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The long-term impact of the Italian colonial expenditures in the Horn of Africa

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LIST OF ABBREVIATIONS

ACS: Archivio Centrale dello Stato

ASMAE: Archivio Storico del Ministero degli Affari Esteri

IAC: Istituto Agricolo Coloniale

MAI: Ministero dell'Africa Italiana

ABSTRACT

A growing body of literature analyses the relationship between colonialism and long-term development, but largely overlooks the effect of colonial public investments on transportation infrastructure, schooling and sanitary facilities. In my research, I exploit the case study of Italian colonial investments in the Horn of Africa between 1934 and 1941, to unveil the relationship between such investments and present-day inequalities in terms of level of development and living standards and to explore the mechanisms that explain the persistence of colonial investments over time.

I create three geo-referenced (a grid dataset and two individual) datasets by matching historical data on colonial investments, collected from both archival and printed primary sources, with micro-level open-source contemporary data for development and modern surveys for living standards to perform OLS and probit regression analysis. Firstly, I regress proxies for level of development, such as population density and light density at night, on dummies for being within 20km from colonial roads. Secondly, I regress measures of living standards, such as female literacy, BMI and children holding a sanitary card, on binary variables for living less than 10km away from a colonial schools and hospitals. Several robustness checks are performed to address the possible endogenous placement of colonial facilities including IV estimation, placebo treatment and nearest neighbour score matching.

The data show a strong, positive and statistically significant relationship between proximity to colonial roads and economic development, on the one hand, and proximity to schooling, sanitary facilities and living standards, on the other. This demonstrates that areas endowed with more generous investments from the colonial period perform better in terms of economic development and living standards at present. The analysis also points out that the effect persisted mainly through phenomena of path-dependency and re-location.

INTRODUCTION

Despite a growing body of literature that analyses the relationship between colonialism and long-term development, little attention has been dedicated to colonial public investments and their long-term impact on former colonies. My dissertation sheds light on this relationship. It explores the extent to which colonial-era investments can explain present-day inequalities in terms of economic development and living standards at a micro level. The work can be divided in two main parts: in chapter 2, I focus on the long-term impact of colonial roads on contemporary economic development at a sub-district level. In chapter 3, I analyse the long-term effect of colonial schooling and sanitary facilities on long-term living standards indicators, such as literacy and body mass. In both cases, I also explore the persistence mechanisms.

By unveiling the relationship between colonial investments and contemporary development and, at the same time, by describing the channels through which colonial endowments affected post-colonial countries, my research sheds new light on the reasons for the unequal development in Africa. With regard to the related literature, this dissertation adds to the existing knowledge on the historical origins of unequal African development and provides new evidence about the impact of colonialism on African countries. Moreover, the specific focus on infrastructure and welfare facilities makes my work particularly interesting for policy makers, who can exploit the evidence coming from historical data to analyse, with new awareness, the contemporary social and economic environment and, eventually, use it to make more informed decisions.

To address the above issues, I exploit the case study of the Italian colonies of the Horn of Africa, namely Eritrea, Somalia and Ethiopia. This is not only an unexplored context (to the best of my knowledge no empirical analysis has been performed for this area), but it also represents an ideal experiment to study the impact of colonial investments: it was only due to the unprecedented importance attributed to the colonies by Benito Mussolini between 1934 and 1941 that the governmental public expenditure in this area reached a remarkable level. Italians were subsequently abruptly expelled from the Horn of Africa in 1941 and any colonial activity immediately came to an

end. This short period of intense public expenditure translated into the creation of numerous public facilities and transportation infrastructure across extremely poor areas. These facilities were generally placed independently from the pre-colonial local characteristics, due to the fact that their construction was often decided in Rome according to general strategic needs.

I collect historical data on Italian investments from both archival and primary printed sources and I gather data on population density, light density and people living standards online and from modern surveys. I create two major datasets on which I perform regression analysis.

In chapter 2, I construct a grid dataset composed by 15,204 cells covering the three Italian colonies in the Horn of Africa. I regress two proxies for economic development largely employed in the literature[1], population density and light density at night on dummies for being within 20km from colonial roads. The results show a strong and positive relationship between proximity to colonial infrastructure and economic development both at the end of the colonial period and at present. This suggests that placement of transportation infrastructure during the colonial era started causing unequal sub-district level development at the end of the colonial period in 1940 and that this early effect persisted overtime up to the present.

The possible endogenous placement of roads, in other words the possibility that unobservable factors could have driven the location of colonial roads, certainly constitutes the main threat to my analysis. In order to address this issue, I instrument colonial roads for straight lines and, furthermore, I employ a placebo treatment by exploiting projected colonial roads not built due to the outbreak of WWII. I believe that these two main strategies, along with several additional minor robustness checks, satisfactorily deal with endogeneity.

I subsequently explore the emergence and persistence mechanisms that explain these results. I find that the effect of colonial roads construction already emerged by the end of the colonial period due to the advantage that better connected areas provided in terms of transportation costs and access to facilities: the government built the vast majority of schools and hospitals along the new

[1] Michalopoulos, S., and Papaioannou, E., 'Pre-Colonial Ethnic Institutions and Contemporary African Development', *Econometrica*, Vol. 81(1), (2013), pp. 113-152

arteries, the white population of the colonies found it advantageous to start a business next colonial roads and big modern farms could more easily commercialise their crops if placed in these areas. The combination of these elements, according to the available data, made treated areas attractive for both white and black population who already co-located there between 1936 and 1940.

I account for the persistence of the effect by referring to a path dependency mechanism similar to what Bleakley and Lin found for *portage* locations in the United States[2]. Firstly, I discover that colonial roads' effect endured because roads operated as an original form of sunk investment, canalising post-colonial governmental investments for road construction on pre-existing colonial infrastructures. Secondly, I find that other forms of sunk investments mattered as well: hospitals and schools built along colonial roads continued to attract people well after 1941. Thirdly, I point out how, from the 1960s, the direct attractiveness of colonial investments was lost. Starting from this point, the effect of roads persisted through a phenomenon of population co-location in the treated areas. Finally, I show that these zones presently have the characteristics of an urban environment, which suggests that urbanisation is a possible channel through which we can explain higher levels of development along colonial roads.

In order to study the long-term effect of the placement of colonial schools and hospitals in chapter 3, I create two individual-level datasets, by employing the women and children DHS surveys 2011 for Ethiopia. These are composed by 15,789 and 11,253 observations, respectively. I regress women's literacy and Body Mass Index on a dummy for living within 10km from a colonial school for blacks, in order to test whether investments in schooling are still driving living standards inequalities in 2011. With regard to children, I run a regression with a dummy for having a sanitary card, proxy for sanitary assistance efficiency, as dependent variable and a dummy for living within 10km from colonial hospitals as explanatory one. Both analysis show a positive and statistically significant correlation between proximity to colonial facilities and higher living standards at present.

[2] Bleakley, H., & Lin, J. 'Portage and path dependence', *The quarterly journal of economics*, (2012), *127*(2), 587

As for chapter 2, I am mainly concerned with endogeneity. I therefore employ nearest neighbour matching estimation for both models and, additionally, I use a placebo treatment estimation for colonial schools, exploiting colonial schools projected before 1941 and not completed because of the war. The robustness checks give estimates consistent with the hypothesis that colonial facilities play a role in shaping modern living standards.

With regard to the persistence mechanism I find that, for both types of investments, the long-term persistence is mainly due to a phenomenon of relocation of governmental investments to the same locations overtime: areas that were endowed with a colonial hospital or school are more likely to enjoy an operational facility of the same type nowadays. On the one hand, I hypothesise that this is due both to the comparative advantage provided by colonial sunk investments that economically incentivise the independent government to maintain services in the same locations. It is cheaper to establish a school or hospital in areas that already had buildings and trained personnel from the colonial era. On the other hand, I suggest that these outcomes can be explained by the higher educational investments a more educated environment could request to the central government.

As pointed out more in detail in section 1.2 of chapter 1, by looking at the micro-level impact of colonial investments on economic development and living standards, this research innovates the existing literature in several ways. Primarily, by focusing on investments, it adds to the body of empirical literature on the relationship between colonialism and long-term development and its focus on the impact of institutions[3], land tenure systems[4] and pre-colonial factors.[5] Secondly, by looking at the micro-level of colonial investments in facilities and infrastructures, this work innovates the existing literature that analyses the impact of colonial investments in human capital at

[3] Acemoglu, D., Johnson, S. and Robinson, J. A., 'The Colonial Origins of Comparative Development: An Empirical Investigation', *The American Economic Review* Vol.91(5), (2001), pp.1369-1401; Dell, M., 'The Persistent Effects of Peru's Mining Mita', *Econometrica*, Vol.78(6), (2011), pp.1863-1903

[4] Banerjee, A. and Iyer, L., 'History, institutions, and economic performance: the legacy of colonial land tenure systems in India', *American economic review*, Vol.95(4), (2005), pp.1190-1213; Frankema, E., 'The Colonial Roots of Land Inequality: Geography, Factor Endowments, Or Institutions?', *The Economic History Review*, Vol. 63 (No. 2, 2010), 418-51

[5] Michalopoulos, S., and Papaioannou, E., 'Pre-Colonial …*Op. Cit.;* Nunn N., 'The Long Term Effects of Africa's Slave Trades', *Quarterly Journal of Economics.* 123(1), (2008), pp. 139-176

the district level.[6] Thirdly, by focusing on low-cost transportation infrastructure, schooling and sanitary facilities my research adds to the body of literature that explores railroads construction and missionary activities.[7] Finally, with a regional focus, my dissertation innovates the existing qualitative contributions on Italian colonialism that either consider only cultural heritage[8] or overlook the issue of the long-term impact of Italian colonial economic policies.

I structured my dissertation into three chapters: chapter 1 wants to provide a general context in order to locate the empirical analysis of chapters 2 and 3 into precise historical and bibliographical frameworks. In section 1.1, I outline the history of the Italian colonisation in the Horn of Africa between 1880 and 1941, whereas in section 1.2 I provide a detailed literature review.

In chapter 2, I empirically analyse the short and long-term impact of transportation infrastructure on economic development. Section 2.1 provides a detailed description of the history of road building activity in Eritrea, Ethiopia and Somalia between 1880 and 1941, in section 2.2, I present my identification strategy, in section 2.3 I describe my data, in section 2.4 I present my main results. Section 2.5 reports my main robustness checks, section 2.6 accounts for the emergence mechanisms of the effect in 1940, section 2.7 describes the persistence mechanisms.

In chapter 3, I look at the long term impact of colonial schools and hospitals. In section 3.1, I describe the historical context in which colonial facilities were created and the main features of their activity, in section 3.2 I present my main specification, in section 3.3 I describe the data, while in section 3.4 I display my main results. Section 3.5 presents my main robustness checks and section 3.6 describes the channels of persistence.

[6] Huillery, E., 'History matters: The long-term impact of colonial public investments in French West Africa', *American Economic Journal: Applied Economics*, (2009), pp. 176-215

[7] Burgess, R. and Donaldson, D., 'Can Openness Mitigate the Effects of Weather Shocks? Evidence from India's Famine Era', *The American Economic Review* (2010), pp. 449-53; Gallego, F. A., 'Historical origins of schooling: The role of democracy and political decentralization', *The Review of Economics and Statistics*, Vol. 92(2), (2010), pp. 228-243; Woodberry, R. D., 'The missionary roots of liberal democracy', *American Political Science Review*, Vol. 106(02), (2012), pp. 244-274

[8] Andall, Jacqueline & Duncan, Derek, Italian colonialism. Legacy and memory, (Bern, 2005)

CHAPTER 1:

Historical context and literature review

1.1 THE ITALIAN COLONIES OF THE HORN OF AFRICA: AN HISTORICAL CONTEXT

Before looking at the various infrastructural realisations achieved by the Italian colonial government in the Horn of Africa between 1935 and 1941, it is necessary to provide a brief historical context to the Italian expansion in Eritrea, Somalia and Ethiopia. I will firstly describe the origins of the Italian colonialism in the region between the 19th and the 20th centuries. Secondly, I will outline the fascist colonial policy between 1922 and 1934 and describe the invasion of Ethiopia between 1935 and 1936. Thirdly, I will analyse the administrative organisation given to the newly conquered territories between 1936 and 1941 and the economic and social environment that was formed in this period. Finally I will focus on the British-Italian war and the end of the Italian possessions in the Horn of Africa. This historical context aims to make the empirical analysis of chapters 2 and 3 more easily comprehensible by providing the necessary spatial and historical framework.

1.1.1 The origins of the Italian colonial possession in the Horn of Africa (1869-1922)

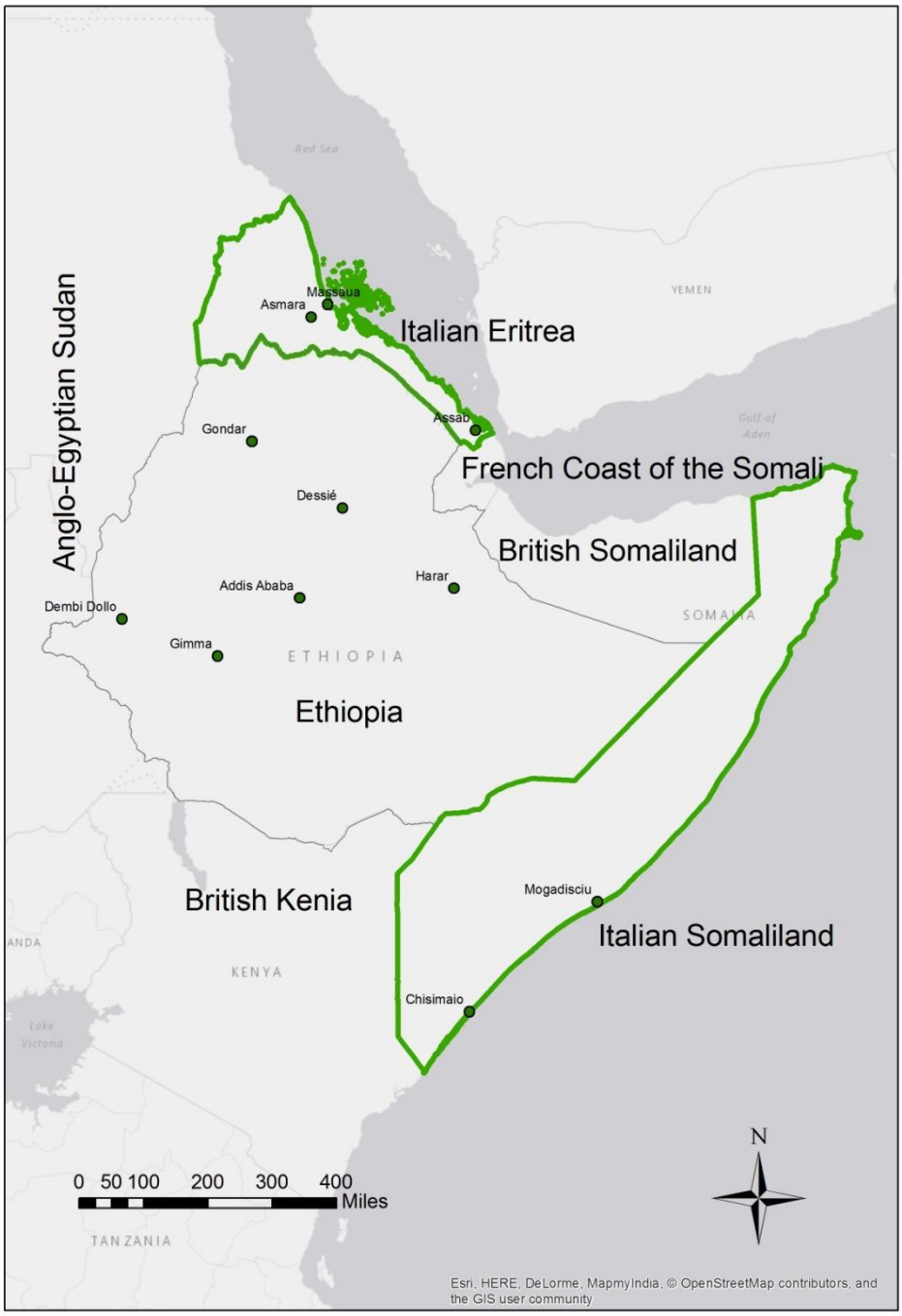
The Italian presence in the area began with the private initiative of the ship-owner Raffaele Rubattino, who purchased from the local sultan the small port of Assab in 1869; this investment followed the opening of the Suez canal and aimed to create a strategic base for Italian commerce towards the Indian Ocean.[9] Due to the unprofitability of the operation, Rubattino was tempted to abandon the base of Assab, but was financially backed by the Italian government that was looking for colonial affirmation after the unilateral French annexation of Tunisia and that saw Assab as a starting point for further expansion. In 1882, Assab officially became a colony administered by a

[9] Del Boca, Angelo, *Gli italiani in Africa Orientale. Dall'Unità alla marcia su Roma*, (Laterza, 1976), pp. 36-40

governor.[10] At the Conference of Berlin (1884-5) Italy obtained British diplomatic support for the occupation of the port of Massawa: this was fully achieved, along with the surrounding area by 1890. Between 1890 and 1896 Crispi's government fostered the military expansion in the Eritrean Highlands, in the region of the Hamasien, whose capital Asmara substituted Massawa as administrative capital of Eritrea in 1897.[11] The Italian expansion in the Tigré region, the area beyond the Mareb river, was stopped in 1896 by the victory of Emperor Menelik at Adwa, where the better equipped Italian army lost between 5,000 and 7,000 men and more than 3,000 were made prisoners. This battle brought to the formal establishment of the frontier between Italian Eritrea and Ethiopia along the Mareb River and, more importantly, created what some historians call the 'Adwa complex'.[12] This expression is normally used to identify the sense of military inferiority that the Italian public opinion and governments developed towards Ethiopia and, at the same time, the desire for revenge against an Ethiopia that had humiliated Italian colonial aspirations. This certainly played a role in the Fascist propaganda preceding the Ethiopian invasion of 1935.[13]

The occupation of Somalia followed a similar pattern. Originally, only a small coastal territory was purchased by the entrepreneur Vincenzo Filonardi from the Sultan of Zanzibar in 1893, in order to pursue cotton cultivation.[14] In the same period the Italian government obtained the protectorates on the Sultanates of Obbia and Migiurtina by diplomatically exploiting the rivalries among the local Sultans.[15] Filonardi was financially backed by the Italian government to exert administrative control on the area; the failure of the company to achieve a satisfactory administration of the zone, and the modest revenue provided by the agricultural exploitation of the region [16] convinced the Italian government to proceed with a more direct control on the area: in

[10] Labanca, Nicola, *Oltremare. Storia dell'espansione coloniale italiana, (Il Mulino, 2002),* pp.49-51
[11] Ivi, pp. 65-70
[12] Goglia, Luigi and Grassi, Fabio, *Il colonialismo italiano da Adua all'Impero* (Laterza, 1993), pp. 56-9
[13] Labanca, Nicola, *Oltremare. Storia dell'espansione…Op. Cit.*, p. 155
[14] Ivi, pp. 88-9
[15] Ibidem
[16] Del Boca, Angelo, *Gli italiani in Africa Orientale. Dall'Unità, Op. Cit.*, pp. 567-71



Map 1.1. Italian colonies in the Horn of Africa in 1934

1900 the ‘Società del Benadir’ was created and substituted for the ‘Filonardi company’. This new company, funded by combining private and public capital, extended the Italian control to the

more internal zones and facilitated the transition to a direct governmental control in 1905, when Somalia officially became a colony.[17]

Both Eritrea and Somalia played a marginal role in the economic and cultural life of Italy between the end of the 19th and the early 20th century, mainly due to the scarce resources that liberal governments were willing to invest in the colonies, and to the lack of natural resources in the colonies that made any business unprofitable. The Libyan campaign between 1911 and 1913, and the large cultural mobilisation that followed, created new interest for the African colonies in the public opinion.[18] The outbreak of WWI prohibited a stable occupation of the territory, that was forcefully limited to the main centers of the coast.[19] The new importance that the occupation of Libya gave to the colonies in the national public opinion can be clearly perceived in the decision of creating a Ministry of colonies in 1912, separated from the Ministry of foreign affairs.

Despite the fact that the British government promised in the 'London pact' African territorial compensations to Italy in case of allied victory in order to push Italy into the conflict, this promise was not fully respected at Versailles.[20] This created the myth of the 'Vittoria mutilata' ('mutilated victory'), according to which the allies deprived Italians of the fair prizes for their victory. Mussolini largely exploited this concept in order to motivate the public opinion to pursue a more aggressive colonial policy and ultimately to justify the conquest of a 'Posto al sole' ('place under the sun') with the aggression to Ethiopia.[21]

1.1.2 The fascist colonial policy and the invasion of Ethiopia (1922-1936)

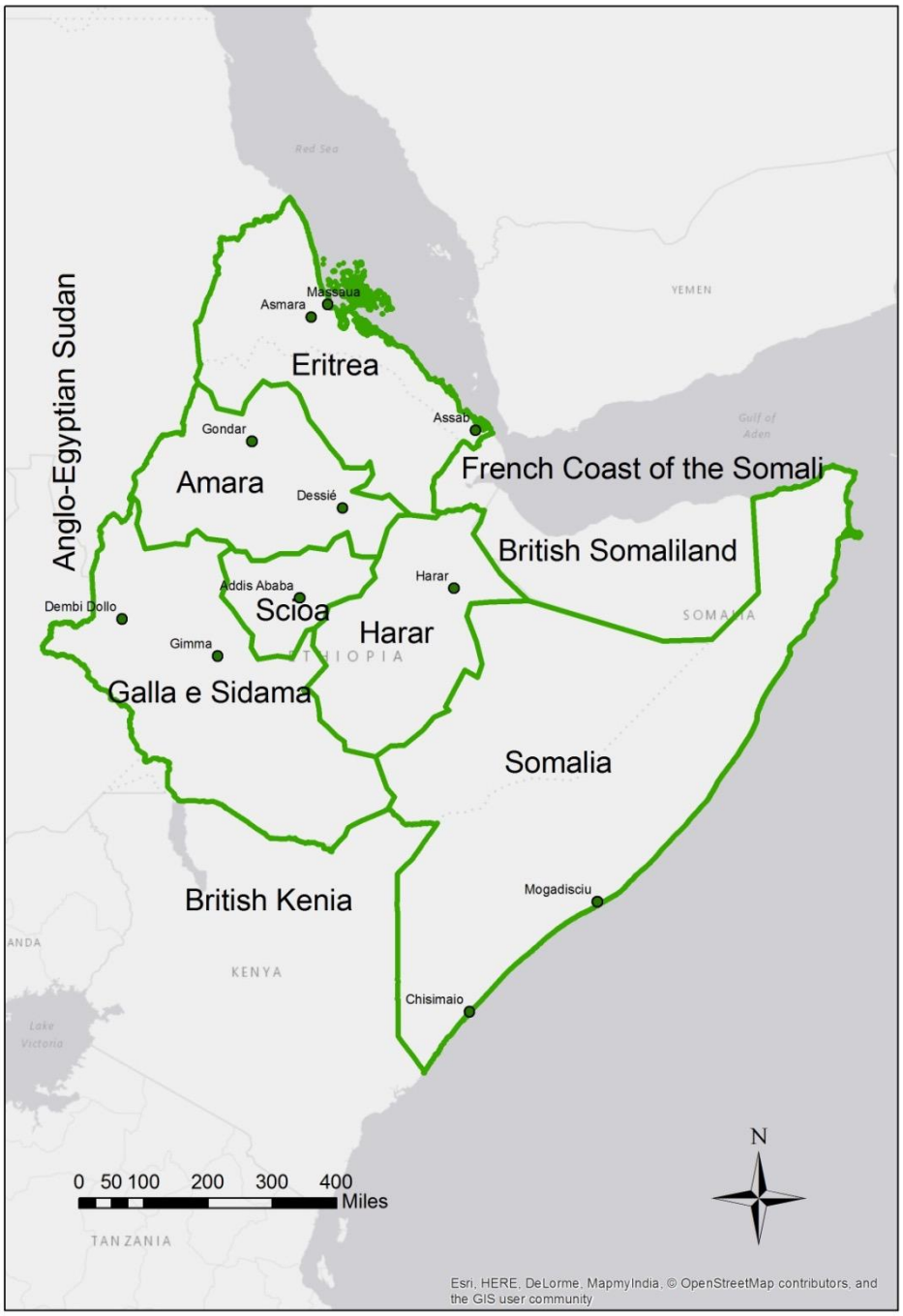
The fascist colonial policy between 1922 and 1934 was substantially based on the same objectives as the liberal policy of the previous years, although a more decisive and aggressive action was taken in order to pacify the colonies. The main objectives, in fact, remained the repression of the rebellions in Libya, the improvement of the agricultural production in Eritrea and Somalia, and

[17] Ivi, pp. 801-2
[18] Goglia, Luigi and Grassi, Fabio, *Il colonialismo…Op. Cit,* pp. 140-1
[19] Labanca, Nicola, *Oltremare. Storia dell'espansione…Op. Cit.*, pp. 119-22
[20] Only the Jubaland was annexed to Italian Somaliland in 1924 as partial compensation, but due to the change in foreign relations operated by Mussolini.
[21] Rochat, Giorgio, *Il colonialismo Italiano,* (Torino, 1973), pp. 163-4

the territorial extension of the Italian Somalia. In 1924, through negotiations with the British government, Italy obtained the Jubaland from the British Kenya, while the military campaign of governor De Vecchi extended the direct Italian control on the protectorates of Obbia and Migiurtina; at the end of his mandate in 1928, Italian Somaliland comprehended the coast from Chisimaio to Alula, with an extension towards the interior of 90km.[22] Simultaneously to these territorial annexations, Mussolini's government started putting more emphasis on the role played by the colonies, on their economic importance and on the international prestige they provided. The visit of Mussolini in Libya in 1926 along with the official visits of members of the royal family in Libya, Eritrea and Somalia witness renovated interest for the colonies that the fascist regime achieved.

