offer important insights into the effect of settler farming on the indigenous agricultural sector that go beyond the Libyan context, the study presents a few limitations. First, while offering the possibility to identify market dynamics linking commercial and subsistence sectors in a dual settler economy, it is important to note how land grabbing in Libya markedly differed from other colonial settings, where settler communities were stronger and land expropriation faced fewer constraints. Thus, one should be careful when generalising these findings: arguably, when settler farming entailed a combination of drain of factors of production and land expropriation, the effect on indigenous productivity and welfare could be even more severe. Second, the results should be considered in the context of interwar Libya, a colony managed by an authoritarian government with a strong inclination for state intervention in the economy. While the described fascist policies in Libya provide an insightful case study that allows one to effectively isolate the impact of settler farming, the level of support that the Italian farmers received through

[99] Arrighi, *Political economy;* Mosley, *Settler economies*; Feinstein, *Economic history.*

[100] Parman, 'Good schools'; Conley and Udry, 'Learning about a new technology'; Foster and Rosenzweig, 'Learning by doing'.

[101] Dyer, Boucher and Taylor, 'Subsistence response'.

subsidies, land grants, and direct investments by the fascist government was significant throughout the period of analysis, and arguably unprecedented in the African context. It was largely due to state support, in itself a non-market mechanism, that Italian settlers gained a competitive edge over indigenous producers.

Two aspects of the story were not discussed in depth in the paper and require further analysis. First, it remains unclear whether the described negative impact through factor markets was a persistent feature of the Libyan agricultural sector, or evaporated in the medium term. Second, the distributional consequences of Italian settlement on Libyan welfare also require additional research. While an average negative effect on income due to a drop in yields is a plausible finding, agricultural migration is welfare maximising.[102] Hence, it is likely that parts of the population benefited from better wage labour opportunities. The exact quantification of this distribution, as well as the medium- and long-term consequences for Libyan welfare and development, however, falls beyond the scope of the present investigation.

Notwithstanding these limitations, my findings provide a useful conceptual and empirical framework for the study of the impact of the settlement of European farmers in other colonial settings, and of the presence of skilled cultivators more broadly. In fact, the market dynamics pinpointed in Libya would apply to any settings where the productivity gap between the commercial and subsistence sector is severe and the allocation of agricultural factors of production strongly unequal, even in the absence of openly discriminatory policies.[103]

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REFERENCES

Arrighi, G., *The political economy of Rhodesia* (The Hague, 1967).

Austin, G., 'Resources, techniques, and strategies south of the Sahara: revising the factor endowments perspective on African economic development, 1500–2000', *Economic History Review*, 61 (2008), pp. 587–624.

[102] Ibid.

[103] Bertazzini, Replication files.