Mussolini's colonial propaganda became more concrete in 1934, when he started planning the invasion of Ethiopia. The decision to attack a country that was member of the League of Nations and that would have therefore exposed Italy to sanctions and international isolation in case of invasion, was taken regardless of these factors for both strategic and political considerations. Firstly, Mussolini needed a great success in foreign policy in order to satisfy public opinion which, after several years of fascist propaganda, required a concrete sign of the 'imperial destiny' of Italy.[23] Secondly, the dictator aspired to a significant territorial extension of the colonies in order to convince the other European powers of the leading role that Italy was destined to play on the international stage. Finally, economic reasons were pushing Mussolini towards the intervention: the great depression was hitting the Italian economy hard, especially after 1933, causing high unemployment rates and a production crisis. Financing a war on a large scale, along with the multiple infrastructural works needed in the new territories after the campaign, would have significantly stimulated Italian industry. In fact, in Mussolini's mind the Ethiopian war could constitute an alternative form to Keynesian policies.[24]

[22] Goglia, Luigi and Grassi, Fabio, *Il colonialismo…Op. Cit,* pp. 236-42
[23] Labanca, Nicola, *Oltremare. Storia dell'espansione…Op. Cit.,* pp. 246-53
[24] Ivi, pp. 183-4



Map 1.2. Italian colonies in the Horn of Africa in 1938

The incident of Ual Ual in 1934, where regular Abyssinian troops had a short but intense fight with Italian colonial detachments in a contended area between Ethiopia and Somalia, provided Mussolini with the ideal pretext to start the war. The campaign had to be fast, in order to prevent the other members of the League of Nations to apply effective sanctions or, even worse, to

provide military support to Emperor Hailé Selaissé. For these reasons, Italy deployed an incredibly large army, quite unusual for a colonial campaign: at the end of the war, in May 1936, roughly 330,000 Italian and 90,000 colonial soldiers (mostly Eritreans, the 'Ascari') were employed in the operations, along with 1,100 artillery pieces, 250 tanks and 350 airplanes.[25] Ethiopia opposed the invasion with 250,000-300,000 men, of whom only a small part were well equipped and trained for a modern war. The Italian army was divided into two groups: the main one had to attack from Eritrea under the command of general De Bono (October-November 1935) and later Badoglio (November-May of 1935-6), while a smaller one (roughly 60,000), under the command of general Graziani, had to attack from Somalia.

The first phase of the war started in October 1935 and was concluded with the occupation of Macallé in November. At the end of November De Bono was substituted with Badoglio, who spent December and January re-organising the logistic supply. At the end of January 1936, Badoglio took the initiative and re-started the offensive towards Dessié: between January and March he won several battles (Endertà, Tembien, Sciré and Mai Ceu) that essentially destroyed the Abyssinian army of the Northern front. In February, Graziani launched an offensive on the Southern front, that led to the occupation of Neghelli in the Galla & Sidamo region and, in April 1936, moved towards the Harar region, where he occupied the centers of Giggiga, Harar and Dire Daua. The war officially ended on the 5th of May 1936, when general Badoglio reached Addis Ababa, abandoned by the Emperor on the 2nd of May, although several groups of partisans, led by Ethiopian chiefs loyal to the exiled emperor, continued to fight in the peripheral areas until 1938. On the 9th of May, Mussolini announced the creation of Italian Empire and the King of Italy Vittorio Emanuele III received the title of Emperor of Ethiopia.[26]

[25] Ivi, p. 189
[26] Del Boca, Angelo, *Gli italiani in Africa Orientale. La conquista dell'Impero,* (Laterza, 1979), pp. 710-1

1.1.3 The construction of the Empire (1936-40)

The newly acquired territories were organised in a new administrative entity called Africa Orientale Italiana (AOI, the 'Oriental Italian Africa') that also incorporated the original colonies of Eritrea and Somalia. These received additional territories as a compensation for the support furnished during the Ethiopian campaign (see map 1.2). The administrative organisation of the AOI was based on a strongly vertical conception[27]: every decision depended on the Ministry of the Colonies that disposed as general lieutenant in Addis Ababa of the General Governor (or Viceroy). Both the military and the administrative organisations of the AOI depended on the Viceroy. The territory was divided into 5 governorships (Eritrea, Somalia, Harar, Galla & Sidamo and Amara) plus the metropolitan district of Addis Ababa.[28] Each Governorship controlled several regional districts (called 'Commissariati'), further divided into provincial units named 'Residenze' or 'Vice-residenze'. At each level of this structure an Italian official was appointed by the central administration, while some forms of indirect rule remained at a village level, where local chiefs, loyal to the Italian authorities could sometimes maintain their position.

In Mussolini's intentions the AOI should have rapidly become a source of raw materials for Italy in the context of the autarky promoted by the dictator, who aimed to make Italy self sufficient from foreign imports. Grains, cotton and bananas were the initial productive targets in the AOI, along with mineral products and oil, both thought to be largely present in the new territories. At the same time the AOI had to become a colony of settlement, so that it could constitute a valid alternative to the phenomenon of Italian emigration to the American continent or Australia. By favouring the settlement of Italian settlers, Mussolini also expected to create a new market capable of absorbing a part of Italian industrial production.[29] Finally, as previously pointed out, Mussolini wanted to make the AOI a territory where the public national expenditures could be dramatically

[27] Dominioni, Matteo, 'Il sistema di occupazione politico-militare dell'Etiopia' in Irsifar, *Politiche di occupazione dell'Italia Fascista* (Milan, 2008), pp. 47-8
[28] In 1938 the metropolitan area was extended and became a sixth governorship called Scioa
[29] Labanca, Nicola, *Oltremare. Storia dell'espansione…Op. Cit.,* pp. 324-29

enlarged, so that the national firms could benefit at all levels: in fact, everything had to be built in the new territories, from roads to aqueducts, from schools to hospitals.

In order to meet these needs, the Council of the ministers approved a six-year plan of investments in 1937, which originally scheduled expenditures of 2bn Italian Lire for each one of the six years; due to the budgetary difficulties, the plan was changed to a twelve-year plan, without any modification of the official name for propaganda purposes. In fact, the expenses of the six-year plan reached 2bn only for the financial year 1936-7, a year where an additional 3.1bn was invested to cover the cost of exceptional road construction.[30] The plan was already modified by the end of 1937 with an agreement of minister of finance and the minister of colonies that reduced the total amount to 1bn a year.[31] Therefore, total government investment in the AOI amounted to 5bn for the financial year 1936-7, roughly 1bn for each of the financial years 1937-8, 1938-9, 1939-40 and only 330 million for the financial year 1940-1, when war preparation absorbed a large part of the governmental budget.[32] This constitutes a total investment over the period of approximately 8.3bn Italian Lire, which represented an incredible improvement in terms of public investments for Ethiopia, especially if we consider, for instance, that the total capital of the Bank of Ethiopia amounted to £750,000 in 1936[33], which would roughly equal 70 million Italian lire[34], 1/115 of total investment between 1936 and 1940.

These investments were mainly directed at road building activity, to the re-construction and development of the main cities and towns, to the construction of new schools and hospitals, to the creation of a electricity network, to the building of new churches and to various works to facilitate the agricultural colonisation. The large scale and intense injection of capital led to high levels of inflation and a wave of speculation, and drove an increasing number of Italians to migrate to the AOI to exploit this situation: in 1940 almost 300,000 Italians lived in the AOI. Many found

[30] Sillani, Tommaso, *L'Impero (A.O.I.),* (Roma, 1937), pp. 242-3
[31] Telegram Lessona to Di Revel, 30/10/1937, fund Archivio Segreto, folder 160_xi, ASMAE
[32] *Decree on the repartition of funds for civil expenses for the financial years 1940-1*, fund MAI folder 102, ACS
[33] Zervos, Adrien, *L'Empire d'Ethiopie. Le miroir de l'Ethiopie moderne. 1906-1935.* (Athens, 1936), p. 183
[34] Echange rate Lire to Pounds 90/1 employed for calculation

employment in retailing and transports, both particularly profitable due to high inflation of prices and the high transportation costs due to the necessity of transporting increasing quantities of materials across the territories of the AOI.[35] On the contrary, despite the strong emphasis of propaganda, agricultural colonisation did not really take off in this period due to the difficult conditions in which the settlers had to operate, and also to the attractiveness of other activities that provided easier forms of gain.

The Italian policy towards the local populations was based upon a strong paternalism, especially during the years 1936-8: racial segregation was present (the local population had the juridical status of 'subjects', had separate quarters in the main cities, different schools and departments in the hospitals) but the idea of elevating the native population by providing better infrastructures and services was certainly present in the intentions of the Italian government, which stressed this aspect during the both the preparation of the invasion and the 'construction of the empire'.[36] After the racial laws of 1938, also the racial segregation in the AOI became more stringent, with the absolute prohibition of mixed unions and the progressive exclusion of mix-blood individuals from the society (e.g. exclusion from schools, prohibition to marry)[37] and a parallel worsening of the living conditions of the local populations.[38]

1.1.4 The end of the Empire (1940-1)

In Mussolini's plans, the AOI had to become independent from the metropole, since in case of a conflict with Britain, which was becoming more and more likely in the years after 1936, the horn of Africa would have been completely separated from Italy due to the British control of Suez and to its naval superiority. This goal had not been reached in 1940, when Italy joined Germany against Britain and France. With the Italian declaration of war on the 10th of June 1940, the war spread in AOI as well: Amedeo Duke of Aosta, viceroy and commander in chief of the Italian troops in AOI, could count on 90,000 national soldiers and 200,000 colonial soldiers from Eritrea

[35] Del Boca, Angelo, *Gli italiani in Africa Orientale. La conquista…op. Cit.*, pp. 184-6
[36] Labanca, Nicola, *Oltremare. Op. Cit.*, pp. 247-9
[37] Goglia, Luigi and Grassi, Fabio, *Il colonialismo…Op. Cit.,* pp. 333-5
[38] Sbacchi, Alberto, *Ethiopia under Mussolini. Fascism and colonial experience* (Totowa, 1985), pp.168-70

and Somalia. The British general Wavell had in 1940 only 20,000 men dislocated in Sudan, Kenya and British Somaliland.[39] Despite this apparent net superiority of the Italian army, Amedeo of Aosta had to face serious problems of supply (nothing could be shipped from Italy), the inefficiency of the equipment, largely outdated, and the weakness of air force. On the contrary, the British had a small but modern army, with abundant supply and the possibility of receiving strong reinforcements from the other colonies.

In order to exploit their initial superiority, the Italian troops invaded the British Somaliland, launched an offensive against Cassala in Sudan and attacked the Dolo gradient between Somalia and Galla & Sidamo. The British troops, thanks to the abundant reinforcements received (250,000 men in 1941), were soon able to fight back: the first significant offensive was directed against Agordat and Cheren in Northern Eritrea and was concluded in late March 1941 with the conquest of Cheren and consequently of Asmara and all Eritrea. Simultaneously two divisions attacked from Kenya and Southern Somalia, rapidly reaching Mogadisciu and then Harar at the end of March. The Amedeo of Aosta decided to abandon Addis Ababa, which was occupied by the British forces on the 6th of April 1936. The Italian generals tried to resist separately in fortified areas (Amba Alagi mountain, Gondar and Galla & Sidamo region), but these invariably fell one by one at the hands of the British troops supported by Ethiopian partisans. The last one left was the fortress of Gondar that surrendered on 27th of November 1941.

After the complete conquest the independent imperial government of Hailé Selaissé was restored and the Italian population of the AOI was progressively shipped back to Italy. The end of the Italian empire certainly represented a shock for the region, that experienced the expulsion of the entire white population, which had represented between 1936 and 1941 in Ethiopia and even before in Eritrea and Somalia the productive and administrative elite. Similarly also the realisations of the Italian colonial government were largely damaged during the war and often left abandoned in the following years due to the precarious financial and political situation.

[39] Del Boca, Angelo, *Gli italiani in Africa Orientale. La caduta dell'Impero*, (Laterza, 1982), pp. 343-55

1.2 RELATED LITERATURE AND CONTRIBUTION

By focusing on the long-term impact of colonial investments in transportation infrastructures, schooling and sanitary facilities, this dissertation adds to the existing literature in several ways. On the one hand, it fills a gap in the existing quantitative literature, which looks at the relationship between colonial factors and long-term outcomes, by analysing the effect of neglected types of investments, such as roads, schools and hospitals, and by shedding light on new persistence and path dependence mechanisms. On the other hand, it develops the existing qualitative contributions on the Italian colonial history through the employment of an empirical methodology and by focusing on investments normally overlooked by the vast majority of the historiography.

The existing quantitative literature chiefly focuses on the long-term impact of colonial institutions, and distinguishes between colonies with different patterns of settlement[40], policy discontinuities across colonial boundaries[41] and direct versus indirect colonial rule[42]. Another group of relevant contributions pinpoints the importance of colonial investments in human capital at a district level in education and sanitary assistance[43], whereas some authors point out the preeminent role played by human capital in fostering growth.[44] Other authors focus on the colonial land tenure system and its impact on long-term development.[45] Finally, some papers analyse the lasting impact of pre-colonial institutions[46] and slave trade.[47]

[40] Acemoglu, D. and Johnson, S., 'Unbundling Institutions', *Journal of Political Economy*, Vol.113(5), (2005), pp.949-995; Acemoglu, D., Johnson, S. and Robinson, J. A., 'The Colonial…*Op. Cit.*

[41] Dell, M., 'The Persistent Effects…*Op. Cit.*

[42] Banerjee, A. and Iyer, L., 'History, institutions…*Op. Cit.*; Iyer, L., 'Direct versus indirect colonial rule in India: Long-term consequences', *The Review of Economics and Statistics*, Vol. 92(4), (2010), pp. 693-713

[43] Huillery, E., 'History matters…*Op. Cit.*; Wietzke, Frank-Borge. "Long-Term Consequences of Colonial Institutions and Human Capital Investments: Sub-National Evidence from Madagascar", *World Development* 66 (2015), pp. 293-307

[44] Glaeser, E.L., La Porta, R., et al., 'Do Institutions Cause Growth?', *Journal of Economic Growth*, Vol. 9 (No. 3, 2004), pp. 271-303

[45] Deininger, K., and Jin, S., 'Tenure security and land-related investment: Evidence from Ethiopia', *European Economic Review*, Vol. 50(5), (2006), pp. 1245-1277; Fenske, J., 'Land Tenure and Investment Incentives: Evidence from West Africa', *Journal of Development Economics*, Vol. 95 (No. 2, 2011), 137-56; Frankema, E., 'The Colonial…*Op. Cit.*

[46] Michalopoulos, S., and Papaioannou, E., 'Pre-Colonial Ethnic…*Op. Cit*

[47] Nunn N., 'The Long Term…*Op. Cit.* ; Nunn N, and Wantchekon L., 'The Slave Trade and the Origins of Mistrust in Africa' *American Economic Review,* 101(7), (2011), pp. 3221-3252

With regard to these contributions, my research innovates by looking at the long-term impact of colonial public investments that have been largely overlooked. More specifically, this study points out the importance of colonial roads, hospitals and schools in shaping present day living standards inequalities across African countries. Moreover, my analysis operates at a sub-district level, by exploiting micro-data on economic development and living standards: this allows for a more accurate exploration of the rate of development in the analysed African countries and methodologically adds to the mentioned contributions that mainly employed country-level or district-level data.

The few quantitative contributions that more closely engage with the issues discussed in this thesis only tangentially cover the relationships and the mechanisms considered in my analysis. With regard to the impact of transportation infrastructure on long-term development studied in chapter 2, the existing papers mainly focus their analysis on colonial railroads, infrastructures typically requiring high levels of investment and long periods of time for construction.[48] The few contributions that analyse the impact of roads are either concentrated on non-African countries, such as China[49], which cannot possibly be considered representative of the African colonial environment, or on post-colonial road building activity in Africa.[50] My research is innovative in this part of the literature through looking at the persisting effect of colonial roads, which as low cost transportation infrastructure also played a central role in the infrastructural investments of post-colonial African governments.

Through the analysis performed in chapter 2, I also shed light on the path dependency mechanism, which explains the persistence of higher population density along colonial paved roads

[48] Burgess, R. and Donaldson, D., 'Can Openness…*Op. Cit.*; Jedwab, R. and Moradi, A., 'Transportation Technology and Economic Change: Evidence from Colonial Railroads and City Growth in Africa', *Unpublished Manuscript, Department of Economics, George Washington University,*2013)

[49] Banerjee, A., Duflo, E. and Qian, N., 'On the road: Access to transportation infrastructure and economic growth in China', *National Bureau of Economic Research* No. w17897., (2012)

[50] Burgess, R., et al. 'The Value of Democracy: Evidence from Road Building in Kenya', *National Bureau of Economic Research* No. w19398, (2013); Shiferaw, A., Söderbom, M., et al., 'Road Networks and Enterprise Performance in Ethiopia: Evidence from the Road Sector Development Program', *International Growth Centre, the College of William and Mary, Working Paper,*Vol. 12 (2012), 0696; Worku, Ibrahim, 'Road sector development and economic growth in Ethiopia', *The Ethiopian development research institute working papers,* (2011)

after independence. The available contributions normally focus on treatments with a relatively long duration (60-70 years)[51] and on persistence mechanisms based on different forms of sunk investments concentrated next to areas that had an original comparative advantage.[52] In this respect, my analysis adds to the existing literature by looking at an infrastructure which was fully operational only for a short span of time (5 years) and by underscoring how roads represented an original form of sunk investment.

Similarly, with regard to the contributions that engage more closely with the analysis undertaken in chapter 3 regarding the long-term impact of education policies, it must be noted that these do not directly consider schools and hospitals created by colonial governments, but rather the long term-impact of missionary activities.[53] By looking at the location of colonial hospitals and schools and by employing micro-level data, my dissertation helps in explaining present-day inequalities in living standards through the analysis of an overlooked form of colonial investment, and suggests a phenomenon of the relocation of facilities in the same areas between colonial and post-colonial period. This pinpoints a consistent and continuous provision of facilities in the same areas across time due to the attractiveness of the colonial facilities that operated as sunk investments, a mechanism that has been overlooked by the existing literature and that is of paramount importance to understand inequalities in Africa.

This thesis also enlarges the evidence provided by the qualitative contributions on the Italian colonial experience in the Horn of Africa between 1935 and 1941. In fact the main qualitative works tend to focus either on the chronological reconstruction of the facts[54] or on the persistence of

[51] Bleakley, H., & Lin, J. 'Portage…*Op. Cit.*

[52] Jedwab, R., Kerby, E., et al., 'History, Path Dependence and Development: Evidence from Colonial Railroads, Settlers and Cities in Kenya', *working paper*, (2014)

[53] Arbesu, H.A.L., 'The Lasting Impact of Colonial Educational Policies in Nigeria: Evidence from a Policy Experiment on Missionary Activity', *Department of Economics, Massachussets Institute of Technology*, (2011); Gallego, F. A., 'Historical origins…*Op. Cit.*; Gallego, F. A., and Woodberry, R., 'Christian missionaries and education in former African colonies: How competition mattered', *Journal of African Economies* Vol. 19(3), (2010), pp.294-329; Woodberry, R. D., 'The missionary roots…*Op. Cit.*

[54] Del Boca, Angelo, *Gli italiani in Africa Orientale. La conquista…Op. Cit.*; Del Boca, Angelo, *Gli italiani in Africa Orientale. La caduta…Op. Cit*; Labanca, Nicola, *Oltremare…Op. Cit.*

some cultural colonial traits in the post-independence period.[55] Only a few works engage with the Italian economic activities in the Horn of Africa during the mentioned period and even those tend to omit public transportation infrastructures, schooling, and sanitary facilities from their analysis by looking more concertedly at agricultural investments, private entrepreneurial activities, banking activity and trade.[56] A partial exception to this pattern can be found in some contributions that look more specifically at the schooling activity in these colonies.[57] But these contributions are more concerned with the general setting of the scholastic system, the racial prejudices driving its realisation and the scholastic program that was employed, rather than with the construction of the buildings, the geographical distribution of the facilities and the magnitude of undertaken investments. These works aim to describe as much in detail as possible the different elements of the economic sector in AOI, but no substantial effort is made in order to evaluate the long-term impact of the Italian activity, except maybe in a few strongly politically biased contributions.[58] Through the consultation of various primary sources my work allows for a more complete understanding of the construction process of the road network and of the welfare colonial system in the former Italian colonies of the Horn of Africa; at the same time, the employment of an empirical econometric analysis allows the assessment of the long-term impact of these investments.

[55] Andall, Jacqueline & Duncan, Derek, Italian colonialism…*Op. Cit.;* Calchi Novati, G., L'Africa d'Italia : Una Storia Coloniale e Postcoloniale (Roma, 2011); Del Boca, Angelo, L'Africa nella coscienza degli italiani. Miti, memorie, errori, sconfitte, (Laterza, 1992)

[56] Larebo, Haile, L., The building of an empire: Italian land policy and practice in Ethiopia, 1935-1941, (Oxford, 1994); Podestà, Gian Luca, *Il mito dell'Impero. Economia, politica e lavoro nella colonie italiane dell'Africa orientale 1898-1941,* (Torino, 2004); Tuccimei, Ercole, *La Banca d'Italia in Africa. Introduzione all'attività dell'istituto di emissione nelle colonie dall'età crispina alla seconda guerra mondiale,* (Laterza, 1999)

[57] Negash, Tekeste, *Italian Colonialism in Eritrea, 1882-1941. Policies, Praxis and Impact* (Uppsala University, 1987); Pankhurst, Richard, 'Education in Ethiopia during the Italian Fascist occupation', The international journal of African historical studies', *vol. 5, n. 3,* (1972), pp. 361-396

[58] Pankhurst, Richard, 'Economic verdict on the Italian occupation of Ethiopia', *Ethiopia Observer,* vol. 14, no. 1 (1971), pp. 68-82; Randazzo, Antonella, *Roma predona : il colonialismo italiano in Africa, 1870-1943* (Milan, 2006)

CHAPTER 2:

The long-term impact of colonial transportation infrastructure

2.1 HISTORICAL FRAMEWORK: COLONIAL ROAD CONSTRUCTION IN THE HORN OF AFRICA AND QUALITATIVE EVIDENCE OF EXOGENEITY (1880-1941)

In this section I will discuss the historical process of road building in Eritrea, Somalia and Ethiopia between 1880 and 1941 through the analysis of qualitative sources. My purpose is, on the one hand, to provide a detailed historical background as a complement to the empirical analysis of the following sections and, on the other hand, to provide qualitative evidence of the 'exogenous'[59] placement of roads between 1934 and 1941.

From this analysis some important elements of the empirical analysis emerge, as will be addressed in the following paragraphs: 1) pre-1934 road building activity in the area had little effect on road locations between 1934 and 1941; 2) Road building activity between 1934 and 1936, which had significant influence on subsequent road construction, was driven purely by strategic and military considerations and tended to connect important locations with straight lines; 3) Between 1936 and 1941, Mussolini wanted to connect as quickly as possible the main cities of the AOI, therefore he continued the pattern of road building in straight lines. These elements point to a clear conclusion. Colonial roads were not located in more densely populated, wealthier or more fertile areas, but rather were placed so that they connected points of interest in the most cost-efficient way, which often meant roads being laid out in straight lines.

In order to understand the historical road building process in Eritrea, Somalia and Ethiopia, it is useful to divide the development of the infrastructural sector of the area into four distinct phases: firstly, the period between 1880 and 1934 which preceded the preparation of the Italian invasion, when the Ethiopian imperial governments and the Italian governments in Eritrea and Somalia implemented independent and modest road plans; secondly, the preparation of the war,

[59] By 'exogenous' I intend uncorrelated with unobserved determinants of population density.

which took place between 1934 and 1936, when the Italian army dramatically improved the existent road network in order to facilitate the invasion; thirdly, the period between 1936 and 1941 when the colonial government tried to provide the unified area with an ambitious and geographically pervasive network; and finally, the road construction implemented by the post-colonial governments between 1941 and the present. In this historical section I will describe the first three phases between the 1880s and 1941, while elements of the post-colonial road building activity will be outlined in the persistence mechanisms section.

The first organic interventions on the Ethiopian road network date back to the second half of the nineteenth century and followed the formation and consolidation of the Amhara Empire. Emperor Tewodros (1855-68) was responsible for the creation of an embryonic centralised network which gravitated around the Amhara region in the north of the country. This network was comprised of simple paths, appropriate for the rapid deployment of infantry troops for military campaigns.[60] A net improvement in terms of quality of the existing paths and the extension thereof was achieved under the emperors Menelik II (1889-1913) and Hailé Selaissé (1920-1936), who better understood the importance of infrastructures in achieving complete military and political control over the heterogeneous regions of the Ethiopian empire. The road network was then centred on Addis Ababa, elevated to the rank of capital of the empire by Menelik in 1889. Hailé Selaissé instituted a Ministry of Public Transport and promoted a more structured road building plan starting in the late 1920s. This project, which aimed to connect the major centers of the empire with Addis Ababa, was not completed due to the outbreak of war as well as the lack of financial resources, materials and know-how.[61] As a result, at the outset of the Italian-Ethiopian war, few roads were completed and none had modern asphalt surface. Only two major unpaved tracks for lorries existed in 1935 in Ethiopia, the Jimma-Addis Ababa and Addis Ababa-Dessié.[62] Some other major unpaved

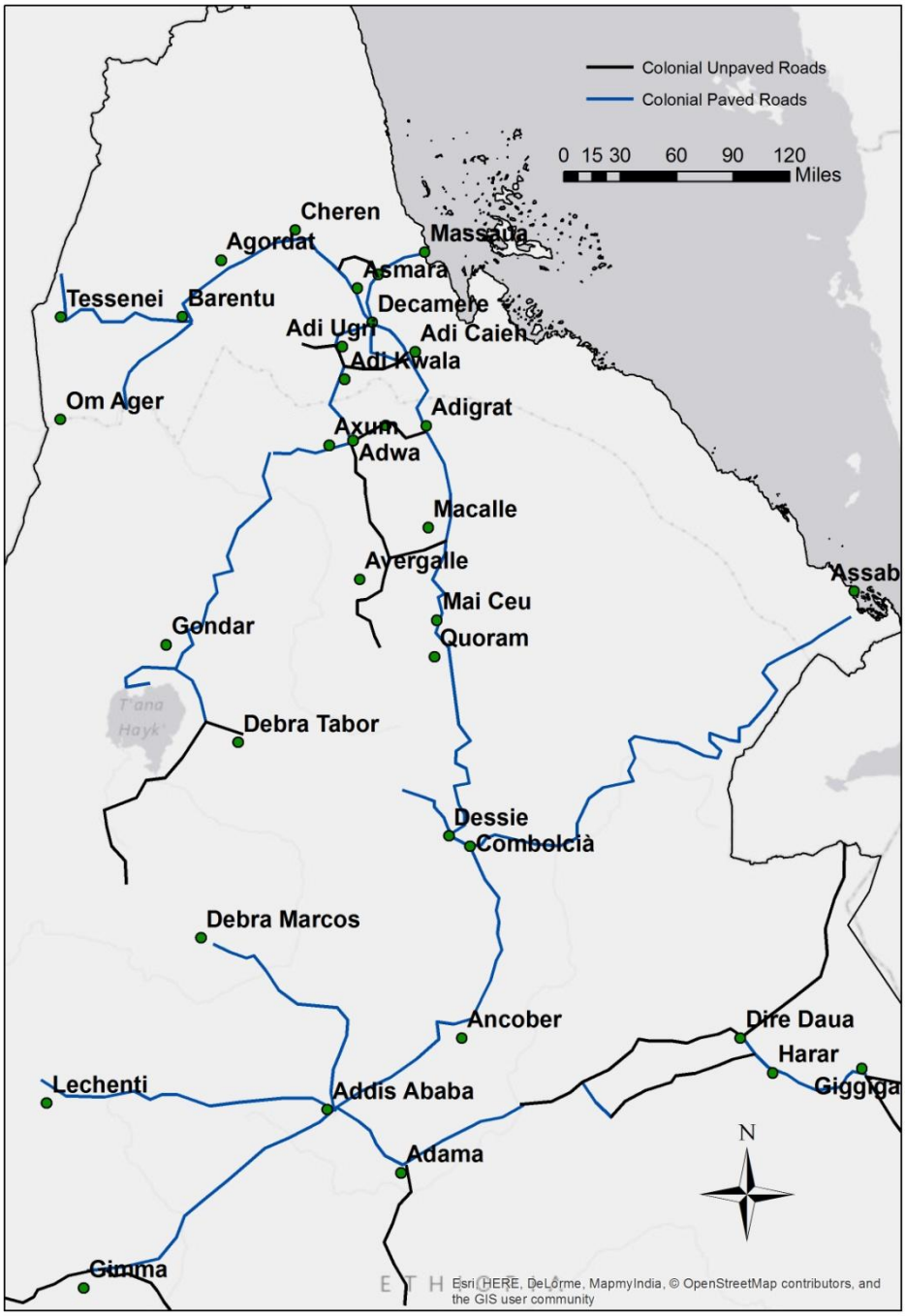
[60] Emmenegger, Rony, 'The roads of decentralization. The history of rural road construction in Ethiopia', *NCCR North-South dialogue,* no. 39 (2012), p. 15
[61] Kone, L., Argaw, P., Kebede, Y., 'The status of road construction in Ethiopia and its future activities', *Addis Ababa University,* (2008), Bsc thesis, pp. 7-8
[62] IAC, *Main features of Italy's action in Ethiopia,* (Firenze, 1946), plate 1

tracks existed, but these were completely lacking any manmade structures, such as viaducts, bridges and tunnels, and were simply following the natural roughness of the terrain.

In the Italian colonies of Eritrea and Somalia before 1935, the situation did not greatly differ in terms of infrastructural endowments and road building from pre-colonial Ethiopia: these colonies were neither particularly densely populated nor endowed with valuable natural resources that could justify significant investments in infrastructure. In Somalia, only 4 major lorry tracks existed in 1925, and none of them was paved: these connected Mogadisciu with Brava, Lugh Ferrandi, Oddur and Fer Fer respectively.[63] In the same year, only the region of Asmara in Eritrea showed a more developed road network: paved roads with rudimental asphalt surface[64] connected Asmara to the port of Massawa and the towns of Cheren, Adi Qualà and Adi Caieh.[65] From this brief description of the existing road network before 1934, it is clear that the road network in the area was extremely poor with no asphalted roads or infrastructures that allowed natural obstacles such as rivers and mountains to be overcome.

Between 1934 and 1935, several interventions were made in the two aforementioned colonies in order to provide logistic support during the military campaign. In Eritrea, the civil engineering from the Eritrean government and the military engineering noticeably improved the pre-existent road network. The artery connecting Massawa to Asmara was re-paved and some parts of it were improved by making hairpin bends smoother and the carriageway larger. Moreover, the military engineers rapidly built the road Nefasit-Decameré[66] *ex nihilo*, which aimed to direct the traffic coming from Massawa directly to Adigrat without passing through Asmara. After the first phase of operations in 1935 and the occupation of Macallé, where Badoglio established his headquarters[67], the major road Adigrat-Macallé was built rapidly in order to support military

[63] IAC, *Some data on Italian activity in the colonies,* (Firenze, 1945), plate 69
[64] MAI, *Gli Annali dell'Africa Italiana,* year 2, issue 4 (Milan, 1939), p. 326
[65] IAC, *Some data…Op. Cit*, plate 66
[66] Del Boca, Angelo, *Gli italiani in Africa Orientale. La conquista…Op. Cit.,* p. 297
[67] Badoglio, Pietro, *La guerra d'Etiopia,* (Milano, Mondadori, 1936), p. 42



Map 2.1. Colonial road network in the Northern sector in 1939

penetration.[68] After the battles of Endertà, Tembien and Sciré in February 1936, Badoglio proceeded to conduct a complete reorganisation of the front, which was reflected in a simultaneous improvement of the road network. At the battle of the Ascianghi Lake (Mai Ceu) at the end of

[68] Ivi, p. 34 and p. 37

March 1936, the last army of the Negus was destroyed. Badoglio started planning the march towards Addis Ababa that would have constituted a conclusive act of the war. In order to make the pre-existing rudimentary tracks between Macallé and Addis Ababa accessible to motor vehicles, the Marshal employed all available men to refurbish the track connecting Macallé and Quoram and then Quoram to Dessié.[69]

Similarly, in Somalia, General Graziani employed remarkable means for the construction of strategic roads in order to support the penetration of the Italian troops from the South. During 1935, Graziani convinced the Ministry of the Colonies to build rapidly the paved road Mogadisciu-Fer Fer-Mustahil, which satisfied the double need of connecting the outposts with the capital of the colony and of facilitating the march towards Harar and Dire Daua in the planned offensive of 1936.[70] During the two main operations on the Southern front, the one leading to the occupation of Neghelli in January 1936 and, subsequently, the one aiming for the occupation of Gorrahei, Dagabur and Harar in the following April, Graziani ordered the construction of new tracks in these direction. Mogadisciu was connected with Neghelli[71] and Fer Fer with Harar.[72]

After the conquest of Addis Ababa on the 5th of May 1936, the war was officially concluded despite some remaining pockets of resistance. Mussolini immediately stated that the priority in the newly founded 'Italian empire' in Oriental Africa was to build, as quickly as possible, an extensive network of highways that could safely connect the principal centers of the AOI. Several reasons motivated Mussolini: firstly, the peripheral regions such as Jimma and Gore were completely out of Italian control due to the impossibility of efficiently moving troops without modern roads; secondly, some of the major cities of the Empire such as Gondar, Harar, Dire Daua and even Addis Ababa were at risk of remaining isolated during the rainy season (September- December); thirdly, the army and the civilian personnel in the main centers needed a constant flow of supplies from the

[69] Ivi, pp. 197-8
[70] Ivi, p. 89
[71] MAI, *Gli Annali…Op. Cit.,* year 2, issue 4 (Milan, 1939), pp. 334-8
[72] Graziani, Rodolfo, *Fronte Sud,* (Milan, 1938), pp. 284-5

metropole, due to the poverty of the conquered regions and the destruction of the war;[73] finally, it was necessary to create a network through which the main centers of the Empire could be connected with each other and ultimately integrated with the metropolitan market. Roads were cheaper to build than railroads, faster to realise and, moreover, it was clear that for at least the next 20 years the volumes of trade in the AOI would not have justified the construction of additional railroads lines.[74]

Following this reasoning, Mussolini personally drew up the first project, and, through an official communication to all the relevant institutions officially communicated on the 19th of May 1936, he announced his grand plan for infrastructure realisations in AOI. Five main arteries had to be realised immediately, the Om Ager-Gondar-Debra Tabor-Dessié (650km), the Debra Tabor-Debra Marcos-Addis Ababa (500km), the Adigrat-Dessié-Addis Ababa (850km), the Assab-Dessié (500km) and the Addis Ababa-Jimma (350km), as well as the Addis Ababa-Allata-Neghelli-Dolo (1,100km), which had to be constructed after the completion of the other roads which had been deemed more important.[75] This original plan was modified after the approval of the six-year plan on the 21st June 1937[76], but the fundamental arteries remained the same. Some of these projects were started but not completed because of the outbreak of WWII.

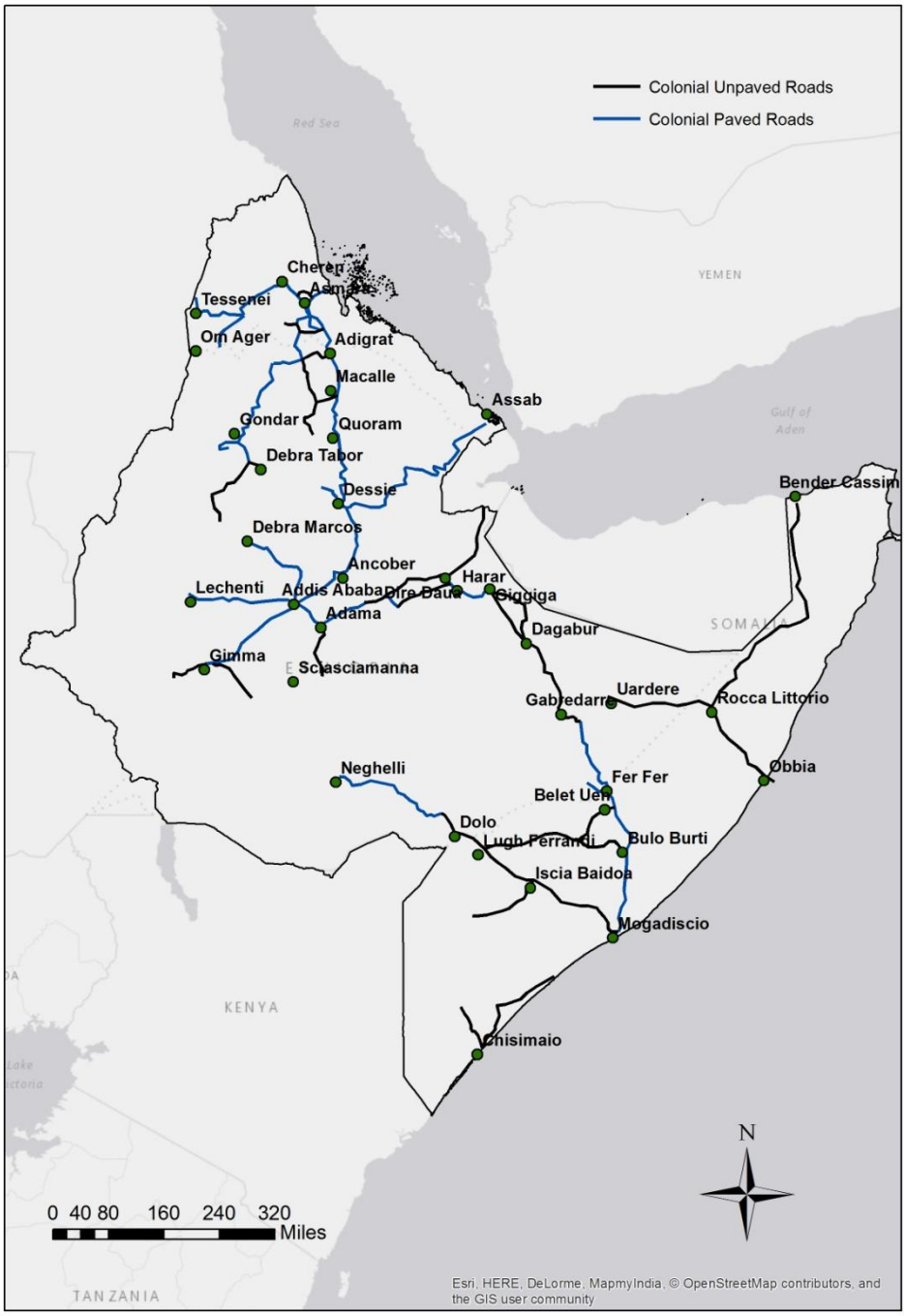
As is clearly visible in map 2.2, the described set of roads was not laid out so that it passed through particularly wealthy or profitable regions, but it was chiefly aimed to connect the major cities with each other and these with the important ports of Assab and Massawa. To these main 'imperial roads' several local and rural roads have been added, the responsibility for which fell on the local governments and regional administrations.

[73] Cobolli Gigli, Giuseppe, 'Le strade dell'Impero' in MAI, *Rassegna Economica dell'Africa Italiana*, Year 25 no 10, (Istituto Poligrafico dello Stato, October 1937), p. 1480

[74] Marchitto, Nicola, 'Prospettive ferroviarie dell'Impero' in MAI, *Rassegna…Op. Cit.*, Year 28 no 2, (Istituto Poligrafico dello Stato, February 1940), pp. 78-81

[75] MAI, *Gli Annali…Op. Cit.*, year 2, issue 4 (Milan, 1939), pp. 321-2

[76] The Om Ager-Dessié was cancelled and substituted with the extension of the Asmara-Adi Qualà to Gondar. The completion of the Addis Ababa-Debra Marcos-Gondar was postponed, whereas new roads were planned and built, such as the Addis Ababa-Lechenti (344km), the Addis Ababa-Dire Daua-Harar-Giggiga (500km) and the Giggiga-Fer Fer (550km).



Map 2.2. Road network in AOI in 1940

From map 2.2, the magnitude of the public expenses and organisational issues that had to be faced is immediately evident, especially considering the scarcity of suitable construction materials available in the colonies and the therefore massive quantities that had to be imported from the

metropole.[77] The vast majority of the works related to the main 'imperial roads' were administered by a company created specifically for the task, the AASS (Azienda Autonoma Statale della Strada), which took over the works already started by the military engineers and civil engineers of Eritrea and Somalia between 1934 and 1936.[78] The AASS obtained an incredibly large budget from Rome: not only did the six-year plan destined more than 7.7bn Italian Lire out of the total 12bn for road building[79], but the AASS received additional funds for a total of 3.1bn Lire for the financial year 1936-7 on top of the resources of the six-year plan.[80] In 1939, the new colonial paved roads in AOI totalled roughly 4,625km, whereas the unpaved ones totalled about 4,877km, including pre-existing tracks readapted by the colonial government.[81]

The rapid construction of a vast and modern road network in a short period of time did not prevent Italians from being expelled from the Horn of Africa by the British troops in November 1941. During the military events of 1940-1, the Italians were forced progressively to abandon all the territories of the Empire: in order to slow the British progress and to defend some fortresses, the army destroyed a large part of the bridges, tunnels and roads. Some of the major threats to network integrity were the disruption of Mussolini Bridge between Agordat and Cheren and of the ramp which gave access to Cheren from the North-West[82], the dismantlement of the road surface on the Mogadisciu-Harar[83], Addis Ababa-Dessié[84] and on all arteries that gave access to Gondar.[85] After the end of the war in the Horn of Africa and the return of Heilà Selaissé to the throne, the restraints in the governmental budget prevented any maintenance or reconstruction of the road network, whose extension progressively decreased between 1941 and 1951 when the first Highway Plan was

[77] Del Boca, Angelo, *Gli italiani in Africa Orientale. La caduta…Op. Cit.*, p. 162
[78] Sillani, Tommaso, *L'Impero…Op. Cit.*, p. 242
[79] Ivi, p. 233
[80] Ivi, pp. 242-3
[81] *Carta progressiva delle costruzioni stradali*, in *Gli Annali dell'Africa Italiana,* year 2, issue 4 (Milan, 1939), p. 365
[82] Del Boca, Angelo, *Gli italiani in Africa Orientale. La caduta…Op. Cit.,* p. 411
[83] Ivi, p. 451
[84] Ivi, p. 486
[85] Ivi, p. 507

implemented.[86] This plan, which had as a main objective the restoration of the pre-existing Italian network, is the first of a series of Highway Plans that will be more closely analysed in section 2.6.

Through the detailed analysis of the different phases of road building in the Horn of Africa, this historical framework section strongly argues for the exogenous placement of colonial roads in AOI between 1935 and 1941 and supports the empirical analysis of the following sections.

2.2 MAIN SPECIFICATION

The two main hypotheses I want to test are a) whether the construction of colonial roads caused population growth in the connected areas by the end of the colonial period in 1940, and b) whether placement of colonial roads is still causing higher population at present. My main dataset is a cross-sectional dataset composed by 15,204 cells of the size of 0.1x0.1 decimal degrees (roughly 11x11km), covering the territories that were part of the Italian Oriental Africa (AOI) between 1936 and 1940: contemporary Eritrea, Ethiopia and part of contemporary Somalia. In order to test these hypotheses, I run an OLS regression in the form of

$$y_{i,r,t} = \alpha + D20kmPav_{i,r}\beta_1 + D20kmUnpav_{i,r}\beta_2 + x_{i,r}'\gamma + \delta_r + \varepsilon_{i,r,t}$$

where $y_{i,t}$ is population density in cell *i*, in district r, in year *t*. α is the constant. $D20kmPav_i$ is my first variable of interest, which is a binary variable equalling 1 if the cell *i* in district *r* lies within 20km from a colonial paved road. $D20kmUnpav_i$ is my second variable of interest, which is also a dummy that equals 1 if the cell *i* in district *r* falls within 20km from a colonial unpaved road. I expect paved and unpaved roads to have a positive effect on population density for both 1940 and 2000 (β_1 and $\beta_2 > 0$). $x_{i,r}'\gamma$ represents a vector containing the full set of control variables I add to the equation. These variables can be divided into three main groups: pre-colonial controls, controls for other colonial factors (administrative boundaries and other colonial investments) and geographical/ environmental controls. $\varepsilon_{i,r,t}$ is the error term.

[86] Emmenegger, Rony, 'The roads of decentralization. The history…*Op. Cit.,* pp. 16-7

δ_r is my standard set of fixed effects, which are the 74 colonial regions called 'commissariati' through which the AOI was administered between 1936 and 1941.[87] The choice of using this set depends on two main reasons. Firstly, when the colonial government decided to divide the new territories in regional administrative levels, they tried to created homogenous areas in terms of ethnicity, religion, language and economic activities, in order to smooth the social conflicts and to make the administration easier[88]. Adding this set of fixed effects, therefore, helps control possible unobservable factors that might have been clear to the colonial administrators and that do not vary within a region. Secondly, as opposed to the colonial provinces that never really played a role in projecting and realising any type of colonial roads, some commissariati were important and wealthy enough to implement some independent local plan of rural road building[89], which could bias my results.

Standard errors are clustered by colonial provinces. These are the 202 'Residenze' that constituted the administrative units in which the different regions were partitioned. [90] This strategy is particularly helpful in order to address possible problems of serial spatial correlation. To further tackle this issue I recalculate the standard error of the variables of interest through the Conley standard error estimator.

Population density is always expressed in standardized *z-scores*. This strategy has a double advantage: on the one hand it makes the interpretation of the coefficients easier, on the other, it allows for a comparison of different years. In fact, the steady growth of the population density between 1940 and 2000 would cause a dramatic increase in the magnitude of the coefficients which could be erroneously interpreted as a larger effect of colonial investments, rather than the effect of the natural absolute population growth.

More specifically, in order to eliminate the possible confounding factors from my estimation, I control for the following variables: with regard to pre-colonial factors I control

[87] The administrative division I am employing reflects the division made in 1938
[88] Sillani,Tomaso, *L'Impero…Op. Cit.*, p. 191
[89] MAI, *Gli Annali..Op. Cit.,* year 2, issue 4 (Milan, 1939), p. 362
[90] From 1938 onwards

proximity to pre-colonial main tracks (dummy < 20km) and population density in 1920 and 1930. This is done, on the one hand, to verify that the effect attributed to colonial roads is not in reality a reflection of the effect of pre-colonial tracks which might have driven the location of colonial arteries, and on the other hand, to check that more populated areas before 1936 are not simply maintaining their original advantage overtime. The reason why both years are added is that the period between 1925 and 1935 saw a social turmoil in independent Ethiopia, colonial Eritrea and Italian Somaliland, due to the reforms implemented by Hailé Selaissé and to the preparation for the imminent war on both sides, which triggered significant phenomena of population relocation in the area.

As a second step, several controls for colonial factors are added to the equation in order to make sure I am not capturing the effect of other facilities. I am controlling for a dummy <20km from colonial railroads, a dummy <20km from primary colonial hospitals, a dummy <10km from secondary colonial hospitals, dummy <10km from colonial school for the local population, a dummy <10km from a colonial provincial capital and a dummy for having the centroid within an area of mining interest at the colonial time.

Thirdly, in order to make sure I am not capturing the effect of environmental factors on population density I control for latitude and longitude of the centroid, a dummy <20km from perennial rivers, a dummy <30km from the coast, average altitude of the cell, annual rainfall average, malaria rate and FAO land propensity score (the estimated agricultural fertility of each area). I expect my estimates to be robust to this set of controls.

As robustness checks I employ two main strategies that address the omitted variable problem and allow me to argue for a causal effect of colonial roads on population density, a IV methodology and a placebo treatment. I instrument the possible endogenous variable, paved colonial roads, for straight lines connecting major colonial cities. This instrument, which is largely

employed by the related literature[91], is likely to be efficient since it is an excellent proxy for location of transportation infrastructure and, at the same time, is unlikely to be correlated with anything in the error term. I expect these lines to have a positive and significant effect on population density in 1940 and 2000.