Ballico, P., *Brevi note illustrative sulla Libia* (Florence, 1939).
Bazzi, S., Gaduh, A., Rothemberg, A. D., and Maisy, W., 'Skill transferability, migration, and development: evidence from population resettlement in Indonesia', *American Economic Review*, 106 (2016), pp. 2658–98.
Bertizzolo, F. and Pietrantonio, S., 'A denied reality? Forced labour in Italian colonies in Northeast Africa', *Africana Studia*, 7 (2004), pp. 227–46.
Bharadwaj, P. and Mirza, R. A., 'Displacement and development: long term impacts of population transfer in India', *Explorations in Economic History*, 73 (2019), 101273.
Boserup, E., *The conditions of agricultural growth: the economics of agrarian change under population pressure* (London, 1965).
Bruhn, M. and Gallego, F. A., 'Good, bad, and ugly colonial activities: do they matter for economic development?', *Review of Economics and Statistics*, 94 (2012), pp. 433–61.
Cavanagh, E. and Veracini, L., eds., *The Routledge handbook of the history of settler colonialism* (Abingdon & New York, 2020).
Conley, T. G., and Udry, C. R., 'Learning about a new technology: pineapple in Ghana', *American Economic Review*, 100 (2010), pp. 35–69.
Cresti, F., *Non desiderare la terra d'altri: la colonizzazione italiana in Libia* (Rome, 2011).
Del Boca, A., *Gli italiani in Libia. Dal fascismo a Gheddafi* (Bari, 1988).
Dell, M. and Olken, B. A., 'The development effects of the extractive colonial economy: the Dutch cultivation system in Java', *Review of Economic Studies*, 87 (2020), pp. 164–203.
Dyer, G. A., Boucher, S. and Taylor, J. E., 'Subsistence response to market shocks', *American Journal of Agricultural Economics*, 88 (2006), pp. 279–91.
Federico, G., *Feeding the world: an economic history of agriculture, 1800–2000* (Princeton, NJ, 2005).
Feinstein, C. H., *An economic history of South Africa: conquest, discrimination, and development* (Cambridge, 2005).
Fenske, J., 'Land abundance and economic institutions: Egba land and slavery, 1830–1914', *Economic History Review*, 65 (2012), pp. 527–55.
Foster, A. D., and Rosenzweig, M. R., 'Learning by doing and learning from others: human capital and technical change in agriculture', *Journal of Political Economy*, 103 (1995), pp. 1176–209.
Fourie, J. and von Fintel, D., 'Settler skills and colonial development: the Huguenot wine-makers in eighteenth-century Dutch South Africa', *Economic History Review*, 67 (2014), pp. 932–63.
Fowler, G. L., 'Italian agricultural colonization in Tripolitania, Libya', unpub. Ph.D. thesis, Syracuse University (1969).
Fowler, G. L., 'Decolonization of rural Libya', *Annals of the Association of American Geographers*, 63 (1973), pp. 490–506.
Herbst, J., *States and power in Africa: comparative lessons in authority and control* (Princeton, NJ & Chichester, 2000).
Heywood, L. M., 'The growth and decline of African agriculture in central Angola, 1890–1950', *Journal of Southern African Studies*, 13 (1987), pp. 355–71.
Hornung, E., 'Immigration and the diffusion of technology: the Huguenot diaspora in Prussia', *American Economic Review*, 104 (2014), pp. 84–122.
Klein Goldewijk, K., Beusen, A., Van Drecht, G. and De Vos, M., 'The HYDE 3.1 spatially explicit database of human-induced global land-use change over the past 12,000 years', *Global Ecology and Biogeography* 20 (2011), pp. 73–86.
Labanca, N., *Oltremare: storia dell'espansione coloniale italiana* (Bologna, 2002).
Larebo, H. M., *The building of an empire: Italian land policy and practice in Ethiopia, 1935–1941* (Oxford, 1994).
Lowes, S. and Montero E., 'Concessions, violence, and indirect rule: evidence from the Congo Free State', *Quarterly Journal of Economics*, 136 (2021), pp. 2047–91.
Lützelschwab, C., 'Settler colonialism in Africa', in L. Christopher, J. Metzer and S. Richard, eds., *Settler economies in world history* (Leiden, 2013), pp. 141–67.
Michalopoulos, S. and Papaioannou, E., 'Historical legacies and African development', *Journal of Economic Literature*, 58 (2020), pp. 53–128.
Mosley, P., *The settler economies: Studies in the economic history of Kenya and Southern Rhodesia, 1900–1963* (Cambridge, 1983).
Parman, J., 'Good schools make good neighbors: human capital spillovers in early 20th century agriculture', *Explorations in Economic History*, 49 (2012), pp. 316–34.

Peri, G., 'The effect of immigration on productivity: evidence from US states', *Review of Economics and Statistics*, 94 (2012), pp. 348–58.
Piccioli, A., *La nuova Italia d'oltremare: l'opera del fascismo nelle colonie italiane*, 2 vols (Milan, 1934).
Sartre, J.-P., *Colonialism and neocolonialism* (Paris, 1964).
Segrè, C. G., *Fourth shore: the Italian colonization of Libya* (Chicago, 1974).
Shutt, A. K., 'Squatters, land sales and intensification in Marirangwe purchase area, colonial Zimbabwe, 1931–65', *Journal of African History*, 43 (2002), pp. 473–98.
Simkins, C., 'Agricultural production in the African reserves of South Africa, 1918–1969', *Journal of Southern African Studies*, 7 (1981), pp. 256–83.

OFFICIAL PUBLICATIONS

British Military Administration, *Survey of land resources in Tripolitania* (Tripolitania, 1945).
Commissione Bertolini, *La Tripolitania settentrionale* (Rome, 1913).
Missione Franchetti, *La missione Franchetti in Tripolitania* (Florence, Milan, 1914).
Regno d'Italia, *VIII Censimento generale della popolazione, 1936*, vol. 5, *Libia, Isole Italiane dell'Egeo, Tientsin* (Rome, 1939).
Theodorou, N., *Report to the Government of Libya on indigenous and Italian enterprises in the Zavia area*, 259, FAO expanded technical assistance program (ETAP) (Rome, 1954).
Wheatley, O., *Report to the government of Libya on the agriculture of Libya*, 13, FAO Expanded technical assistance program (ETAP) (Rome, 1951).

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