Secondly, I exploit the natural placebo treatment provided by the Italian case study: Italians did not expect a rapid fall of their dominion and, therefore, made diverse projects of paved roads that had to implement the existing network to be concluded in the early 1940s. These roads were not completed because of the outbreak of WWII and the rapid fall of the AOI. If the effect of colonial roads on population density is exogenous, no effect should be measurable along placebo lines.[92]

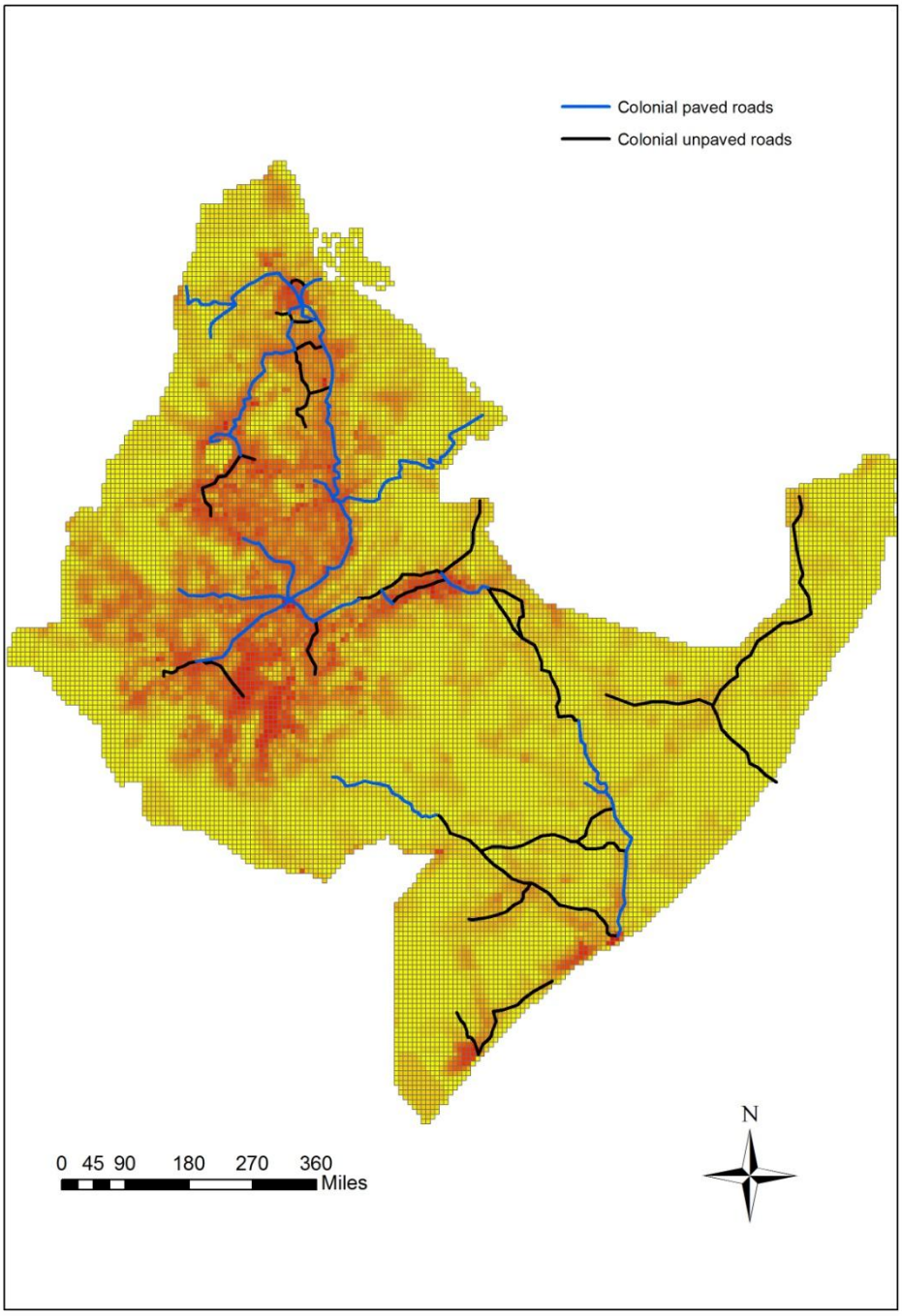
Finally, I perform an additional set of robustness checks in order to further test the consistency of the estimates: distance from contemporary roads is added to the model as control variable, the sample is reduced to cells within 200 and 100 km from the colonial paved roads and, finally, different sets of fixed effects are tested. In addition, for the estimates of population density in 2000, I replicate the results with a dataset composed by bigger cells, roughly 30x30km, in order to dismiss convincingly any concern about spatial correlation. Each of these strategies leaves room for possible criticism, but if all the different strategies will provide results consistent with the research hypotheses, I can consider the problem of the endogenous placement of this infrastructure satisfactorily solved and the causal relationship demonstrated.

2.3 DATA

The data I analyse through the described model can be divided into three categories: dependent variables, explanatory historical variables and geographical-environmental control variables.

[91] Jedwab, R. and Moradi, A., 'Transportation Technology…*Op. Cit.*, p. 12; Banerjee, A., Duflo, E., et al., *On the Road…Op. Cit.,* p. 17

[92] I use as placebo lines those paved roads that were projected between 1936 and 1937. These can be divided in two groups: on the one hand, those that have never been started during the colonial time, the Lechenti-Asosa, the Jimma-Gambela, the Jimma-Sciasciamanna-Fer Fer, the Adama-Mega, the Neghelli-Mega, the Debra Marcos-Debra Tabor and the Dessié-Debra Tabor. On the other, those that were not completed, but that were operative during the colonial period as unpaved roads: the Mogadisciu-Dolo, the Gabredarre-Giggiga and the Dire Daua-Auasc.



Map 2.3. Colonial roads and population density distribution in 2000. Population density is ranging from a minimum of 0 (yellow) to a maximum of 13,761 (dark red)

2.3.1 Dependent variables

The main employed dependent variable is *population density*. For the years 1960, 1970, 1980, 1990 and 2000, data come from the Unep/Grid Sioux Falls dataset.[93] The data can be downloaded as a geo-referenced raster dataset, which is constructed by matching population density data at an administrative level with the location and population of villages and towns, accessibility to transportation facilities and waterways. Data are at a fine spatial level, each pixel measuring 0.04x0.04 degrees. I converted pixels to points and each cell (0.1x0.1) of the dataset reports an average of the contained points. For the years 1920, 1930, 1940 and 1950, data come from the History Database of Global Environment (HYDE)[94], where historical population density data, cropland and pasture statistics are combined to create a raster dataset at a relatively fine spatial level (0.08x0.08 degrees). The same procedure as previously described is employed to calculate average population density for each cell. The second dependent variable employed is *light density at night in 2010*. These data come from the grid raster dataset (roughly 0.008x0.008 decimal degrees) of the National Geophysical Data Center (NOAA)[95], which are introduced into dataset with the same methodology.

Finally, in the persistence mechanisms section, the individual Demographic and Health Survey (DHS) dataset 2011[96] for men in Ethiopia is employed to test whether areas close to colonial roads show characteristics compatible with an urban environment. This dataset would potentially give me a total of 14,110 respondents, but due to missing coordinates of a few of the 650 DHS clusters to which each individual is associated, I can only employ 13,528 individuals. For each cluster and, therefore, for each man, I know the distance from colonial infrastructures and the

[93] Available on the website of the United Nations Environmental Program, lastly accessed the 15 April 2015, at http://na.unep.net/siouxfalls/datasets/datalist.php, lastly

[94] Available on the website of the Netherland Environmental Assessment Agency, lastly accessed the 15 April 2015, at http://themasites.pbl.nl/tridion/en/themasites/hyde/download/index-2.html

[95] Available on the website of the National Geophysical Data Center, lastly accessed the 15 April 2015, at http://ngdc.noaa.gov/eog/download.html

[96] Available on the website of the demographic and Health Survey Program, lastly accessed the 15 April 2015, at http://dhsprogram.com/

control variables values at a cluster level. For each individual I select categorical variables about profession, access to media and employed methods of payment.

With regard to the quality of the data, it has to be pointed out that the HYDE data on population density is not high, due to the fact it is just an approximation from other historical measures. Unfortunately, no better population density data can be used, since no census was made during the colonial occupation or during the pre-colonial period. On the contrary, Unep data, NOAA and DHS data are collected through modern and accurate methods.

2.3.2 Historical explanatory variables and instrument

The vast majority of the historical data has been collected from primary printed sources material. My main sources on colonial investments are the 3rd and 4th issues of 1939 and the 1st and 2nd of 1940 of *Gli Annali dell'Africa Italiana,* a review edited by the Italian Ministry of the Colonies, which reports precisely the public investments undertaken by the Italian Government in AOI. The location of *colonial paved* and *unpaved roads* in 1939 comes from a map contained in the 4th issue of 1939[97], which I geo-referenced.

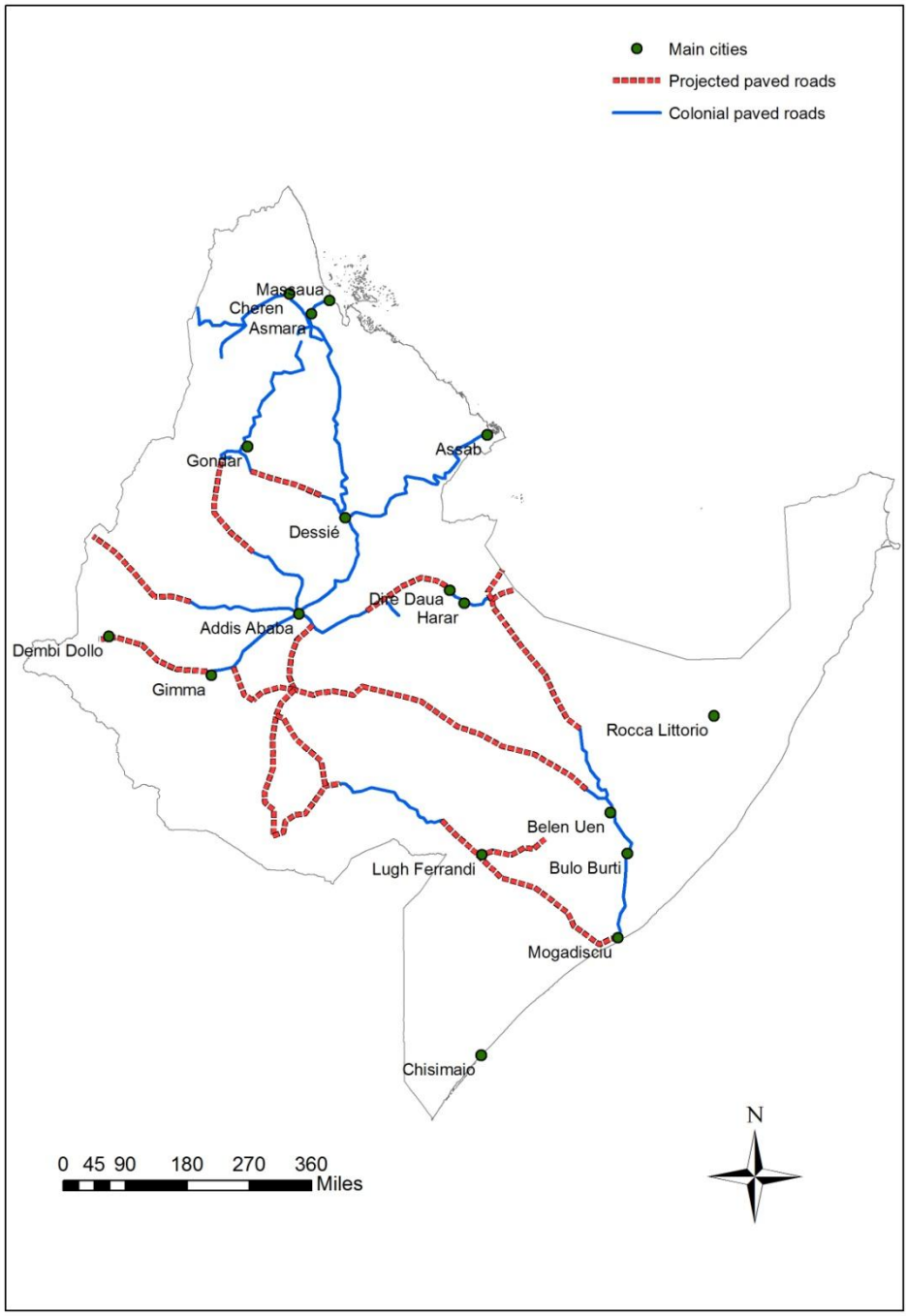
The location of colonial district capitals, along with the provincial (Residenze), regional (Commissariati) and state (Governi) boundaries, in which the AOI was divided in 1938 and employed as fixed effects and for clustering are obtained by geo-referencing a map contained in the issue 3 of 1939.[98] From issue 1 of 1940, I collected data on the location of colonial schools for locals, which are manually geo-coded by attributing them to the relevant town or village.[99] The location of primary colonial hospitals and colonial clinics has been obtained by geo-referencing a series of maps from the same volume.[100] Information on whether a cell's centroid falls within a

[97] *Carta progressiva delle costruzioni stradali,* in *Gli Annali dell'Africa Italiana,* year 2, issue 4 (Milan, 1939) in MAI, *Gli Annali dell'Africa Italiana,* issue 4 (Milan, 1939), pp. 364-6

[98] Ufficio studi MAI, *Circoscrizioni amministrative dell'Africa Orientale Italiana,* in MAI, *Gli Annali dell'Africa Italiana*, year 2, issue 3 (Milan, 1939), pp. 48-50

[99] MAI, *Gli Annali…Op. Cit.*, year 3, issue 1 (Milan, 1940), pp. 674-90

[100] *Dislocazione dei servizi sanitari nell'Eritrea,* p. 793; *Dislocazione dei servizi sanitari nella Somalia,* p. 807; *Dislocazione dei servizi sanitari nello Scioa,* p. 813; *Dislocazione dei servizi sanitari nel Harar,* p. 819; *Dislocazione dei servizi sanitari nell'Amara,* p. 823; *Dislocazione dei servizi sanitari nel Galla Sidama,* p. 831, in MAI, *Gli Annali dell'Africa Italiana,* year 3, issue 1 (Milan, 1940)



Map 2.4. Projected roads, paved roads and population density in 1940

zone of mining interest at the colonial time is collected by geo-referencing a map from issue 2 of 1940.[101]

[101] *Carta mineraria dell'A. O. I. ,* in MAI, *Gli Annali dell'Africa Italiana,* year 3, issue 2 (Milan, 1940) pp. 1195-7

With regard to the location of colonial railroads, for Eritrea and Ethiopia the data come from DIVA GIS (the functioning railroads have not changed since 1941), whereas for Somalia, where the existing colonial trunk disappeared, I geo-referenced a map from Corni's book on Somalia.[102] *Placebo lines* come from another geo-referenced map, contained in Sillani's book.[103] Finally, *pre-colonial tracks* are taken from several maps coming from two apologetic publications of the Italian government dated 1945 and 1946 destined for the UN commission in charge of deciding the destiny of former Italian colonies.[104] I calculate the Euclidean distance in km of each cell's centroid from the closest point of each of the mentioned historical infrastructures or facilities.

Since these sources usually had either a propagandistic or an apologetic purpose, one might be worried about their reliability. Although they are official governmental publications in which the risk of significant bias for the mentioned elements seems minimal, I have double checked the data when possible with alternative archival sources. I cross checked pre-colonial track locations of Dardano's map of 1935[105], the roads projects and realisations with some reports from minister Cobolli-Gigli[106], and balance sheets reporting road realisations in 1939.[107] The data coincide with negligible variations. With regard to the *instrumental variable*, I drew straight lines connecting major ports and cities of the AOI, and I calculated the Euclidean distance.[108]

2.3.3 Environmental and geographical controls

For environmental and geographical controls, I use the longitude and latitude of each cell's centroid, along with the average elevation of each cell in meters. This comes from the fine spatial level (0.008x0.008 degrees) raster grid dataset available on the DIVA GIS website for Eritrea,

[102] 'Somalia Italiana', in Corni, Guido, *Somalia Italiana,* 2 vol., (Milano, 1937), appendix
[103] *La grande rete stradale dell'Impero,* in Sillani,Tomaso, *L'Impero…Op. Cit.*, pp. 221-3
[104] *Etrirea: roads system 1895*, plate 65; *Somalia: roads system 1905*, plate 68, both in IAC, *Some data on…Op. Cit.; Ethiopia: road net in 1935*, in IAC, *Main features…Op. Cit.*, plate 1
[105]Dardano, Achille, *Africa Orientale Op. Cit.,* ASMAE, sez Archivio Segreto, file 172
[106] Cobolli-Gigli, *Relazione per sua eccellenza il capo del governo,* 14th of November 1937, ASMAE, sez Archivio Segreto, file 16
[107] Giunta generale del bilancio, *Relazione della giunta generale del bilancio 1938-9*, 1939, ASMAE, sez Archivio Segreto, file 199_23
[108] The lines I employ are: Asmara-Massawa, Asmara-Gondar and Asmara Dessié. Dessié-Addis Ababa and Dessié-Assab. Addis Ababa-Lechenti, Addis Ababa-Gondar, Addis Ababa-Jimma and Addis Ababa-Harar. Jimma-Mogadisciu. Mogadisciu-Bulo Burti and Bulo Burti-Harar.

TABLE 2.1. DESCRIPTIVE STATISTICS

	(1) mean	(2) sd	(3) min	(4) max	(5) N
Population density Hyde 1920	9.735	24.56	0	2,794	15,204
Population density Hyde 1930	10.61	28.77	0	3,313	15,204
Population density Hyde 1940	10.83	11.11	0	95	15,204
Population density Hyde 1950	11.70	12.15	0	154	15,204
Population density Unep in 1960	15.38	37.68	0	2,554	15,204
Population density Unep in 1970	19.48	47.84	0	3,158	15,204
Population density Unep in 1980	25.13	74.43	0	6,490	15,204
Population density Unep in 1990	33.96	109.3	0	10,251	15,204
Population density Unep in 2000	44.93	145.4	0	13,762	15,204
Light density 2010	0.0710	0.895	0	60.50	15,204
Dummy <20 km from primary colonial hospital	0.0105	0.102	0	1	15,204
Dummy <10 km from a secondary colonial hospital	0.0343	0.182	0	1	15,204
Dummy <20km from a colonial paved road	0.102	0.303	0	1	15,204
Dummy <20km from colonial unpaved road	0.113	0.317	0	1	15,204
Dummy <20km from a colonial railroad	0.0224	0.148	0	1	15,204
Dummy <20km from a precolonial track	0.278	0.448	0	1	15,204
Dummy <10 km from colonial school for natives	0.0118	0.108	0	1	15,204
Dummy <10 km from colonial district capital	0.0321	0.176	0	1	15,204
Dummy <20km from projected colonial road	0.103	0.304	0	1	15,204
Dummy < 20 from straight lines (IV)	0.120	0.325	0	1	15,204
Elevation (meters)	967.756	742.471	0	4,139.5	15,204
Rainfall (centimeters/year)	11.15	11.47	0	95.17	15,204
Malaria rate	6.475	4.975	0	30.64	15,204
Fao land propensity	6.169	1.906	0	9	15,204
Longitude	41.24	4.009	33.05	51.37	15,204
Latitude	8.053	3.781	-1.500	17.76	15,204
Dummy for being within an area of mining interest	0.144	0.351	0	1	15,204
Dummy <30km from the coast	0.133	0.339	0	1	15,204
Dummy <10km from a contemporary road	0.567	0.495	0	1	15,204
Dummy <20km from a perennial river	0.467	0.499	0	1	15,204

Somalia and Ethiopia.[109] From DIVA-GIS I downloaded the annual average rainfall in centimetres as raster grid dataset (0.04x0.04 decimal degrees), from which I calculated the cell's average value, the shape file for contemporary roads for each of the three analysed countries, and the perennial rivers one. I calculated the Euclidean distance of each cell's centroid from the closest point of these lines.

With the same methodology I calculated the distance of each centroid from the coast. The *malaria transmission index* data come from raster grid dataset of 0.5x0.5 decimal degrees pixels

[109] Available on the DIVA-GIS website, lastly accessed the 15 April 2015, at http://www.diva-gis.org/gdata

from Kiszewski's dataset.[110] This informs the rapidity and likelihood of malaria transmission in each cell. Since in this case pixels are slightly larger than dataset's cells, the value of each pixel's centroid from the raster dataset has been attributed to each cell. A *Land propensity score* for each cell was taken from a raster dataset from the FAO land fertility dataset[111] which reports the average fertility of each cell, also with a definition of 0.5x0.5 decimal degrees. Finally, with regard to the *ethnic boundaries* employed as fixed effects in the robustness checks section, I employed the Murdoch's Atlas map[112] of African ethnic boundaries, geo-referenced by Nunn[113] and available online. Each centroid has been attributed to the ethnic group where it falls within.

2.4 MAIN RESULTS

Table 2.2 shows the effect of colonial road building on population density in 1940 just prior to the end of the Italian occupation of Eritrea, Italian Somaliland and Ethiopia. I first test whether areas located next to colonial paved and unpaved roads displayed higher population density at the end of the colonial period. In column 1 and 2 no controls are added, while in column 3 controls for pre-colonial population density and transportation infrastructures are introduced into the equation, and in columns 4 and 5 controls for other colonial investments and geographical factors are added respectively. Moreover, regional fixed effects are estimated in columns 1 to 5 and robust standard errors, clustered by colonial provinces, are reported in brackets.

Paved road locations and population density in 1940 are positively and strongly correlated: zones within 20km from a paved road were more densely populated as opposed to other areas. From column 1, it is clear that, without controlling for other variables, being within 20km from a paved road correlates with an increase in population density of roughly 0.22 standard deviations.

[110] Kiszewski, Anthony, et al. "A global index representing the stability of malaria transmission." *The American journal of tropical medicine and hygiene* 70.5 (2004), pp. 486-498
[111] Available on the FAO Statistics website, lastly accessed the 15 April 2015, at http://faostat.fao.org/site/377/default.aspx#ancor
[112] Murdock, Peter George, *Africa. Its people and their culture history*, (New York, Toronto, London, 1959)
[113] Nunn N., 'The Long Term…*Op. Cit.*

TABLE 2.2. EMERGENCE OF ROADS BUILDING EFFECT ON POPULATION DENSITY IN 1940

	(1)	(2)	(3)	(4)	(5)
Dependent: Population density in 1940 (z-scores)					
Dummy <20km from a colonial paved road	**0.224*** **	**0.220*** **	**0.197*** **	**0.169*** **	**0.132*** **
	(0.046)	(0.047)	(0.044)	(0.043)	(0.043)
					[0.037]
Dummy <20km from colonial unpaved road		0.056**	0.045*	0.028	0.004
		(0.025)	(0.025)	(0.025)	(0.025)
Dummy <20km from a precolonial track			0.016	0.013	0.005
			(0.023)	(0.023)	(0.023)
Standardized values of population density in 1920			0.089	0.086	0.084
			(0.058)	(0.057)	(0.056)
Standardized values of population density in 1930			0.072	0.070	0.068
			(0.060)	(0.059)	(0.057)
Dummy <20km from a colonial railroad				0.149*	0.160*
				(0.080)	(0.083)
Dummy <10 km from colonial district capital				0.115***	0.108***
				(0.041)	(0.040)
Dummy <10 km from a secondary colonial hospital				0.125**	0.116**
				(0.054)	(0.053)
Dummy <20 km from primary colonial hospital				0.061	0.076
				(0.121)	(0.120)
Dummy <10 km from colonial school for natives				-0.042	-0.047
				(0.081)	(0.081)
Observations	15,204	15,204	15,204	15,204	15,204
R-squared no FE	0.08	0.08	0.26	0.27	0.52
R-squared FE	0.79	0.79	0.80	0.80	0.81
Provincial FE	YES	YES	YES	YES	YES
Pre-colonial controls	NO	NO	YES	YES	YES
Colonial controls	NO	NO	NO	YES	YES
Geographical Controls	NO	NO	NO	NO	YES

Note: robust standard errors clustered for 202 administrative provinces (residenze) in parentheses. Regional Fixed Effects (74 Commissariati) columns 1-5. Columns 1-2 no controls. Column 3 pre-colonial controls: dummy <20km from precolonial tracks and standardized population density in 1920 and 1930. Columns 4 controls for other colonial investments: dummy <20km from colonial railroads, dummy<10km from colonial district capital and dummy <10 km from colonial school for natives, dummy <10km from secondary colonial hospitals and clinics, dummy <20km from primary colonial hospital. Column 5 geographical and environmental controls: dummy <20km from perennial waterways, rainfall annual average, elevation, malaria rate, FAO land propensity score, latitude, longitude, dummy <10km from contemporary roads, dummy for being in a mineral area, dummy for being within less than 30 km from the coast. Conley Standard error for spatial correlation in squared brackets in column 5. *** p<0.01, ** p<0.05, * p<0.1.

When compared with the relevant literature[114], this coefficient shows a strong effect, being also statistically significant at the 1% level. The magnitude of the coefficient is reduced dramatically once the full set of controls is added in column 5, but it remains large (0.13 standard deviations increase) and at the same level of significance. With regard to colonial unpaved roads, the effect that seems to be in place in column 2 disappears once controls for other colonial investments are added in column 4, suggesting that at this stage unpaved roads did not matter in shaping the population distribution patterns in the Horn of Africa. According to the adjusted R-squared indicator, the model works well explaining the sample's variation: in fact the location of paved and unpaved roads explains 8% of the variation; conversely when the full set of controls has been added, the model accounts for 52% of the variation in population density. The results are robust to the introduction of regional fixed effects and to clustering, both applied in columns 1 to 5. As an additional robustness check, I compute Conley's standard corrected for spatial auto-correlation, in order to make sure that the estimates are not biased due to the absence of valid underlying sources of variation (column 5).[115]

Although at this stage it is not possible to argue for a causal relationship between colonial roads placement and population density, the results advocate a strong and robust correlation between the dependent and the explanatory variable.

In table 2.3, the results related to the persistence of the effect of colonial road building at present are reported. Panel A is intended to answer the question of whether the placement of colonial paved and unpaved roads is still shaping population density patterns today, and therefore standardized population density in 2000 is employed as dependent variable. In panel B, I use the data to answer a slightly different question: I am not only interested in understanding whether areas close to colonial roads are, on average, more populated, but also whether these areas are more economically developed. For this reason, in panel B, I employ the logarithm of light density at night, as dependent

[114] Jedwab, R., Kerby, E., et al., *History, Path Dependence and Development: Evidence from Colonial Railroads, Settlers and Cities in Kenya*,2014) , pp. 15-16

[115] Due to the long time that Conley standard error estimation takes to run with large datasets, I calculated it only for the estimation with the full set of controls.

TABLE 2.3. EFFECT OF COLONIAL ROADS ON CONTEMPORARY POPULATION AND LIGHT DENSITY

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: dependent variable is population density in 2000 (z-scores)						
Dummy <20km from a colonial paved road	**0.375*** **	**0.356*** **	**0.295*** **	**0.139*** **	**0.130*** **	
	(0.063)	(0.062)	(0.059)	(0.052)	(0.048)	
					[0.05]	
Dummy <20km from colonial unpaved road		**0.221*** **	**0.195*** **	**0.146*** **	**0.122** **	
		(0.046)	(0.047)	(0.049)	(0.048)	
					[0.046]	
Dummy <20km from a precolonial track			0.133***	0.122***	0.100***	
			(0.029)	(0.028)	(0.026)	
Standardized values of population density in 1920			0.129***	0.110***	0.109***	
			(0.038)	(0.038)	(0.037)	
Standardized values of population density in 1930			-0.044	-0.055	-0.055	
			(0.041)	(0.039)	(0.039)	
Dummy <20km from a colonial railroad				0.175	0.182	
				(0.136)	(0.127)	
Dummy <10 km from colonial district capital				0.221***	0.215***	
				(0.076)	(0.076)	
Dummy <10 km from a secondary colonial hospital				0.234***	0.224***	
				(0.062)	(0.061)	
Dummy <20 km from primary colonial hospital				1.251*	1.240*	
				(0.649)	(0.648)	
Dummy <10 km from colonial school for natives				0.635	0.632	
				(0.385)	(0.384)	
R-squared FE	0.22	0.22	0.24	0.27	0.28	
R-squared no FE	0.03	0.04	0.11	0.15	0.19	
Panel B: dependent variable is ln(0.01+light density at night in 2010)						
Dummy <20km from a colonial paved road	**0.326*** **	**0.316*** **	**0.302*** **	**0.142*** **	**0.132*** **	**0.122*** **
	(0.058)	(0.057)	(0.057)	(0.035)	(0.034)	(0.035)
Dummy <20km from colonial unpaved road		0.126***	0.119***	0.062**	0.053*	0.043
		(0.034)	(0.033)	(0.030)	(0.030)	(0.028)
Standardized values of population density in 2000						0.089***
						(0.028)
Dummy <20km from a precolonial track			0.049**	0.038**	0.036*	0.028
			(0.020)	(0.019)	(0.019)	(0.018)
Standardized values of population density in 1920			-0.013	-0.032***	-0.033***	-0.042***
			(0.012)	(0.011)	(0.011)	(0.008)
Standardized values of population density in 1930			-0.008	-0.014	-0.014	-0.009
			(0.013)	(0.011)	(0.011)	(0.009)
Observations	15,204	15,204	15,204	15,204	15,204	15,204
R-squared FE	0.17	0.17	0.17	0.24	0.25	0.51
R-squared no FE	0.02	0.02	0.02	0.12	0.13	0.44
Provincial FE	YES	YES	YES	YES	YES	YES
Pre-colonial controls	NO	NO	YES	YES	YES	YES
Colonial controls	NO	NO	NO	YES	YES	YES
Geographical Controls	NO	NO	NO	NO	YES	YES

Note: robust standard errors clustered for 202 administrative provinces (residenze) in parentheses. Regional Fixed Effects (74 Commissariati) columns 1-6. Columns 1-2 no controls. Column 3 pre-colonial controls: dummy <20km from precolonial tracks and standardized population density in 1920 and 1930. Columns 4 controls for other colonial investments: dummy <20km from colonial railroads, dummy<10km from colonial district capital and dummy <10 km from colonial school for natives, dummy <10km from secondary colonial hospitals and clinics, dummy <20km from primary colonial hospital. Column 5 geographical and environmental controls: dummy <10km from perennial waterways, rainfall annual average, elevation, malaria rate, FAO land propensity score, latitude, longitude, dummy for being in a mineral area, dummy for being within less than 30 km from the coast. Conley Standard error for spatial correlation in squared brackets in column 5. *** p<0.01, ** p<0.05, * p<0.1.

variable. My two explanatory variables of interest are, just as in table 2.2, a dummy for being within 20km from a colonial paved road and another for being within 20km from an unpaved

road. Regional fixed effects are added in columns 1 to 6 and the standard errors are clustered by colonial provinces. In squared brackets in column 5 the Conley's standard errors corrected for spatial correlation are reported. Pre-colonial controls are added in column 3, other colonial investments in column 4 and geographical controls in column 5.

The estimates in panel A show a strong and positive correlation between colonial road placement and population density in the present day. Even when the full set of controls has been added in column 5, the coefficient remains big (1.3 standard deviations) and statistically significant at the 1% level. According to these results, a path dependence phenomenon is in place: the local population remains more highly concentrated along colonial paved roads, despite the fact that these roads have lost their monopoly on transportation due to the infrastructural realisations between 1970 and 2000, and despite the disruption of the network between 1941 and 1951. Cells within 20km from a colonial paved road present a higher population density rate (about 0.13 standard deviations) as compared to other cells. Interestingly, in 2000 as opposed to 1940, unpaved colonial roads seem to matter in shaping population density: as is visible in column 5 of panel A, in cells within a distance of less than 20km from a colonial unpaved road, population density is 0.12 standard deviations higher and the coefficient is significant at the 5% level. This can be partially explained by the fact that colonial unpaved roads were paved from 1960, following a mechanism that will be more specifically explored in section 2.6. Conversely, according to the R-squared, the model does not work particularly well in explaining the sample's variation. In fact, proximity to paved and unpaved colonial roads explains only the 4% of the total variation, whereas the restricted model reaches the 19%. This fact, which is probably an effect of the more sophisticated level reached by the Ethiopian infrastructural system during the last few decades, does not undermine the importance of the long-term correlation between colonial roads and population density, which remains strong throughout the period.

In panel B I replicate the results using light density at night as dependent variable: I have hitherto demonstrated that there is a strong, positive and statistically significant correlation between

colonial roads placement and population density. I now want to explore whether proximity to colonial roads also correlates with a higher level of economic development, of which light density is a good proxy. I employ a logarithmic function of light density at night, in the form ln(0.01+light density), following Michalopoulos and Papaioannou.[116] The coefficients in columns 1 to 5 show a positive and statistically significant correlation between proximity to colonial roads (both paved and unpaved) and light density at night, which underscores the fact that areas next to colonial roads are not only more densely populated, but also better illuminated and therefore more economically developed. In column 6, I also control for population density in 2000, in order to test whether the analysed areas are more luminous *per se*, or whether this is simply due to higher contemporary population density. Consistently with my research hypothesis, colonial paved roads' coefficient remains positive and statistically significant at the 1% level, which suggests that the mentioned areas are more luminous because they are more developed and not simply because they are more densely populated. Unpaved roads, instead, completely lose significance.

To conclude, from tables 2.2 and 2.3 it is possible to observe how proximity to paved and unpaved roads, built during the colonial Italian occupation of Eritrea, Somalia and Ethiopia, positively correlates with population density and light density at night. In table 2.2 it is shown that this correlation is already in place in 1940, one year before the end of the Italian colonial occupation of the zone. Table 2.3 gives evidence of how the effect, already evident at the end of the colonial period, still persists today. Those areas, which are located within 20km from colonial paved or unpaved roads have proven to be more densely populated. Furthermore, areas next to colonial roads are also more luminous at present, which demonstrates that colonial infrastructure are associated with a higher level of economic development in the present time.

2.5 ROBUSTNESS CHECKS

In this section, I want to demonstrate the existence of a causal relationship between colonial roads and population distribution, in other words, I want to demonstrate that the mentioned areas

[116] Michalopoulos, S., and Papaioannou, E., 'Pre-Colonial Ethnic…*Op. Cit.*

TABLE 2.4. MAIN ROBUSTNESS CHECKS FOR TABLE 2.2: DEMONSTRATING CAUSAL RELATIONSHIP FOR 1940

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	BASELINE	IV First Stage	IV	PLACEBO I	PLACEBO II	Ethnic FE	CONT. ROADS
Dummy <20km from a colonial paved road	**0.132*** **		**0.414** **			**0.275*** **	**0.127*** **
	(0.043)		(0.172)			(0.074)	(0.043)
Dummy < 20 from straight lines 2 (Instrument)		**0.222*** **					
		(0.035)					
Dummy <20km from projected colonial road				**0.085** **	**0.006**		
				(0.036)	(0.040)		
Dummy <10km from a contemporary road							0.046***
							(0.013)
Observations	15,204	15,204	15,204	15,204	15,204	15,204	15,204
R-squared	0.81	0.39	0.81	0.81	0.72	0.72	0.81
widstat	n	n	39.54	n	n	n	n
Regional FE	YES	YES	YES	YES	NO	NO	YES
Ethnicity FE	NO	NO	NO	NO	YES	YES	NO
State FE	NO	NO	NO	NO	NO	NO	NO
Provincial FE	NO	NO	NO	NO	NO	NO	NO
Full set of Controls	YES	YES	YES	YES	YES	YES	YES

Note: The dependent variable is population density in 1940 (in *x-scores*). Robust standard errors clustered by colonial provinces (202 'Residenze') in parentheses. The full set of controls from table 2.2 has been added from column 1 to 7. Pre-colonial controls: dummy <20km from precolonial tracks and standardized population density in 1920 and 1930. Other colonial investments: dummy <20km from colonial railroads, dummy<10km from colonial district capital and dummy <10 km from colonial school for natives, dummy <10km from secondary colonial hospitals and clinics, dummy <20km from primary colonial hospital. Geographical and environmental controls: dummy <20km from perennial waterways, rainfall annual average, elevation, malaria rate, FAO land propensity score, latitude, longitude, dummy <10km from contemporary roads, dummy for being in a mineral area, dummy for being within less than 30 km from the coast. In column 1 the baseline regression from table 1 is reported, in column 2 the first stage regression of the 2SLS, in column 3 the second stage. In column 4 placebo lines are employed as explanatory variable with standard regional FE. In column 5 the same placebo lines are used, but Ethnic FE are added. In column 6 the baseline regression with ethnic fixed effects is reported. In column 7 a dummy for being within less than 10 km from a contemporary paved road has been added. *** p<0.01, ** p<0.05, * p<0.1.

are more densely populated because they are located next to colonial roads. Concretely this translates into the elimination of the possibility of the endogenous placement of colonial roads. As outlined above, my strategy can be divided into three main parts: IV estimation with straight lines for colonial paved roads, placebo treatment with projected but not realised roads, and additional robustness checks of various natures.

In table 2.4, I report the first set of robustness checks for table 2.2. In column 2 of table 2.4, the first stage regression is reported; this shows a positive and strong correlation between the potential endogenous variable and the instrument. In column 3, where the second stage estimates of the IV procedure are shown, it is clear that the instrumented variable has a strong and positive effect on population density in 1940. The coefficient of column 3, although of a magnitude comparable to the beta coefficient of the baseline regression, is roughly two times larger. I am not concerned by

this fact since the IV procedure is likely to be correcting for measurement error in the calculation of the distance from colonial paved roads. In column 4, a dummy for being within 20 km from a projected colonial paved road is employed as placebo treatment: despite the fact that the magnitude and the statistical significance of the coefficient are reduced from 0.13 to 0.08 and from 1 to 5% respectively, the result is still positive and statistically significant, which seems to undermine the validity of the results. The effect is gone, however, when I add ethnic fixed effects to the equation, meaning that the estimates were capturing the effect of tribal population density. In fact, in column 5 the coefficient becomes smaller and statistically insignificant, whilst, as shown in column 6, the effect of real colonial roads is robust to the same set of fixed effects. Moreover the estimates are robust to the introduction of a dummy for being within 10km from contemporary roads in column 7.

In table A1 in the appendix, additional robustness checks for table 2.2 are reported: As is consistent with the results, colonial roads do not affect population density distribution in 1930, before the beginning of the preparation of the invasion and the start of organic roads construction in 1936. This is visible in column 2, where population density in 1930 is employed as dependent variable. Moreover when I exclude cells with population density higher than 50 points (proxy for colonial towns) in 1940, the estimates are robust and significant (column 3). Finally, the results hold if I reduce the sample to cells within 200km and 100km from a colonial paved road (columns 4 and 5) and if I throw colonial provincial and colonial state fixed effects into the equation (columns 6 and 7).

In table 2.5, the robustness checks for table 2.3 are reported. The instrument performs well in predicting the population density distribution in 2000, as shown in column 3. When compared to the same column in table 2.4, the coefficient is now about 70% larger, and it is statistically significant at the 1% level. The estimates obtained from the placebo test in column 4 further strengthen the argument that higher population density is causally related to the placement of colonial paved roads. In fact, the coefficient measuring the effect of placebo lines is significantly smaller than the baseline one and is not significant even at the 10% level. In column 5 the estimates

TABLE 2.5. MAIN ROBUSTNESS CHECKS FOR TABLE 2.3: DEMONSTRATING CAUSAL RELATIONSHIP FOR 2000

	(1)	(2)	(3)	(4)	(5)	(6)
	BASELINE	FIRST STAGE	IV	PLACEBO	CONT. ROADS	CELLS 30x30 Km
Dummy <20km from a colonial paved road	**0.130*** **		**0.779*** **		**0.116** **	**0.306*** **
	(0.048)		(0.248)		(0.047)	(0.092)
Dummy < 20 from straight lines		**0.222*** **				
		(0.035)				
Dummy <20km from projected colonial road				**0.038**		
				(0.056)		
Dummy <10km from a contemporary road					0.145***	
					(0.017)	
Observations	15,204	15,204	15,204	15,204	15,204	1,713
R-squared	0.28	0.39	0.25	0.28	0.28	0.58
widstat	n	n	39.54	n	n	n
Regional FE	YES	YES	YES	YES	YES	YES
Full set of Controls	YES	YES	YES	YES	YES	YES

Note: robust standard errors clustered by colonial provinces (202 'Residenze') in parentheses. The full set of controls from table 1 has been added from column 1 to 6. Pre-colonial controls: dummy <20km from precolonial tracks and standardized population density in 1920 and 1930. Other colonial investments: dummy <20km from colonial railroads, dummy<10km from colonial district capital and dummy <10 km from colonial school for natives, dummy <10km from secondary colonial hospitals and clinics, dummy <20km from primary colonial hospital. Geographical and environmental controls: dummy <20km from perennial waterways, rainfall annual average, elevation, malaria rate, FAO land propensity score, latitude, longitude, dummy <10km from contemporary roads, dummy for being in a mineral area, dummy for being within less than 30 km from the coast. In column 1 the baseline regression from table 2 is reported, in column 2 the first stage regression of the 2SLS, in column 3 the second stage. In column 4 placebo lines are employed as explanatory variable. In column 5 a dummy for being within less than 10 km from a contemporary paved road has been added. In column 6 the same model is run in a dataset composed by 1,713 of 30x30km. *** p<0.01, ** p<0.05, * p<0.1.

are shown to be robust to the introduction of a dummy for being within 10 km from a contemporary roads, with the coefficient remaining significant at the 5% level, a robustness check particularly important when measuring the effect of roads on present-day data due to the possible effect of new roads on population distribution.

Finally, in column 6 the analysis is replicated in a smaller sample composed of 1,713 cells with a bigger size (33x33 km as opposed to 11x11 km), a procedure that helps to make my results more robust for possible problems of spatial correlation: even in this case the coefficient remains positive and statistically significant at the 1% level. Lastly, in table A2 I perform some additional robustness checks, in which I reduce the sample size to cells within 200 and 100 km from a colonial paved road and add different sets of fixed effects to the equation. The estimates are robust to these additional checks.

To summarise, from the results discussed in this section, it is possible to argue that the placement of colonial paved roads, built between 1934 and 1940, caused a concentration of the population along the main arteries which had already emerged in 1940. Despite the abrupt interruption of the Italian occupation in 1941 which meant the destruction of several nodal infrastructures by the Italian troops in retreat and the end of any organic program of road maintenance until the 1960s, I demonstrated the persistence of the effect. Hence, as shown in table 2.3 and 2.5, the placement of colonial paved roads is still shaping the population distribution patterns in 2000, as reflected by the higher population density next to colonial roads. Following the main literature in the field, this persistence can be interpreted as a phenomenon of 'path dependence', given the fact that people are still gathering along colonial infrastructures, despite the fact that the direct comparative advantage provided by this colonial infrastructure was lost by the end of the colonial occupation, or at least by the beginning of the implementation of new road construction plans starting in the 1960s. In the next section, the mechanisms that justify the emergence and the persistence of this effect will be explored.

2.6 EMERGENCE MECHANISMS

At this point the causal relationship between the placement of colonial roads and the population density distribution has been demonstrated. Two issues have to be addressed now. Firstly, I need to account for the rapid emergence of population concentration back in the colonial times. In fact, between 1930 and 1940, as clearly shown in table 2.2, the population in Oriental Italian Africa relocated near colonial roads in an extremely short period of time and the mechanisms through which this happened have to be explored. Secondly, the path dependency mechanism is in need of attention: as previously pointed out, there cannot exist any simple direct effect of colonial roads building on population density in 2000 due to the decadence of the colonial road network between 1941 and 1951. Which channels allowed the persistence of people's location along colonial roads and the creation of a more developed environment?

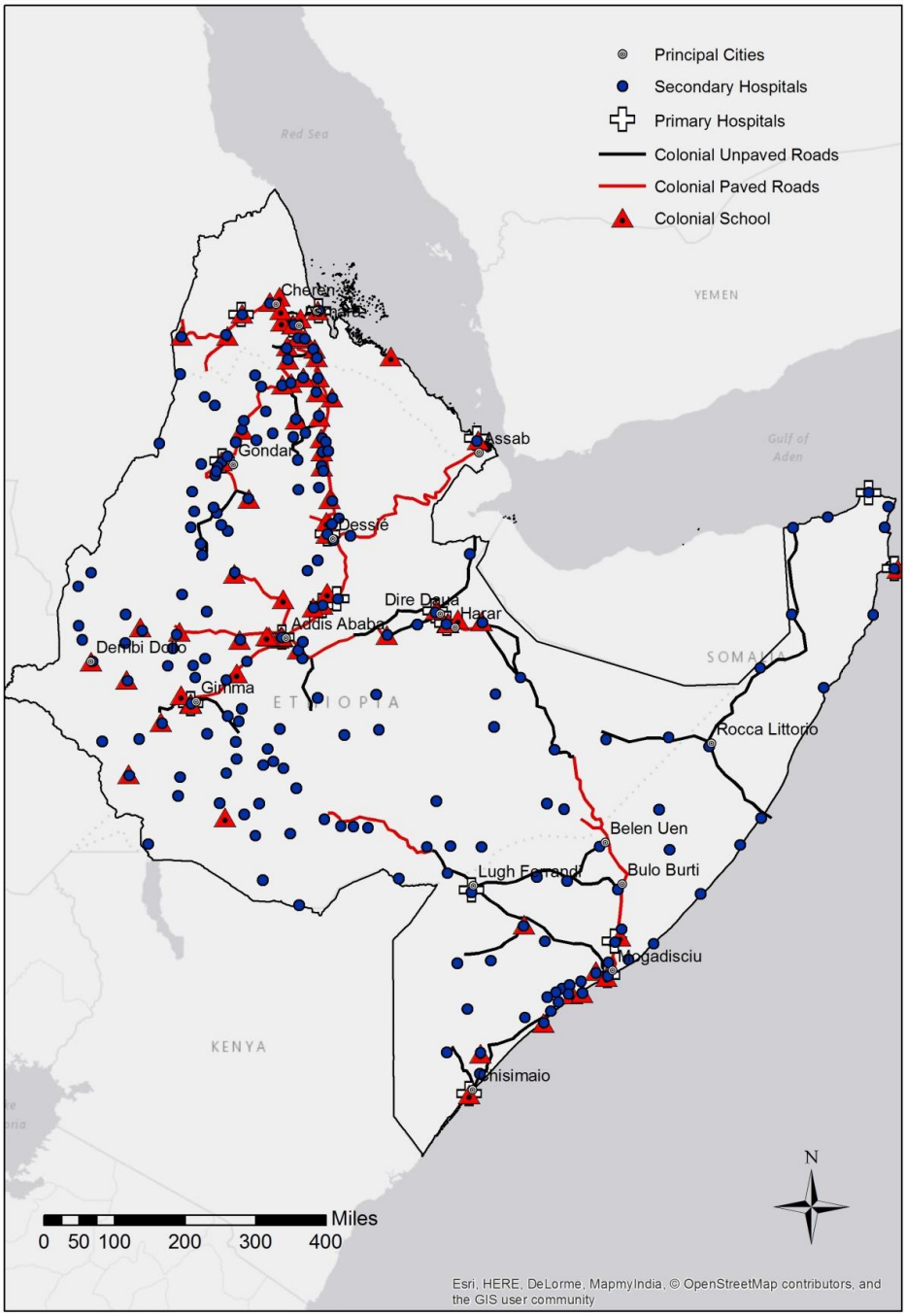
In this section I want to explore the emergence mechanisms. Why did people start moving near colonial roads immediately after the Italian conquest of Ethiopia? It is possible to assume that given the fact that neither Italian settlers nor local people were forced by the colonial government to move towards the new infrastructure, the inhabitants of these regions must have found it economically advantageous to situate themselves next to these lines between 1936 and 1940. Firstly, I will argue that people rapidly concentrated along colonial roads mainly because of a phenomenon of concentration of schooling and sanitary facilities in these areas. Secondly, I will show that also concentration of economic activities along the main arteries played a central role. Thirdly, I will argue that the workforce mobilisation achieved to build the roads could have largely settled next to the newly built infrastructure, in turn triggering higher population density in these zones.

From the available data, it is possible to hypothesise that the first factor that could have brought more people near roads was the fact that these areas were endowed with more generous public investments in facilities. The new roads cut the transportation costs of construction materials, such as cement, bricks and iron, which were only partially produced in the colonies and were still largely imported from the metropole through the main ports of Massaua, Assab and Mogadiscio.[117] This incentivised the local colonial governments and the minister of colonies to locate the construction of the new public buildings such as schools and hospitals next to the new roads in order to exploit this advantage.

As is visible in table A3 from the appendix, roughly 90% (15 out of 17) of the operational colonial primary hospitals in 1940, which along with the secondary ones provided assistance to both the white population and to the local one[118], were built within 20km from a colonial roads. Similarly, despite the fact that the mentioned areas already held the majority of the main colonial hospitals, 50% (96 out of 199) of the secondary clinics as well were located next to colonial roads,

[117] Metals for roughly 50 million of Italian Lire were imported between 1st of January 1939 and 30th of June of the same year, along with 9 million of other construction materials, see MAI, *Gli Annali…Op. Cit.,* Year 3, issue 2 (Milan, 1940), pp. 1166-7

[118] MAI, *Gli Annali…Op.Cit.,* Year 3, issue 1 (Milan, 1940), p. 772



Map 2.5. Location of colonial public facilities along colonial roads

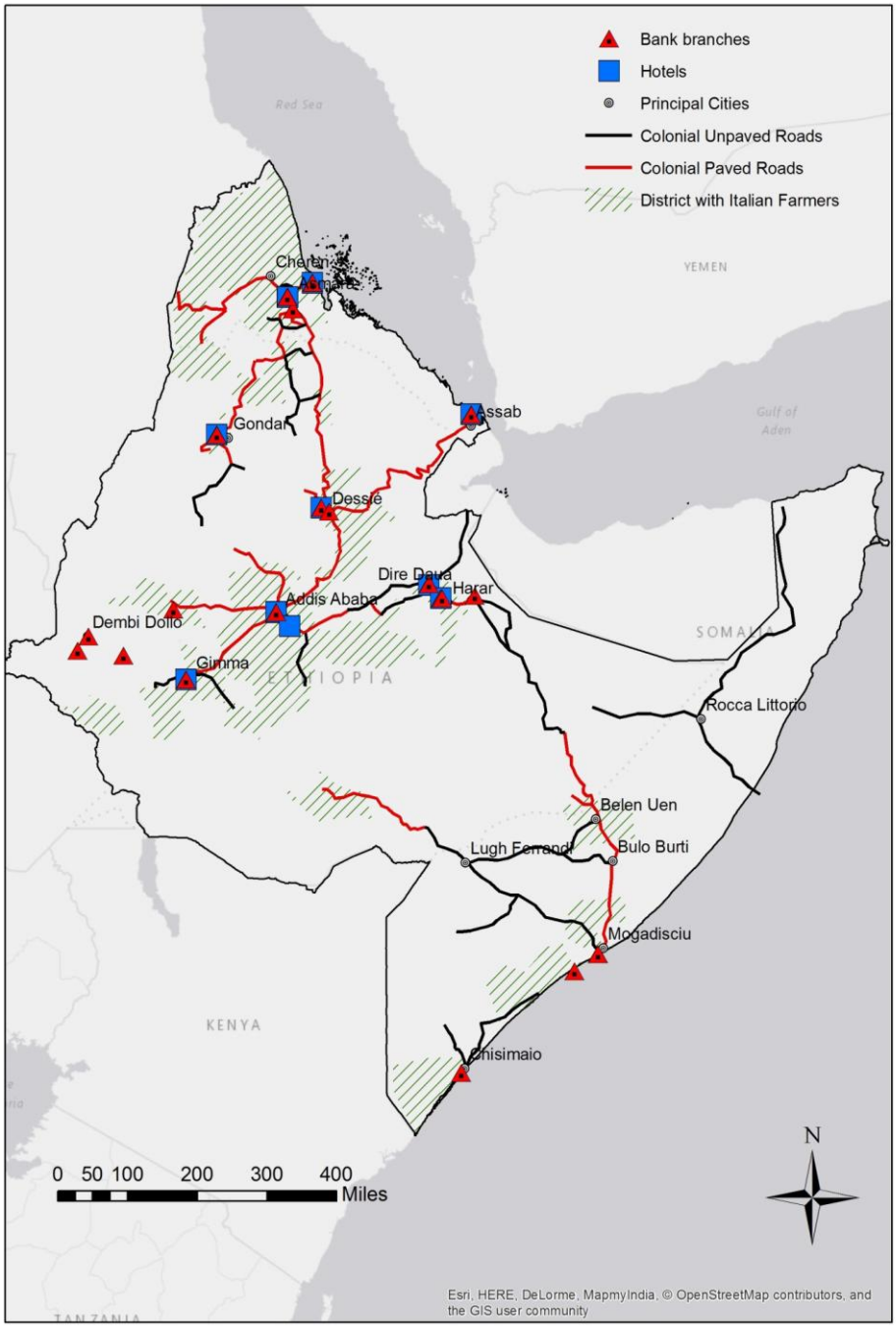
along with the 80% (62 out of 79) of colonial schools for the local population. Map 2.5 portrays the clustering of hospitals and schools in a way that indicates it was clearly preferably to locate them next to the main infrastructures. Living next to roads did not only mean residing in areas with better sanitary and schooling endowments and facilities, but it also allowed the local

population to reach them easily even if they were not at a walking distance due to the existence of the bus transportation network which was available for the black population as well.[119]

Secondly, the data convincingly underscore that the vast majority of the economic activities run by Italian settlers was concentrated along these roadways. Evidently, the first advantage that this location provided to Italian farmers and entrepreneurs was the proximity to services, as pointed out in the previous paragraph, but the advantage of starting an enterprise next to major transportation infrastructure was not restricted to only this. For farmers, having access to roads meant being able to commercialise crops easily in the main colonial markets of Addis Ababa, Asmara and Mogadisciu, as well as to transport them to the main ports of Assab, Massawa and Mogadisciu to ship them to Italy. Moreover, proximity to these infrastructures allowed farmers to acquire the necessary machinery for cultivation, such as automatic ploughs and harvesters, which played an important role in Italian farming and had to be entirely imported from the metropole.[120]

Data about the location of local agricultural population are not easily accessible, but from the available sources it is evident that many workers were employed on the Italian farms. For instance, in the Olettà farm in the Scioa government two Abyssinian households were allocated to each colonist, in order to provide him with sufficient workforce to develop the plantation.[121] Furthermore, in some specific regions such as Amhara and Scioa, different forms of share-cropping contracts and informal agreements between peasants and Italian farmers were in place, which consisted of the cooperation between the two parties in order to take advantage of the higher degree of mechanisation of the white population and the labour-force of the peasants.[122] These elements suggest that the location of local agricultural workers near colonial roads might have been caused by the advantage of cooperating with Italian farmers in the described terms. Moreover, the possibility that colonial infrastructures provided local producers with the ability to commercialise

[119] IAC, *Main features…Op. Cit.*, p. 41
[120] Larebo, Haile, L., *The building…Op. Cit.,* p. 222
[121] Ivi, p. 127
[122] Sbacchi, Alberto, *Ethiopia under Mussolini…Op. Cit.*, p. 101



Map 2.6: Location of economic activities along colonial roads

their crops easily on the principal indigenous markets, which had also been largely relocated along colonial roads[123], probably constituted another incentive to relocate next the new infrastructure.

[123] MAI, *Gli Annali…Op. Cit.,* Year 3, issue 2 (Milan, 1940), pp. 1170-1

Similarly to the agricultural activities, the Italian commercial and industrial firms that started a business in the AOI between 1936 and 1940 were also motivated to locate next to colonial roads: services were superior, transportation was cheaper, and tribunals and political organisations were available. These entrepreneurial activities were mainly dedicated to retailing and commerce (4,785), construction (823) and transportation (1,262), which totalled the noticeable number of 8,792.[124] This rapid rise in the number of operative firms was boosted by the massive public investments undertaken by the colonial government, which artificially increased the industrial activity in AOI immediately after the conquest of Ethiopia.[125] Despite the fact that, to my knowledge, reliable published official statistics about the precise location of firms in AOI are not available, it is possible to appreciate, from the authorisation lists accessible in the archives of the former Ministry of Colonies, how almost the totality of the reported locations was adjacent to principal colonial roads.[126]

In map 2.6, I illustrate the outlined concentration of economic activities in specific areas of the colonial territories, due to the exogenous placement of colonial transportation infrastructure and the subsequent comparative advantages that this provided. From this, it is clear that only the district crossed by or close to a colonial road experienced some kind of Italian farming activity. In order to appreciate the geographic concentration of industrial activity, I plotted the location of two proxies for the location of Italian firms: hotels and bank branches. As it is evident from map 2.6, almost the totality of these structures lies next to colonial roads, a finding that supports my hypothesis.

Finally, the last element that has to be considered is the massive relocation of people caused by the road construction itself. In order to build the principal roads rapidly, the Italian Government employed a huge number of workers: in 1937, 453 yards were operational with 63.530 Italians workers, 43.720 locals and 10,680 Yemenites employed. The total figure remained consistent up to 1940, but the percentage of non-Italian workers increased over time, due to the necessity of cutting

[124] Ivi, pp. 1117-8
[125] Labanca, Nicola, *Oltremare…Op. Cit.,* pp. 300-1
[126] ASMAE, Archivio Segreto, file 66 xi 3

the public expenditures.[127] Next to the main roads were built the facilities to supply and accommodate this large workforce: villages, shops and radio stations[128] were therefore placed next to the main infrastructures, and this could have incentivised some workers and their families to remain in these areas after the yard moved forward or the contract expired. Moreover, after the end of the construction phase, some additional facilities were placed along the roads to provide basic services to travellers: oil stations, first aid points and small restaurants[129] probably had an aggregation effect which further triggered people's relocation along colonial roads.

2.7 PERSISTENCE MECHANISMS

The previous section satisfactorily accounts for people's relocation along colonial roads during the colonial period, but how can we explain the persistence of a higher population density and development along colonial roads after independence? In other words, what are the persistence mechanisms through which the effect of colonial investments has endured until the present day? The answer is not straightforward: firstly, if during the colonial period proximity to colonial roads provided an advantage to the population for the reasons outlined above, this was lost between 1941 and 1951. In fact, during the retreat of the Italian troops in 1941, the militaries largely damaged the asphalt surface of the roads, destroyed several bridges and partially crushed the tunnels.[130] Moreover, between 1941 and 1951, due to the endemic lack of available funds for investments, the imperial government could not implement any plan of road maintenance or construction.[131] By 1951, the initial advantage of living next to colonial roads was largely lost. Secondly, if during the colonial period colonial roads enjoyed a substantial monopoly of transportation, during the post-

[127] Del Boca, Angelo, *Gli italiani in Africa Orientale. La caduta…Op. Cit.,* p. 162
[128] MAI, *Gli Annali…Op. Cit.,* Year 3, issue 2 (Milan, 1940), pp. 1051-71
[129] Ivi, p. 1153; MAI, *Gli Annali…Op. Cit.,* Year 2, issue 4 (Milan, 1939), p. 332
[130] Emmenegger, Rony, 'The roads of decentralization…Op. Cit., p. 16
[131] Ivi, pp. 16-17

TABLE 2.6. PERSISTENCE MECHANISM. VARIATION OF THE EFFECT OVERTIME

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent: population density in (z-scores)	1940	1950	1960	1970	1980	1990	2000
Dummy <20km from a colonial paved road	**0.132*** **	**0.127*** **	**0.239*** **	**0.218*** **	**0.145*** **	**0.130*** **	**0.130*** **
	(0.0428)	(0.0408)	(0.0566)	(0.0530)	(0.0480)	(0.0485)	(0.0484)
Dummy <20km from colonial unpaved road	**0.00393**	**0.0189**	**0.168*** **	**0.178*** **	**0.141*** **	**0.125*** **	**0.122** **
	(0.0254)	(0.0244)	(0.0602)	(0.0600)	(0.0510)	(0.0476)	(0.0475)
Dummy <20km from a precolonial track	0.00517	0.00768	0.113***	0.108***	0.0911***	0.100***	0.0996***
	(0.0231)	(0.0235)	(0.0332)	(0.0323)	(0.0259)	(0.0258)	(0.0258)
Standardized values of population density in 1920	0.0835	0.0724	0.128***	0.113*	0.144***	0.120***	0.109***
	(0.0555)	(0.0488)	(0.0440)	(0.0578)	(0.0457)	(0.0395)	(0.0371)
Standardized values of population density in 1930	0.0681	0.0619	-0.0567	-0.0708	-0.0713	-0.0615	-0.0554
	(0.0574)	(0.0514)	(0.0452)	(0.0596)	(0.0470)	(0.0412)	(0.0387)
Dummy <20km from a colonial railroad	0.160*	0.155*	0.231*	0.336**	0.294**	0.197	0.182
	(0.0829)	(0.0903)	(0.129)	(0.135)	(0.130)	(0.129)	(0.127)
Observations	15,204	15,204	15,204	15,204	15,204	15,204	15,204
R-squared	0.811	0.776	0.402	0.418	0.326	0.282	0.276
Regional FE	YES	YES	YES	YES	YES	YES	YES
Pre-colonial controls	YES	YES	YES	YES	YES	YES	YES
Colonial controls	YES	YES	YES	YES	YES	YES	YES
Geographical Controls	YES	YES	YES	YES	YES	YES	YES

Note: robust standard errors clustered for 202 administrative provinces (residenze) in parentheses. Regional Fixed Effects (74 Commissariati) columns 1-7. Full set of controls for columns 1 to 7. Pre-colonial controls: dummy <20km from precolonial tracks and standardized population density in 1920 and 1930. Other colonial investments: dummy <20km from colonial railroads, dummy<10km from colonial district capital and dummy <10 km from colonial school for natives, dummy <10km from secondary colonial hospitals and clinics, dummy <20km from primary colonial hospital. Geographical and environmental controls: dummy <10km from perennial waterways, rainfall annual average, elevation, malaria rate, FAO land propensity score, latitude, longitude, dummy for being in a mineral area, dummy for being within less than 30 km from the coast. *** p<0.01, ** p<0.05, * p<0.1.

colonial period and especially after the revolution of 1973, several massive road building plans were implemented, which brought the total extension of the road network to 46,812 km in 2009, in contrast to 6,400km in 1941.[132] We would expect a more equitable distribution of the population next to the new infrastructures, which is not shown in the data.

In this section, I will demonstrate that the persistence of higher population density next to colonial roads can be explained through three main mechanisms. Firstly, I will show how colonial roads operated as an original form of sunk investments by attracting governmental investments in the early post-colonial period, due to the economic advantage that the location of colonial roads

[132] Worku, Ibrahim, 'Road *sector…Op. Cit.*, *p.* 3

provided. It was cheaper to reconstruct pre-existent colonial roads than it was to build brand new arteries. Secondly, I will analyse the people co-location mechanism and I will demonstrate that this also operated as a persistence mechanism: people co-located in zones with a higher initial population density. Thirdly, I will provide evidence of the importance of other forms sunk investments for the persistence of colonial roads effect. Other facilities were built along colonial roads between 1936 and 1941, and I will show that these elements also played a role attracting people to the areas near colonial roads after independence, even when the advantage provided by colonial roads was lost. Finally, I will check whether the human environment near colonial roads presents urban characteristics, in order to verify whether a phenomenon of urbanisation that could explain the measured higher level of economic development is in place in these areas.

My first hypothesis is that one of the mechanisms through which the effect of colonial roads persisted over time consists of the maintenance and re-pavement of these infrastructures, operated through the First (1951-1957) and Second Highway Plan (1957-1966).[133] From the data available, it is clear that the re-construction of the pre-existing colonial roads was economically advantageous for the independent imperial Ethiopian government, who could take advantage of the excavations competed by Italian constructors. At the same time, these roads connected the major cities of the Empire, and therefore it also made strategic sense to give precedence to these works.

During the First Highway Plan 4,200km of colonial roads were rebuilt or paved, while during the Second Highway Plan 1,760km were restored. Among others, the Addis Ababa-Assab (860km), the Addis Addis Ababa-Gimma (355km), and the Addis Ababa-Lechenti (355km) were completely rebuilt following the same colonial routes, while major works of maintenance were done on the Addis Ababa-Adigrat, Addis Ababa-Blue Nile and Addis Ababa-Sciasciamanna. After these two Plans, intensive construction of new roads was undertaken by the Ethiopian governments

[133] In this section, due to the unavailability of data or contributions on road building in independent Somalia, only road plans concerning Ethiopia and Eritrea (up to independence in 1993) are included into the analysis.

between 1965 and 1985 (3rd/8th Highway Plans): 6,571km of major asphalted roads and 6,268km of rural roads were built.[134]

Table 2.6 underscores how the maintenance and rebuilding programs of the post-independence governments constitute a fundamental mechanism in explaining the persistence of the effect. For each column, I regress population density over time (between 1940 and 2000) over the right-side variables of the main specification. This allows for comparison between the effect of colonial roads over time. As is visible, the results support the hypothesis of the persistence through rebuilding of pre-existing colonial roads. In 1950, after a period characterised by total absence of maintenance, colonial roads lost part of their effect on population density and unpaved roads remained insignificant. In 1960, after the massive rebuilding and paving of the First Highway Plan, the coefficient of colonial paved roads jumps to 0.239, almost the double of 1950's one, and the coefficient of colonial unpaved roads becomes significant at the 1% level and comparable in magnitude to the paved roads' one (0.168). The estimates remain comparable in size and significance for 1970, mirroring the counteracting effects of the Second HP (between 1957 and 1966, rebuilding of 1,760km of colonial roads and 333km of new roads) and the Third HP (1965-68, maintenance of 1,042km of colonial roads but building of 1,700km of new roads).

Conversely, the population density data for 1980 strongly reflect the impact of the 4th, 5th and 6th HPs (1969-1980), during which 2,169km main roads and 1,660km of secondary roads were built: the coefficients drop from 0.218 to 0.145 and from 0.178 to 0.141 for paved and unpaved roads respectively. The further decline of the coefficients' magnitude for 1990 and 2000 corresponds to the 7th and 8th HPs (1981-1985 and 1985-present), which led to the construction of additional 3,522km main and 4,608km rural new roads.[135] Interestingly, pre-colonial tracks acquire importance for population distribution starting in 1960, probably due to the construction of new

[134] Kone, L., Argaw, P., Kebede, Y., 'The status of …*Op. Cit.*, p. 9
[135] Ibidem

TABLE 2.7. PATH DEPENDENCY AND THE RE-LOCATION MECHANISM

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable: population density in 2000 (z-scores)							
Dummy <20km from a colonial paved road	**0.221*** **	**0.202*** **	**0.211*** **	**-0.116***	**-0.089**	**-0.018**	**-0.001**
	(0.045)	(0.047)	(0.047)	(0.066)	(0.061)	(0.019)	(0.002)
Dummy <20km from colonial unpaved road	**0.126*** **	**0.124*** **	**0.123*** **	**-0.048**	**-0.056**	**-0.021**	**-0.003***
	(0.048)	(0.047)	(0.048)	(0.046)	(0.048)	(0.016)	(0.002)
Standardized values of population density in 1940		0.158**					
		(0.067)					
Standardized values of population density in 1950			0.090*				
			(0.050)				
Standardized values of population density in 1960				**1.004*** **			
				(0.190)			
Standardized values of population density in 1970					1.005***		
					(0.199)		
Standardized values of population density in 1980						1.017***	
						(0.051)	
Standardized values of population density in 1990							1.003***
							(0.006)
Observations	15,208	15,208	15,208	15,208	15,208	15,208	15,208
R-squared	0.26	0.26	0.26	0.88	0.86	0.97	1.00
Provincial FE	YES	YES	YES	YES	YES	YES	YES
Pre-colonial controls	YES	YES	YES	YES	YES	YES	YES
Colonial controls	YES	YES	YES	YES	YES	YES	YES
Geographical Controls	YES	YES	YES	YES	YES	YES	YES

Note: robust standard errors clustered for 202 administrative provinces (residenze) in parentheses. Regional Fixed Effects (74 Commissariati) columns 1-7. Columns 1-7: pre-colonial controls: dummy <20km from precolonial tracks and standardized population density in 1920 and 1930. Controls for other colonial investments: dummy <20km from colonial railroads, dummy<10km from colonial district capital. Geographical and environmental controls: dummy <20km from perennial waterways, rainfall annual average, elevation, malaria rate, FAO land propensity score, latitude, longitude, dummy <10km from contemporary roads, dummy for being in a mineral area, dummy for being within less than 30 km from the coast. Conley Standard error for spatial correlation in squared brackets in column 5. *** p<0.01, ** p<0.05, * p<0.1.

roads next to pre-colonial tracks during the 3rd HP, whereas colonial railroads completely lose any importance for population density, following a pattern similar to that of other African countries.[136]

These results underscore the fact that colonial roads operate as an original form of sunk investments. In other words, as opposed to other contexts where the original comparative advantage given by the geographical location completely disappears and the effect persists only through other

[136] Jedwab, R. and Moradi, A., 'Transportation Technology…Op. Cit.

mechanisms such as alternative forms of sunk investments[137], in the specific case of Italian colonies of the Horn of Africa, there was an economic and strategic advantage in rebuilding colonial roads in the same location even after independence. This implies that the initial infrastructural advantage endures over time, and therefore we can consider this an original mechanism through which the long-term effect persists.

The second and the third hypotheses I want to test in order to explore the persistence mechanisms are the relocation of people in more densely populated areas and the effect of other sunk investments. Areas with higher population density normally foster a phenomenon of population co-location in the same zones over time, due both to the natural higher absolute birth rate and the attractiveness they have in the economic opportunities they provide. My hypothesis is that, back in the colonial times and during the first 20 years after independence, people moved near colonial roads because this decision constituted a net economic and social advantage, but after a certain point these areas maintained higher population densities only due to population co-location.

In order to test this hypothesis and disentangle the effect of population co-location from the attractive effect of other sunk investments, in table 2.7 I regress population density in 2000 on the same explanatory variables as the baseline in table 2.3 except for variables accounting for distance from colonial primary hospitals, clinics and schools, which I consider the most important sunk investments and therefore exclude from the model. For each column, I add as control variable population density over time, from 1940 in column 2 to 1990 in column 7. If colonial roads coefficients remain positive and significant after having added this control, it would mean that their direct attractive effect is still in place in the decade following the year of the control variable, whereas if the coefficient becomes insignificant or negative this means that the effect persists only through population co-location.

The estimates in table 2.7 tell the following story: during the first 20 years after independence, between 1940 and 1960, colonial paved and unpaved roads continued to exert a

[137] Bleakley, H., & Lin, J. 'Portage…*Op.Cit.*

TABLE 2.8. EFFECT OF OTHER SUNK INVESTMENTS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable is population density in 2000							
Dummy <20km from a colonial paved road	0.134***	0.122**	0.130**	-0.112*	-0.090	-0.018	-0.000
	(0.049)	(0.052)	(0.050)	(0.061)	(0.059)	(0.019)	(0.002)
Dummy <20km from colonial unpaved road	0.121**	0.119**	0.119**	-0.046	-0.055	-0.020	-0.003*
	(0.047)	(0.046)	(0.047)	(0.045)	(0.048)	(0.016)	(0.002)
Dummy <10 km from a secondary colonial hospital	**0.233*** **	**0.232*** **	**0.235*** **	**-0.132***	**-0.033**	**-0.052****	**-0.002**
	(0.062)	(0.061)	(0.061)	(0.078)	(0.065)	(0.026)	(0.002)
Dummy <20 km from primary colonial hospital	**1.214***	**1.153***	**1.172***	**0.059**	**0.153**	**0.051**	**-0.018***
	(0.630)	(0.613)	(0.623)	(0.154)	(0.148)	(0.108)	(0.011)
Dummy <10 km from colonial school for natives	**0.607**	**0.573**	**0.576**	**-0.065**	**-0.068**	**-0.008**	**0.003**
	(0.376)	(0.369)	(0.370)	(0.092)	(0.111)	(0.047)	(0.007)
Standardized values of population density in 1940		0.133**					
		(0.062)					
Standardized values of population density in 1950			0.065				
			(0.048)				
Standardized values of population density in 1960				**1.006*** **			
				(0.191)			
Standardized values of population density in 1970					1.004***		
					(0.200)		
Standardized values of population density in 1980						1.017***	
						(0.052)	
Standardized values of population density in 1990							1.003***
							(0.006)
Observations	15,208	15,208	15,208	15,208	15,208	15,208	15,208
R-squared	0.28	0.28	0.28	0.88	0.86	0.97	1.00
Provincial FE	YES	YES	YES	YES	YES	YES	YES
Pre-colonial controls	YES	YES	YES	YES	YES	YES	YES
Colonial controls	YES	YES	YES	YES	YES	YES	YES
Geographical Controls	YES	YES	YES	YES	YES	YES	YES

Note: robust standard errors clustered for 202 administrative provinces (residenze) in parentheses. Regional Fixed Effects (74 Commissariati) columns 1-7. Columns 1-7: pre-colonial controls: dummy <20km from precolonial tracks and standardized population density in 1920 and 1930. Controls for other colonial investments: dummy <20km from colonial railroads, dummy<10km from colonial district capital. Geographical and environmental controls: dummy <20km from perennial waterways, rainfall annual average, elevation, malaria rate, FAO land propensity score, latitude, longitude, dummy <10km from contemporary roads, dummy for being in a mineral area, dummy for being within less than 30 km from the coast. Conley Standard error for spatial correlation in squared brackets in column 5. *** p<0.01, ** p<0.05, * p<0.1.

strong direct effect on population density. In fact, when controlling for population density in 1940 and 1950 in columns 2 and 3 respectively, the coefficients of paved roads suffer only small variations in magnitude and remain significant at the 1% level. Similarly, colonial unpaved roads continue to matter directly as the coefficients remain above 0.120 over the period and statistically significant at the 1 or 5% level. The persistence mechanism changes after 1960, the year that can be considered the real turning point of this narrative. When, in column 3, I add population density in

1960 to the model, the coefficients of both types of colonial roads become negative and lose the statistical significance, whereas the coefficient of population density in 1960 becomes big and significant at the 1% level.

This means that the population density distribution equilibrium, reached in 1960 because of the attractiveness of colonial roads in the previous decades, almost fully predicts the variations in population density in 2000, as demonstrated by the sharp increase of the adjusted R-squared, which jump from 26% in column 3 to 88% in column 4. A similar pattern can be underscored for columns 5 to 7, where population densities in 1970, 1980 and 1990 completely eliminate the effect of colonial roads. In column 7, it is also visible that population density in 1990 fully predicts the variations in population density in 2000, as shown by the R-squared, which equals 100%. These results are consistent with the estimates from table 2.6, where I found a jump in the paved and unpaved roads coefficients in correspondence with the reconstruction of colonial roads between 1950 and 1960 and then a slow decline of their effect, mirroring the extension of the Ethiopian road network through the construction of new roads between 1960 and 1990 and the consequent loss of the monopoly of transportation and access to facilities. The estimates from table 2.7 are also consistent with the results of Bleakley & Lin, who found that people's co-location played a central role in the persistence of *portage* sites.[138]

The third mechanism that has to be explored is the independent effect of different forms of sunk investments. As examined in the previous section, the colonial government placed along these roads the vast majority of schools, hospitals and clinics. This translated into the construction of new buildings, the purchase of the necessary scholastic and medical equipment and the formation of human capital to run this services. It is possible to hypothesise that due to the slow decrease of the marginal returns of these investments, the post-colonial government re-used them once the new welfare system was put in place. If this is the case, the attractiveness of these locations should continue after the colonial period and, therefore, I should be able to measure a positive and

[138] Bleakley, H., & Lin, J. 'Portage and path…*Op. Cit.*

significant effect of these variables once I add them to the model of table 2.7. Their effect should remain positive independently of the presence of population density over time as control variable, which is kept in the specification in order to account for the co-location phenomenon and therefore disentangle the two distinct mechanisms.

In table 2.8 it is possible to measure their effect: the mechanism pinpointed by these estimates also follows, to some extent, the results of table 2.6. When colonial primary hospitals, clinics and schools are added along with population density in 1940 in column 2, they have a positive and strong effect, with large coefficients that for secondary colonial hospitals and primary ones are even significant at the 1% and 10% levels respectively. A similar pattern is shown in column 3, where I control for population density in 1950. From these results it is possible to argue that colonial sunk investments along colonial roads had an independent attractive effect after the end of the colonial period, between 1940 and 1960. After this point, as is visible in column 4, they stop having a direct and independent effect on population density in 2000, but their effect persists through population co-location. In fact, when controlling for population density in 1960, the coefficients' magnitude is reduced, and they become negative, or statistically insignificant, or both. Their effect does not resume in the following decades.

I will now briefly describe the characteristics of the human environment that surrounds colonial roads at present. So far, my analysis has uncovered the causal relationship between placement of colonial roads and higher population density at present and has unveiled the mechanisms that triggered the emergence and the persistence of this phenomenon, but nothing has been said about the current characteristic of these more densely populated areas. What jobs do people have along these roadways? Can we find additional evidence of higher economic development through these indicators? In other words, do these areas show characteristic of an urban environment? In order to answer these questions I employ the dataset from male participants of the DHS survey 2011 for Ethiopia.

In table 2.9, I run a probit model in order to verify the likelihood for men to perform certain works, to have easier access to media, and to pay with modern methods of payment; marginal effects are reported. The results are clustered at a village level (650 clusters from the DHS survey), and colonial regional fixed effects are added to the equation. In panel A, where I regress dummies for different professions on two dummies of interest for being within 10km from paved and unpaved colonial roads and all the pre-colonial, colonial and environmental control variables from the main specification (baseline controls), I find results consistent with the hypothesis that areas located next to colonial roads have urban characteristics.

The estimates point out a clear prevalence of typically urban works next to colonial roads. People located near a colonial paved road are 4% more likely to be professionals, technicians or managers, roughly 5% more likely to work in sales, 1.5% more likely to work in services and almost 6% more likely to be skilled manual workers (columns 2, 4, 6 and 7). Furthermore, men in these areas are 34% less likely involved in agriculture, a result which is particularly significant in pointing out the urban characterisation of these zones (column 5). All these estimates are statistically significant at the 1% level. The results for unpaved colonial roads follow a similar pattern: men next to these infrastructure are 3% and 4% more likely to be in retailing or to be skilled workers respectively (columns 4 and 7), whereas they are the 18% less likely to be farmers (column 5).

The results also provide empirical evidence that proximity to colonial roads correlates with better access to media. As shown in Panel B, areas situated near colonial roads perform better in this respect as well: men living along these infrastructures are 9% more likely to read a newspaper at least once a week, roughly the 14% more likely to listen to radio and 27% more likely to watch television with the same frequency (columns 3, 6 and 9). These results, which are statistically significant at the 1% level, are mirrored by the fact that in the same zones men are less likely not to access newspapers, radio and television at all by 21%, 8% and 25% respectively (columns1, 4 and

TABLE 2.9. COLONIAL ROADS AND URBANIZATION (PROBIT)

Panel A: Profession

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	not working	prof/tech/man	clerical	sales	agric-employee	services	skilled manual	unskilled manual	
<10km colonial paved road	0.0358***	**0.0434*** **	0.00975***	**0.0480*** **	**-0.341*** **	**0.0150*** **	**0.0559*** **	0.00939***	
	(0.00732)	(0.00889)	(0.00279)	(0.0134)	(0.0527)	(0.00360)	(0.0128)	(0.00332)	
<10km colonial unpaved road	0.00484	0.0129	-0.000115	**0.0313** **	**-0.180*** **	-0.00427	**0.0395*** **	0.00591*	
	(0.00856)	(0.00905)	(0.00304)	(0.0147)	(0.0571)	(0.00359)	(0.0124)	(0.00325)	

Panel B: Access to Media

	Newspapers			Radio			Television		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	not at all	less than once a week	at least once a week	not at all	less than once a week	at least once a week	not at all	less than once a week	at least once a week
< 10km colonial paved road	**-0.209*** **	0.0747***	**0.0942*** **	**-0.0787*** **	-0.0773***	**0.139*** **	**-0.249*** **	-0.0931***	**0.274*** **
	(0.0333)	(0.0209)	(0.0176)	(0.0225)	(0.0255)	(0.0307)	(0.0393)	(0.0287)	(0.0402)
< 10km colonial unpaved road	**-0.0655***	-0.0119	**0.0590*** **	0.0238	-0.0636***	0.0396	-0.0530	-0.0911***	**0.116*** **
	(0.0337)	(0.0198)	(0.0181)	(0.0207)	(0.0246)	(0.0280)	(0.0413)	(0.0328)	(0.0401)

Panel C:Method of payment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Not paid	Cash only	Cash and in-kind	In-kind only					
Dummy < 10km from a colonia	-0.120***	**0.303*** **	**-0.179*** **	-0.00726					
	(0.0239)	(0.0444)	(0.0415)	(0.00792)					
Dummy < 10km from a colonia	-0.0143	**0.173*** **	**-0.168*** **	-0.00118					
	(0.0243)	(0.0477)	(0.0498)	(0.00719)					
INDIVIDUAL CONTROLS	YES	YES	YES	YES	YES	YES	YES	YES	YES
BASELINE CONTROLS	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	13,528	13,528	13,528	13,528	13,528	13,528	13,528	13,528	13,528

Note: robust standard errors clustered by clusters of DHS survey in parentheses. Columns 1 to 9 individual controls: age and ethnicity. Columns 1 to 9 baseline controls: latitude, longitude, elevation of the cluster, distance of the cluster from a colonial school for natives, distance of the cluster from a colonial district capital, distance from the coast, distance from a colonial railroad, distance from a perennial river, distance from pre-colonial tracks, distance from mineral area, rainfall annual average, FAO land propensity index, population density in 1920, population density in 2000, distance from contemporary road. *** p<0.01, ** p<0.05, * p<0.1

7). These estimates are all statistically significant between the 5 and the 1% level. Unpaved roads follow the same pattern for some of these indicators of development: people next to unpaved roads are 6% more likely to read a newspaper at least once a week and are also 11% more likely to watch television with the same frequency (columns 3 and 9).

Finally, the considered areas show a more widespread use of modern methods of payment, which is an important indicator of more economically developed areas. Proximity to both paved and unpaved roads drastically increases the likelihood to perform transactions in cash only, by 30% and 17% respectively (column 2). At the same time, the possibility of paying through both cash and kind is reduced by 18% next to asphalted colonial roads and by 17% next to unpaved tracks (column 3). All these estimates are significant at the 1% level.

These results strongly emphasise the fact that areas located near colonial roads are not only more densely populated, but show an higher level of urbanisation and development: the fact that people are more involved in skilled jobs and less in agriculture, along with the larger access to media and the more developed forms of payment, strongly support this hypothesis. It is therefore possible to hypothesise that the higher level of economic development observable in the treated zones is due to the fact that through the phenomenon of people re-location colonial infrastructures triggered the formation of an urban environment.

CHAPTER 3:

The long-term impact of the Italian colonial schools and hospitals in Ethiopia

3.1 COLONIAL SCHOOLS AND HOSPITALS CONSTRUCTION IN ETHIOPIA BETWEEN 1936 AND 1941: AN HISTORICAL FRAMEWORK

I have three goals in this historical section: through the analysis of the available qualitative sources, I firstly want to provide a clear historical framework to contextualise the creation of schools and hospitals in Ethiopia between 1936 and 1941. Secondly, I want to inform about the activities performed by these facilities during the colonial period to prepare the ground for the persistence mechanisms section. Finally, I want to understand the underlying ratio that drove the placement of these facilities on the territory, in order to argue for the exogenous[139] placement of them. In part 3.1.1 I will look at the general historical context that motivated these realisations, in part 3.1.2 I will look at activity and placement of colonial schools for blacks, while in part 3.1.3 I will look at colonial hospitals.

3.1.1 Reasons and magnitude of the investments

During the dramatic period of the Ethiopian crises,[140] the fascist government emphasised through internal and external propaganda the civilising function that Italy was destined to play in Ethiopia.[141] In order to keep these promises, immediately after the conquest, tangible results had to be quickly obtained in the creation of an embryonic welfare system that could elevate the living standards of the local population. The principal way through which the colonial institutions tried to accomplish this task was the implementation of a vast construction plan of schools and sanitary facilities. It must be noticed that this original motivation, which can be related to the personal prestige of the dictator, was accompanied by more practical considerations: certainly, an efficient sanitary assistance on the territory was necessary to assist the white population that was particularly

[139] In the sense of not related to unobservable local characteristics
[140] I am here referring to the period between 1934 and 1937
[141] Podestà, Gian Luca, *Il mito dell'Impero. Economia, politica e lavoro nella colonie italiane dell'Africa orientale 1898-1941,* (Torino, 2004), p. 251

exposed to tropical diseases. Moreover, epidemics had to be kept under control and, possibly, extinguished in order to make the empire suitable for white settlement. With regard to schools for locals, they were considered the main tool to achieve the Italianisation of the Ethiopian society, which in the fascist interpretation meant loyalty to the party and military education.[142]

These motivations pushed the Ministry of the Colonies to invest a lot in these two sectors: an organic analysis of the investments is unfortunately impossible, due to the fact that the six-year plan did not contain specific sections for schools and hospitals and to the loss of the local archives of the different governments in 1941. In fact, in the six-year plan, these expenses fall into the broader category of "opere edilizie" (construction works) and were attributed to each of the 6 governorships that subsequently distributed them among the smaller administrative units according to their needs. Roughly 2bn of Italian Lire were destined to this purpose in 1937.[143] Despite the inaccuracy of the available sources, it is none the less possible to appreciate in some detail the magnitude of these investments, especially for large centers: in the consolidation of the six-year plan it is reported that 10 million was invested for the Central sanitary institute and 13 million for the new hospital "Duca degli Abbruzzi" in Addis Abeba[144], while a total of 48.9 million was invested for main hospitals and other sanitary buildings in Jimma, Gondar and Harar.[145] For the construction of hospitals, schools and other buildings in the different regions and provinces, a total of 1.1bn was allocated.[146]

With regard to schools, from the available data it is possible to appreciate that the government invested 9 million in Harar, Jimma and Gondar for new buildings whereas, for the smaller schools in the provinces, money had to be found in the 1.1 bn previously mentioned.[147] In 1940, after 4 years of colonial rule in Ethiopia, 35 new schools for blacks had been funded, 7

[142] De Marco, Roland, R., *The Italianization of African natives: government native education in the Italian colonies, 1890-1937*, (New York, Columbia, 1943), p. 54
[143] Sillani, Tommaso, *L'Impero…Op. Cit*, p. 233
[144] Ivi, p. 239
[145] Ivi, p. 240
[146] Ibidem
[147] Ibidem

primary hospitals were operational and more than 120 secondary hospitals and clinics had been established permanently. These figures report the financial resources allocated in 1937, but due to the interruption of the six-year plan in 1941, only about 50% of this money was invested. They nonetheless provide an idea of the magnitude of the investments.

From these figures, it is possible to understand how schools and hospitals represented an important undertaking among the various colonial realisations and, despite their quotas of investment not being comparable in magnitude to transportation infrastructure[148], it certainly constituted a massive improvement if compared to the pre-colonial welfare situation. Having described the general context in which the building of colonial schools and hospitals was undertaken, it is now necessary to analyse more in detail the characteristics of these investments, in order to better understand their organisation, their activities and the reasoning behind their placement on the territory.

3.1.2 The activity of colonial schools for blacks and their placement on the territory

The school system implemented in the newly conquered territories did not come *ex nihilo*: the experience accumulated in the previous colonial experiences, in Eritrea and Libya in particular, was largely exploited when the new territories had to be organised. Following the regulations of 1932, colonial schools were divided into two main types: 1) elementary schools were meant to give a general preparation to local pupils and had a duration of 4 years, and 2) secondary schools (or complementary schools), where students could enlarge their knowledge of the basic subjects and specialise for two additional years.[149] Moreover, a small number of special schools for chiefs were implemented: these were destined to children of Abyssinian aristocrats, loyal to the Italian government, that were considered suitable to cover an administrative role in their regions.[150] Finally, some elementary schools for girls were also set in place, where the teaching activity focused on housekeeping activities.

[148] See section 2.1
[149] Pankhurst, R., 'Education…*Op. Cit.,* p. 365
[150] MAI, *Gli Annali dell'Africa Italiana,* year 3, issue 1 (Milan, 1940), p. 694

The racial separation between Italian and local pupils was complete (separate schools) and the underlying assumption that drove the definition of the scholastic programme for the native population in AOI was that it would have been extremely dangerous to culturally elevate the indigenous people through schooling, since an educated indigenous intelligentsia could have posed a serious threat to colonial domination. This concept was enforced under the fascist government, which saw colonial schools mainly as a powerful tool to make the colonial subjects good fascists and future soldiers loyal to the regime.

Especially under superintendent Festa (1934-1941), the political and military education was particularly stressed, while the humanistic education was reduced to a minimum.[151] The scholastic program was tailored to make the students obedient subjects, good fascists and skilled workers: Italian was mandatory at all levels, along with fundamentals of mathematics, physical education and hygiene. Hygienic education in particular was strongly emphasised in the scholastic manuals: the importance of habits such as the daily use of soap and general hygienic prevention measures was continuously stressed.[152] Theoretically, the teaching activity had to be exclusively performed by a body of habilitated teachers, but the language barrier caused the participation of local personnel that acted as translators or, sometimes, as actual teachers under the supervision of Italian tutors.[153]

From these elements, it is possible to point out how the scholastic program implemented by the Italian government in Ethiopia did not necessarily constitute progress in terms of quality of the teaching due to the limitations in the scholastic program for racial segregation purposes. Nonetheless, the Italian occupation brought a sharp quantitative amelioration of the service that became more easily accessible across the territory. Military, hygienic and literacy education had a central part in the colonial education of the local population: I expect these elements to have an impact on long-term outcomes. Moreover the creation of a better-educated class of local teachers might constitute a possible channel through which colonial schools operated as sunk investments.

[151] Ivi, p.71
[152] De Marco, Roland, R., *The Italianization of African…Op. Cit.,* p. 57
[153] Pankhurst, R., 'Education in Ethiopia…*Op. Cit.*, p. 380

With regard to the placement of the Ethiopian colonial schools it is firstly necessary to underline the unequal geographical distribution of the existent pre-colonial Ethiopian schools network. In fact, although Hailé Selaissé had started a program of development of the public education system and despite the fact that, theoretically, education was accessible and gratuitous for all Ethiopians even before 1936, the people rarely had the actual possibility to attend classes: if we exclude Addis Ababa, where several elementary schools and high schools were operational before 1935[154], only Gore, Jimma and Harar had modern governmental schools. Moreover, as opposed to Eritrea and Somalia, where a capillary system of religious missions provided significant support to the government in the education of black people[155], all the religious missions in Ethiopia were almost completely concentrated in Addis Ababa and around the main cities.[156] As it is visible from map 3.1, the Italian colonial schools were instead more evenly distributed across the territory. It is therefore possible to exclude the hypothesis that colonial schools were re-located where pre-colonial schools existed, with the exclusion of the major centers and partially of the territory of Galla and Sidamo, where some schools of the Fathers of the Consolata were re-used.[157]

Due to the loss of the local archives in 1941 it is not possible to collect data that could precisely inform about the reasons behind the location of each colonial school between 1936 and 1941. Nonetheless, from the available information, it is possible to advance two hypothesis: on the one hand, as pointed out in section 2.6, schools tended to be located next to colonial roads, which made transportation of construction material cheaper and access to schools easier. This pattern is clearly visible along the roads Asmara-Addis Ababa, Addis Ababa-Jimma and Addis Ababa-Lechenti (map 2.5). On the other, there is a correlation between political stability and endowments: the Tigré region, whose governor cooperated with Italians during the invasion, received certainly more schools; similarly Galla and Sidamo, that after 1936 became a calm and loyal area was also endowed with more schools, as visible in map 3.1. Conversely, Amhara and Scioa, where the most

[154] Zervos, Adrien, *L'Empire d'Ethiopie…Op. Cit.*, pp. 223-6
[155] Negash, Tekeste, *Italian Colonialism in Eritrea…Op. Cit.,* p. 78
[156] Zervos, Adrien, *L'Empire d'Ethiopie…Op. Cit,* pp. 225-6
[157] MAI, *Gli Annali…Op. Cit.,* year 3, issue 1 (Milan, 1940), p. 688

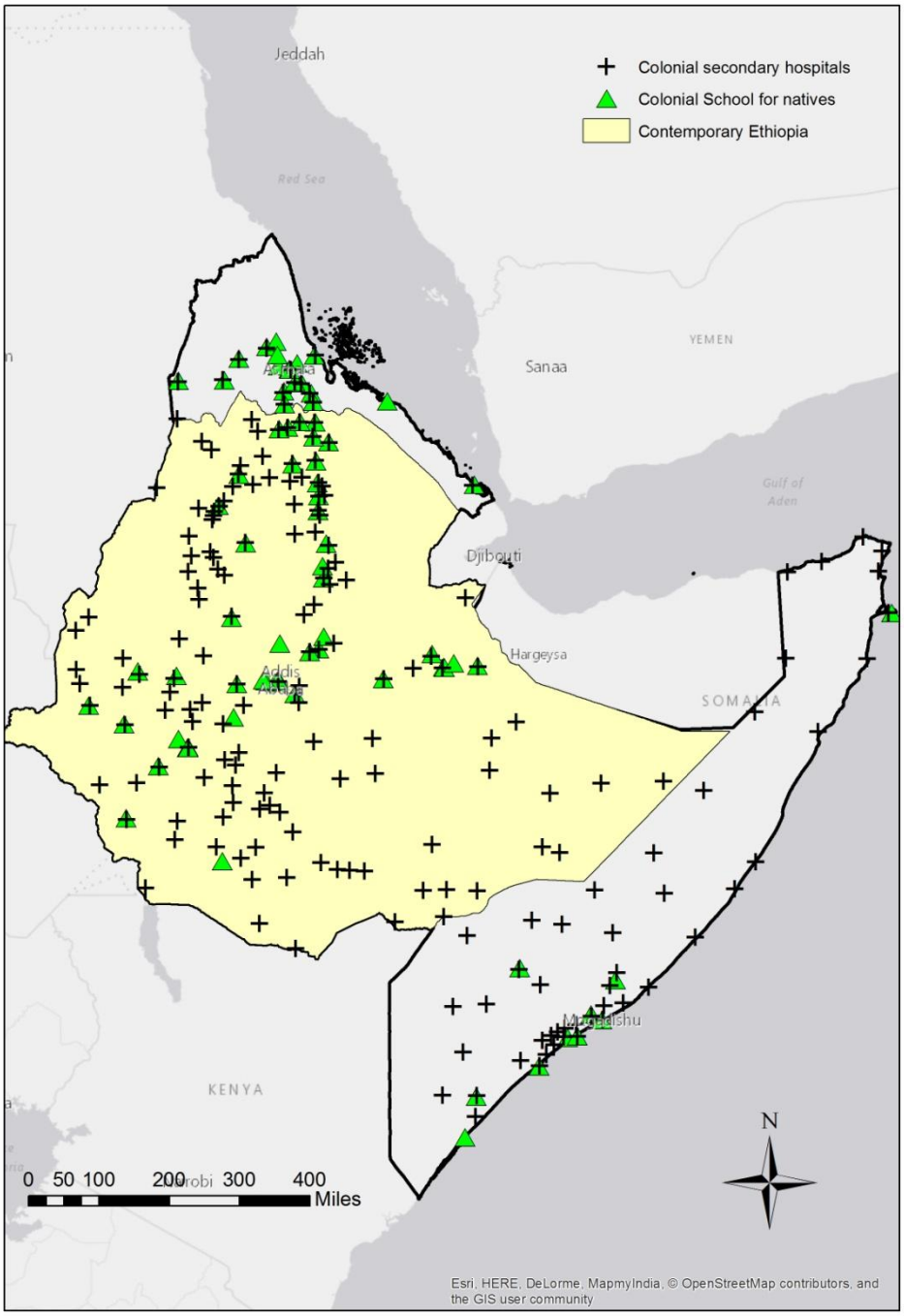
intense guerrilla activity took place, relatively few schools were built, which is interesting especially considering that these areas were the most densely populated at that time. These historical factors suggest a form of spatially randomised[158] assignment of colonial schools on the territory that supports the hypothesis of the exogenous placement of these facilities. In other words, it is unlikely that the placement of colonial schools has been determined by unobservable pre-colonial factors.

3.1.3 Activity of colonial hospitals and considerations about their exogenous placement

Colonial hospitals in the AOI can be divided into two categories: primary hospitals and those that I define as "secondary hospitals". Primary hospitals were normally located in the major cities of the Empire, disposed of more modern facilities and of several departments (surgery included); in colonial Ethiopia this type of structures was available in Addis Ababa, Dessié, Jimma, Harar, Dire Daua and Ancober. "Secondary hospitals", which constitute the focal point of my analysis, were of a different type and could be smaller provincial hospitals with a few doctors, provincial general practices with only one doctor or even infirmaries with no fixed doctor and only local nurses.[159] The reason why I am focusing on the latter category is that secondary hospitals were normally placed in extremely poor rural areas, lacking of any sanitary facility in the pre-colonial period. This means, on the one hand, that their impact on the territory could be relatively larger than the one of primary colonial hospitals in the main centers, on the other, it helps in addressing the problem of the possible endogenous placement of this facilities, which would have been unsolvable in the bigger cities.

During the Italian occupation, secondary hospitals provided assistance to both white and black population.[160] These structures did not simply operate as territorial clinics, but were also

[158] Not driven by local characteristics
[159] Ivi, pp. 789-835
[160] Ivi, p. 808



Map 3.1. Location of colonial schools for locals and colonial hospitals in AOI

responsible for prevention and vaccination campaigns against epidemics, some of the most important of which were exantematic typhus, malaria and hookworm.[161]

[161] MAI, *Gli Annali…Op. Cit.,* year 3, issue 1 (Milan, 1940), pp. 774-89

Their location can be hardly attributed to re-location next to pre-colonial sanitary facilities: if we exclude Addis Ababa which disposed of 6 small hospitals,[162] and the major centers of Jimma, Djiggiga, Harar, Gore and Dire Daua, the sanitary system before 1935 was basically non-existent. Some of the clinics mentioned in the documents, were either missions' infirmaries or private doctors of important governors.[163]

The formation of the Italian sanitary system in Ethiopia often started with the creation by the military engineering of camp infirmaries during the military campaign of 1935-6, which were left in place often already equipped with part of the sanitary material after the campaign.[164] This happened on the northern front, especially in the Tigré region in the direction towards Addis Ababa[165], and in the southern one in the zones where the main offensives of general Graziani took place, towards Neghelli and Harar.[166] Moreover several structures were also placed at the frontier between Italian Somaliland and Ethiopia, as it is visible in map 3.1.

The placement of colonial secondary hospitals can also partially be explained by the necessity of placing infirmaries along the main roads in construction to provide assistance to the Italian workers.[167] The majority of these facilities, in fact, was left in place after the end of the construction, on the Adigrat-Addis Ababa, on the Addis Ababa-Jimma and Addis Ababa-Lechenti, on the Asmara-Gondar and, finally, on the Harar-Addis Ababa and the Harar-Mogadisciu.[168] Also in this case, the qualitative evidence suggests a randomised process of facilities location that supports the hypothesis of an exogenous placement of the sanitary structures in Ethiopia during the colonial period. Hospitals were not placed according to the endogenous pre-colonial features of the different areas, but rather following exogenous motivations determined by the contingent colonisation needs.

[162] Zervos, Adrien, *L'Empire d'Ethiopie…Op. Cit,* p. 255
[163] Ivi, p. 257
[164] MAI, *Gli Annali…Op. Cit.,* year 3, issue 1 (Milan, 1940), p. 771
[165] Badoglio, Pietro, *La guerra…Op. Cit.*, p. 37
[166] Graziani, Rodolfo, *Fronte Sud…Op. Cit.*, pp. 100-3
[167] MAI, *Gli Annali…Op. Cit.,* year 3, issue 1 (Milan, 1940), p. 792
[168] See map 2.4

3.2 MAIN SPECIFICATIONS

In this chapter I want to test whether the location of colonial facilities between 1936 and 1941 is still affecting living standards in contemporary Ethiopia. I am particularly interested in the effect of colonial schools and colonial secondary hospitals on women's literacy and body mass and on children's holding of a sanitary card. These dependent variables will be used as proxies for living standards. I expect proximity to colonial facilities to have a positive effect on these variables.

In order to test this hypothesis I employ two cross sectional datasets composed by individual respondents of the Demographic and Health Survey (DHS) for Ethiopia 2011. For women, I employ the Individual Respondent dataset, which provides me with 15,789 observations assigned to 650 geo-referenced village clusters. For children, I utilise the Children dataset, created through the women's survey, composed by 11,253 suitable individuals distributed among the same number of clusters. For women, I run two different models.

$$(1)\ Dread_{i,r,c} = \alpha + D10kmschool_{i,r,c}\beta_1 + x_{i,r,c}'\gamma + \delta_r + \varepsilon_{i,r,c}$$

and

$$(2)\ BMI_{i,r,c} = \alpha + D10kmschool_{i,r,c}\beta_1 + x_{i,r,c}'\gamma + \delta_r + \varepsilon_{i,r,c}$$

To test the described hypothesis for children I run an equation in the form:

$$(3)\ Dsancard_{k,r,c} = \alpha + D10km\sec hosp_{k,r,c}\beta_1 + \mathrm{X}_{k,r,c}'\gamma + \delta_r + \varepsilon_{k,r,c}$$

Equation (1) is a probit model. A dummy, which equals 1 if woman *i* in district *r* and cluster *c* can read and 0 otherwise, is employed as dependent variable. α is the constant. $D10kmschool_{i,r,c}$ is my explanatory variable of interest; this is a binary variable equalling 1 if women *i* in district *r* and cluster *c* is located less then 10km away from a colonial school for blacks and 0 otherwise. $x_{i,r,c}'\gamma$ is a vector, which represents my standard set of controls for women. The controls can be divided into 4 categories: pre-colonial controls, colonial controls, geographical-environmental controls and individual controls. δ_r is my standard set of fixed effects, the regional colonial administrations which partitioned colonial Ethiopia into 59 regional districts. These are part of the 74

'commissariati' employed in chapter 2 for the entire AOI and, also in this context, capture the regional differences that could have been caused by inequalities in welfare endowment distribution at a district level. $\varepsilon_{i,r,c}$ is the error term.

Equation (2), which is similar to equation (1) in many aspects, differs only because the left-side variable is scalar. I am therefore running an OLS estimation. $BMI_{i,r,c}$, my dependent variable, is the Body Mass Index of woman i in district r and cluster c. All the other terms in the model perfectly coincide with equation (1). I expect my variable of interest $D10kmschool_{i,r,c}$ to have a positive and statistically significant effect on the two dependent variables in both models ($\beta_1 > 0$).

Equation 3 operates on the children dataset. This is a probit model, where my dependent variable is a dummy equalling 1 if child k in district r and cluster c has a sanitary card and 0 otherwise. My variable of interest $D10kmsechosp_{k,r,c}$ is also a binary variable, which equals 1 if child k, living in district r and cluster c, is located within 10km from a colonial secondary hospital and 0 otherwise. Also in this case, I expect my variable of interest to have a positive and statistically significant effect on my dependent variable ($\beta_1 > 0$). Similarly to models (1) and (2) I add a set of baseline controls ($x_{k,r,c}'\gamma$), which can be divided into pre-colonial controls, colonial controls, geographical & environmental controls and individual controls. δ_r is the set of 59 colonial regional districts employed for models (1) and (2), $\varepsilon_{k,r,c}$ is the error term. In all the described models, I cluster the standard errors by DHS villages, in order to account for possible problems of error serial correlation at the village level.

In order to solve the possible problem of the endogenous placement of these facilities at the colonial time I employ different strategies. Firstly, I control for a variety of variables that constitute potential confounding factors for my estimates (x term of the equation). In order to control for pre-colonial factors, I add a dummy for being within 20km from pre-colonial tracks, which accounts for proximity to pre-colonial transportation infrastructure, and population density in 1920 and 1930,

which approximates pre-colonial development (similarly to chapter 2, population density in 1930 has been added to take into account the possible relocation phenomenon caused by the preparation for war on both sides). In models (1) and (2) the following colonial investments have been added: dummies for being located less than 20km away from colonial paved and unpaved roads, colonial railroads and primary hospitals, and dummies for living within 10km from secondary colonial hospitals and provincial district capitals. These account for the major colonial factors that could have an impact on living standards. I employ 20km cut-offs for distance from transportation infrastructure because I expect those to affect the territory with a larger radius, whereas primary colonial hospitals approximate also for principal cities that could have an effect on a larger portion of the territory.

With regard to the environmental and geographical controls, the Euclidean distance from perennial rivers in km, the annual rainfall average in cm, the FAO land propensity index, the malaria rate, the Euclidean distance in km from contemporary roads, the distance in km from mining areas, elevation in meters, latitude and longitude are calculated for each cluster and therefore associated to each individual. Controlling for these factors makes my estimates robust to the main environmental confounding factors.

Finally, I also control for several individual female characteristics: age and age squared, dummies for ethnicity, dummies for religious confession, a dummy recorded in the DHS survey for currently living in urban environment and the total number of children ever born to each woman. Through these controls, I make sure that individual characteristics are not biasing the results. As opposed to other African countries, Ethiopia experienced very low migration rates in particular with regard to women in the last 50 years,[169] which allows me to avoid any specific control for this issue.[170]

[169] Casacchia, O., Crisci, M., and Reynaud, C. 'Internal migration in Ethiopia.', in *Golini A. et al., Migration and Urbanization in Ethiopia, with Special Reference to Addis Ababa, Addis Ababa, Ethiopia, and Rome: CSA and Institute for Population Research—National Research Council*, (2001), pp. 53-90

[170] This kind of controls would be difficult apply in any case, given the fact that the Ethiopian DHS Survey does not report place of birth, but only recent movements.

For equation (3), the same groups of control variables are added to the equation, with a few differences: clearly among colonial controls a dummy for being less than 20km from a colonial school for blacks is substituted to the secondary hospitals one, which becomes here my variable of interest. Moreover different individual controls are chosen: the age of the child in months, a gender dummy and another binary variable equalling 1 if the child has a twin or not.

As additional strategies to address the possible endogenous placement of these facilities, I use a placebo treatment for equations (1) and (2): I have data on schools for blacks projected between 1939 and 1940 that were not opened due to the outbreak of the war. I confront these locations with those were a school was effectively built and operational between 1936 and 1941, by substituting my variable of interest with a dummy for living within 10km from a placebo location. There is no reason to believe that these placebo schools were projected in locations with significantly different characteristics from the realised ones. If, as my research hypothesis states, schools were exogenously placed and are causing inequalities in living standards nowadays, the placebo locations should have no effect on contemporary women's performances in literacy and BMI. Unfortunately there are no similar data on projected secondary hospitals that I can exploit to replicate the same procedure for equation (3).

Additionally, for all the described models I employ a nearest neighbour matching estimation strategy, according to which I compare each treated observation with the 4 most similar neighbours of the untreated group. For the three equations, I expect the treatment to have a positive and statistically significant effect on the various employed proxies for living standards. Finally, I perform a series of robustness checks that include the restriction of the sample, the replication of the results as OLS for the probit models, testing different sets of fixed effects, changing the clusters, changing the cut-offs and modifying the functional form of the dependent variables.

TABLE 3.1. SUMMARY STATISTICS

	(1)	(2)	(3)	(4)	(5)
	mean	sd	min	max	N
Panel A: women					
respondent's current age	27.75	9.236	15	49	15,789
total children ever born	2.785	2.976	0	18	15,789
latitude	9.714	2.244	3.536	14.55	15,789
longitude	38.72	2.287	33.28	43.79	15,789
distance from contemporary roads (km)	6.731	7.951	0.0132	52.64	15,789
distance from the coast (km)	554.4	253.7	44.29	1,067	15,789
distance from perennial rivers (km)	11.77	14.34	0.000675	136.7	15,789
distance from colonial mining area (km)	36.83	48.39	0	273.7	15,789
annual rainfall average (cm/year)	11.42	10.74	0	72	15,789
malaria rate	3.824	5.550	0	21	15,789
elevation (m)	1,734.07	637.83	205	3,322	15,789
Fao land propensity score	179,010	19,920	136,279	228,749	15,789
population density in 1920	21.03	16.51	0	66	15,789
population density in 1930	22.71	17.84	0	69	15,789
Dummy <10 km from colonial district capital	0.258	0.438	0	1	15,789
Dummy <20 km from primary colonial hospital	0.256	0.436	0	1	15,789
Dummy <10 km from a secondary colonial hospital	0.434	0.496	0	1	15,789
Dummy <20km from a colonial paved road	0.396	0.489	0	1	15,789
Dummy <20km from colonial unpaved road	0.195	0.396	0	1	15,789
Dummy <20km from a colonial railroad	0.188	0.391	0	1	15,789
Dummy <20km from a precolonial track	0.424	0.494	0	1	15,789
Dummy for being in an urban area	0.299	0.458	0	1	15,789
Dummy <10km from a colonial school for natives	0.241	0.428	0	1	15,789
Dummy: able to read YES/NO	0.377	0.485	0	1	15,789
Body mass index	22.95	14.41	12.16	99.99	15,789
Panel B: children					
	mean	sd	min	max	N
child's age in months	29.16	17.44	0	59	10,130
latitude	9.604	2.459	3.536	14.55	11,253
longitude	38.69	2.425	33.28	43.79	11,253
distance from contemporary roads (km)	7.400	7.830	0.0132	52.64	11,253
distance from the coast (km)	559.6	266.9	44.29	1,067	11,253
distance from perennial rivers (km)	13.40	16.53	0.000675	136.7	11,253
distance from colonial mining area (km)	42.00	52.43	0	273.7	11,253
annual rainfall average (cm/year)	11.99	11.77	0	72	11,253
malaria rate	4.237	5.601	0	21	11,253
elevation (m)	1,614.52	650.93	205	3,322	11,253
Fao land propensity score	179,904	21,733	136,279	228,749	11,253
population density in 1920	17.06	12.50	0	66	11,253
population density in 1930	18.44	13.48	0	69	11,253
Dummy <10 km from colonial district capital	0.158	0.365	0	1	11,253
Dummy <20 km from primary colonial hospital	0.160	0.366	0	1	11,253
Dummy <20km from a colonial paved road	0.297	0.457	0	1	11,253
Dummy <20km from colonial unpaved road	0.194	0.395	0	1	11,253
Dummy <20km from a colonial railroad	0.103	0.304	0	1	11,253
Dummy <20km from a precolonial track	0.356	0.479	0	1	11,253
Dummy < 20km from a colonial school for natives	0.226	0.418	0	1	11,253
Dummy for gender	0.512	0.500	0	1	11,253
Dummy for twins	0.0154	0.123	0	1	11,253
Dummy for having a sanitary card (YES/NO)	0.220	0.414	0	1	11,253

3.3 DATA

The employed data has been collected from several sources and can be divided into three main categories: outcomes or dependent variables, explanatory historical variables and control variables, which include environmental, geographical and individual controls.

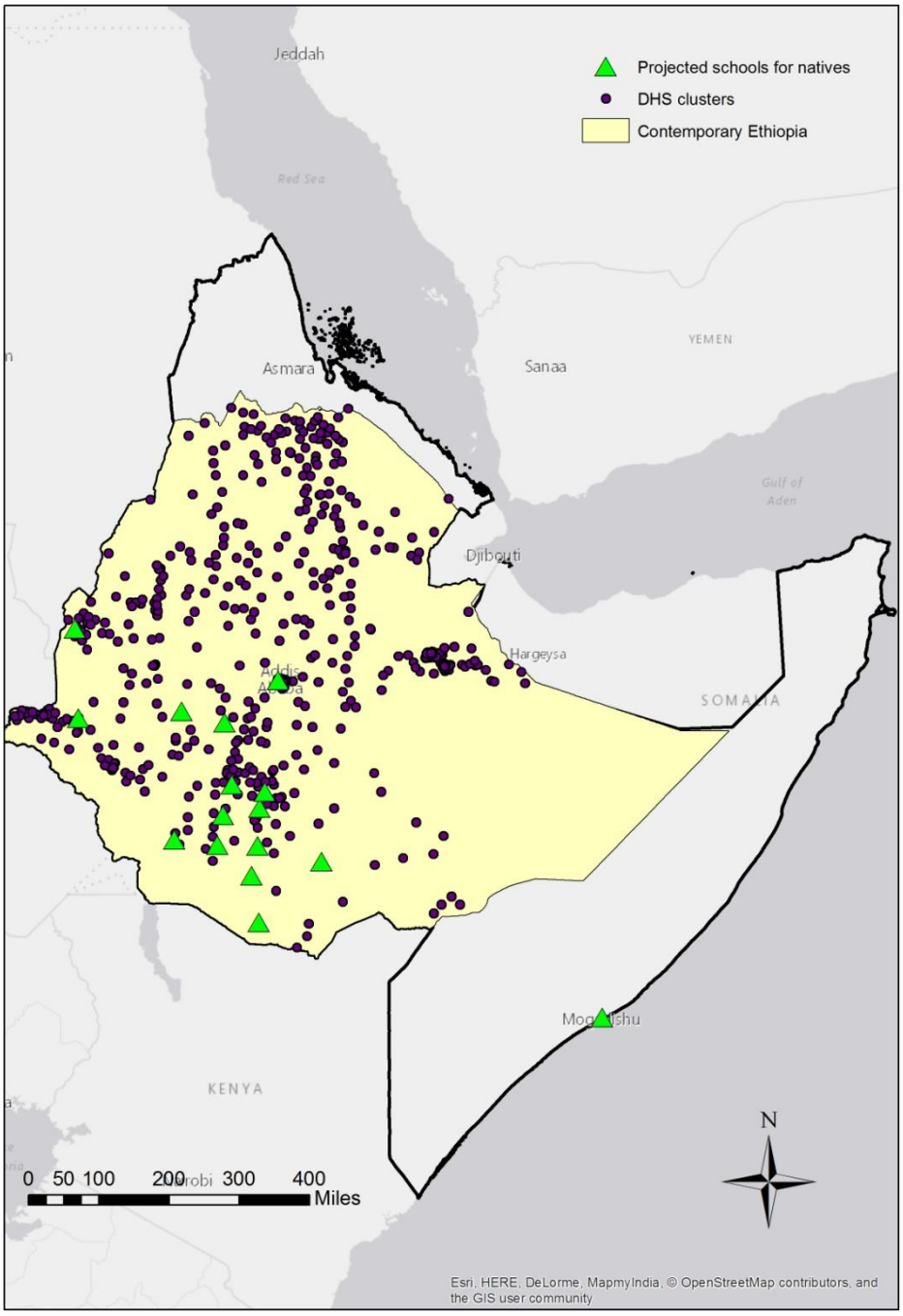
3.3.1 Dependent variables

Data about female *literacy* and *body mass* come from the 2011 Demographic and Health Survey for Ethiopia, collected in the context of the DHS program.[171] This covers modern Ethiopia only (Eritrea and Somalia are not available and for this reason are excluded from the analysis) and was originally constituted of a total of 16,515 women from 650 different geo-coded villages, evenly distributed across Ethiopia (map 3.2). Unfortunately, due to the fact that a few villages have missing coordinates, my sample has been forcefully reduced to 15,789 units of observation and, due to unavailable recoded data about body mass for some individuals, it has been further reduced, for some estimations, to 15,281.

From this dataset I use a *binary variable can/cannot read* and the *BMI index* (normalised dividing by 100). In the persistence mechanism section, I also employ a dummy for having received higher or university education, a dummy for disposing of a modern and hygienic toilet facility and the Wealth Index Factor. This is an index, calculated for each respondent according to the elements of material wealth emerged from the survey, such as construction material of the house, electric appliances and having a car or a bicycle.

With regard to the children dataset, which comes from the same survey, there are potentially 11,654 observations available. Due to the same problem of missing coordinates, I am left with only 11,253 suitable observations and, due to missing data, only with 10,130 when I introduce the child's age as a control. I use a *binary variable for have/have no sanitary card* as left-side variable of interest, employed as a proxy for healthcare assistance on the territory.

[171] Available on the website of the demographic and Health Survey Program, lastly accessed the 15 April 2015, at http://dhsprogram.com/



Map 3.2. DHS survey village clusters and projected colonial schools for blacks

In the persistence mechanism section, I employ two dummy variables in order to explore the relocation mechanism of schools and hospitals in the post-colonial era: for schools I use a dummy for living within 10km from a contemporary generic or secondary school and another dummy for being less than 20km away from an hospital. Data about the location of *contemporary hospitals in*

Ethiopia come from a GIS map, available online on the ARC GIS Online platform, 'Ethiopia health facilities', from which I calculate the Euclidean distance of each cluster from the closest facility. For *contemporary schools*, due to the unavailability of similar sources or official lists, I had to rely on a list of Ethiopian schools, coming from a social network website used by former students to keep in contact after graduation[172], from which I created a geo-coded dataset of Ethiopian contemporary schools.

As visible in map 3.2 the DHS clusters evenly cover the Ethiopian territory, with the partial exception of the Ogaden region in the South-East of the country, which is, on the other hand, a prevalently desert area. The quality of my data about the location of contemporary schools is quite low, but no better data could be found and I had to use it anyway to test the channels of persistence.

3.3.2 Explanatory variables of interest and historical data

I collect the vast majority of the data on the location of Italian colonial facilities, infrastructures and administrative units from *Gli annali dell'Africa Italiana*, a periodical publication of the Ministry of the colonies. In particular, in 4 issues, issues 3 and 4 of 1939 and 1 and 2 of 1940, the authors describe in detail the realisations achieved in AOI between 1936 and 1939/40. Specifically, the locations of *secondary* and *primary colonial hospitals* have been obtained by geo-referencing a series of 6 maps contained in issue 1 of 1940[173], along with the location of *colonial schools for Ethiopians* and Italians that have been manually attributed to the relevant geo-coded villages and towns.[174] *Colonial roads* have been geo-coded from a map contained in issue 4 of 1939[175], whereas the location of *colonial railroads* for Eritrea and Ethiopia has been downloaded from the DIVA-GIS website[176] (railways did not change at all between 1941 and nowadays)

[172] Available on the website graduates.com, lastly accessed 1/04/2015, at http://www.graduates.com/Schools/Ethiopia ,

[173] *Dislocazione dei servizi sanitari nell'Eritrea,* p. 793; *Dislocazione dei servizi sanitari nella Somalia,* p. 807; *Dislocazione dei servizi sanitari nello Scioa,* p. 813; *Dislocazione dei servizi sanitari nel Harar,* p. 819; *Dislocazione dei servizi sanitari nell'Amara,* p. 823; *Dislocazione dei servizi sanitari nel Galla Sidama,* p. 831, in MAI, *Gli Annali dell'Africa Italiana,* issue 1 (Milan, 1940)

[174] MAI, *Gli Annali…Op. Cit.,* issue 1 (Milan, 1940), pp. 674-90

[175] *Carta progressiva delle costruzioni stradali,* in *Gli Annali dell'Africa Italiana,* Vol. 4 (Milan, 1939), pp. 364-6

[176] Available on the DIVA-GIS website, lastly accessed the 15 April 2015, at http://www.diva-gis.org/gdata

whereas for Somalia (the colonial railroad has been dismantled) data has been collected from Corni's work.[177] Colonial *mining areas* have been traced from the map contained in issue 2 of 1940.[178] Administrative district capitals, regional (59 commissariati) and state (6 governi) colonial boundaries have been obtained by geo-referencing the administrative map of AOI in issue 3 of 1939.[179]

Pre-colonial tracks' locations have been traced from a set of maps contained in two apologetic works published by the Italian government in 1945 and 1946 in order to support the Italian claims on the colonies in front of UN commission in charge of assessing the possible re-assignment of some colonies to Italy.[180] Pre-colonial *population density* has been downloaded from the Netherlands Environmental Assessment Agency; data has been collected for the History Database of the Global Environment, part of the HYDE project[181], which reconstructs population density back to 20,000BC relying on the available sources on population density, cropland and pasture statistics. Data is at a fine spatial level and can be downloaded as raster datasets, cell size 0.04x0.04 decimal degrees.

Distance from the various facilities and infrastructures is calculated as Euclidean distance in km from the DHS cluster to the closest point (either closest single point or closest point of a line). Every cluster has been matched to the administrative district it falls within, whereas for population density, every village has been assigned the value of the overlapping cell of the raster dataset. The strategy to calculate these values is the same for both datasets.

As for chapter 2, due to fact that the control of the fascist dictatorship on publications was extremely strong, a problem of sources reliability for colonial investments arises: Mussolini was interested in showing off the capacity of his government to build rapidly modern infrastructure and

[177] 'Somalia Italiana' in the appendix of Corni, Guido, *Somalia…Op. Cit.*
[178] *Carta mineraria dell'A. O. I. ,* in MAI, *Gli Annali dell'Africa Italiana,* issue 2 (Milan, 1940) pp. 1195-7
[179] Ufficio studi MAI, *Circoscrizioni amministrative dell'Africa Orientale Italiana,* in MAI, *Gli Annali dell'Africa Italiana*, issue 3 (Milan, 1939), pp. 48-50
[180] *Etrirea: roads system 1895*, plate 65; *Somalia: roads system 1905*, plate 68, both in IAC, *Some data on Italian activity in the colonies*, (Firenze, 1945); *Ethiopia: road net in 1935,* in IAC, *Main features of Italy's action in Ethiopia,* (Firenze, 1946), plate 1
[181] Available on the website of the Netherland Environmental Assessment Agency, lastly accessed the 15 April 2015, at http://themasites.pbl.nl/tridion/en/themasites/hyde/download/index-2.html

facilities in the colonies. Unfortunately, as opposed to transportation infrastructure for which other sources exist (see section 2.3.2), alternative data about the location of colonial schools and hospitals is, to the best of my knowledge, unavailable. This is due to the fact that these investments were normally administered by local colonial administrators, and therefore do not show up in the archival material of the Ministry of colonies. The sources I am employing are, none the less, official governmental accounts, published by very prestigious editors, which makes unlikely a relevant mystification of the information.

3.3.3 Control variables

*Individual control variable*s have been selected from both DHS surveys and introduced into the respective datasets. For women I am employing age and age squared in years, number of children ever born, ethnicity, a categorical variable with 98 different ethnic groups and religious confession, also a categorical variable with 6 different categories. Always as an individual control, I introduce a dummy associated to each cluster that simply states whether the cluster is an urban or rural area. For children I add dummies for gender, twins and age of the child in months.

With regard to *environmental and geographical controls*: firstly I employ the latitude and longitude associated to each cluster, altitude, which is not reported in the DHS survey, but is calculated from a raster dataset also downloaded from DIVA-GIS[182] for Ethiopia, which has cells of the size of 0.008x0.008 decimal degrees. Each cluster is associated with the value of the overlapping cell. Land propensity values for each cluster are computed by associating values from a raster dataset for Africa from FAO land propensity dataset.[183] Large cells of the size of 0.5x0.5 decimal degrees are associated to each village. Similar procedures are employed for the *malaria transmission propensity index* from Kiszewski[184] (0.5x0.5 decimal degrees) and annual rainfall average data, downloaded from the DIVA-GIS website with a resolution of 0.04x0.04 decimal

[182] Available on the DIVA-GIS website, lastly accessed the 15 April 2015, at http://www.diva-gis.org/gdata
[183] Available on the FAO Statistics website, lastly accessed the 15 April 2015, at http://faostat.fao.org/site/377/default.aspx#ancor
[184] Kiszewski, Anthony, et al. "A global index…*Op. Cit.*

TABLE 3.2. IMPACT OF COLONIAL SCHOOLS FOR NATIVES ON FEMALE LITERACY

	(1)	(2)	(3)	(4)	(5)
Dependent: binary CAN/CANNOT read	Able to read YES/NO	Able to read YES/NO	Able to read YES/NO	Able to read YES/NO	Able to read YES/NO
Dummy < 10km from a colonial school for natives	**0.389*** **	**0.366*** **	**0.151*** **	**0.107*** **	**0.0998*** **
	(0.0333)	(0.0355)	(0.0550)	(0.0366)	(0.0367)
Dummy <20km from a precolonial track		0.0135	-0.0230	-0.00265	-0.0144
		(0.0285)	(0.0282)	(0.0274)	(0.0266)
Population density in 1920		0.00426	0.00753	0.00313	0.00276
		(0.0145)	(0.0139)	(0.0108)	(0.0105)
Population density in 1930		-0.000306	-0.00400	-0.00253	-0.00325
		(0.0137)	(0.0131)	(0.0102)	(0.00997)
Dummy <10 km from colonial district capital			0.187***	0.0252	0.0257
			(0.0467)	(0.0304)	(0.0301)
Dummy <20km from a colonial railroad			0.0545	-0.0810	-0.0575
			(0.125)	(0.0809)	(0.0826)
Dummy <20km from a colonial paved road			0.109***	0.0507	0.0617**
			(0.0385)	(0.0312)	(0.0304)
Dummy <20km from colonial unpaved road			0.0199	0.00149	-0.000629
			(0.0338)	(0.0255)	(0.0246)
Dummy <20 km from primary colonial hospital			0.0152	-0.0515	-0.0481
			(0.0913)	(0.0619)	(0.0626)
Dummy <10 km from a secondary colonial hospital			0.0649**	0.0654**	0.0561**
			(0.0305)	(0.0274)	(0.0260)
Respondent's current age				-0.0425***	-0.0426***
				(0.00388)	(0.00387)
Age squared				0.000576***	0.000576***
				(5.96e-05)	(5.96e-05)
Dummy for being in an urban area				0.328***	0.325***
				(0.0233)	(0.0231)
Total children ever born				-0.0400***	-0.0394***
				(0.00319)	(0.00317)
Observations	15,754	15,754	15,754	15,738	15,738
Regional FE	YES	YES	YES	YES	YES
Precolonial Controls	NO	YES	YES	YES	YES
Colonial Controls	NO	NO	YES	YES	YES
Individual Controls	NO	NO	NO	YES	YES
Baseline Controls	NO	NO	NO	NO	YES

Note: Probit estimation, the dependent variable is a binary variable can/cannot read. Standard errors clustered by DHS village. Colonial regional fixed (59 commissariati) effects from columns 1 to 5. Precolonial controls: population density in 1920 and 1930, dummny <20km from a pre-colonial track. Colonial controls: dummies <20km from colonial paved roads, unpaved roads and railroads, dummy <10km from colonial district capital, dummy <10km from a colonial clinic and dummy <10km from primary hospital. Individual controls: age of the respondent, age squared, dummy for being in an urban area, total children ever born, ethnic group and confession. Environmental and geographical controls: latitude, longitude, altitude, annual rainfall average, FAO land propensity score, euclideian distances from mining areas, coasts and perennial rivers and malaria rate. *** p<0.01, ** p<0.05, * p<0.1

degrees. Also contemporary roads and perennial rivers are downloaded from the DIVA-GIS website and the distance in km of each cluster from the closest point belonging to these lines has been computed. The same procedure has been applied to calculate distance from the coast.

3.4 MAIN RESULTS

Table 3.2 reports the results from equation (1). This is a probit model and marginal effects are reported in order to directly measure the variations in likelihood of the outcome when the observations are treated. In column 1 no controls are added, whereas in columns 2, 3, 4 and 5 pre-colonial controls, other colonial investments, individual controls and environmental & geographical controls are added respectively. Colonial regional fixed effects (59 commissariati) are introduced in columns 1 to 5, whereas the standard errors are clustered by DHS villages in order to make my estimates robust to serial measurement error and heteroskedasticity.

As it is clearly visible, the estimates suggest a strong and positive effect of colonial schools on Ethiopian women's literacy in 2011. The coefficient in column 1 is positive, large and statistically significant at the 1% level, despite the presence of regional fixed effects in the equation. Adding controls for pre-colonial characteristics in column 2, for other colonial investments in column 3, individual factors in column 4 and geographical controls in columns 5 reduces the magnitude of the coefficient, but does not affect the level of significance, which remains at the 1% level. The data show that, when all the relevant controls are added, a woman who lives less than 10km away from a colonial school that used to provide elementary education to Ethiopians between 1936 and 1941 is almost 10% more likely to be able to read. The only other colonial investments that survives the introduction of the full set of controls is colonial paved roads and secondary hospitals, a finding which is highly consistent with the results of chapter 2 and with the estimates of table 3.4 for from this section.

TABLE 3.3. IMPACT OF COLONIAL SCHOOLS FOR NATIVES ON WOMEN'S BMI

	(1)	(2)	(3)	(4)	(5)
Dependent: Body Mass Index	BMI	BMI	BMI	BMI	BMI
Dummy < 10km from a colonial school for natives	**1.272*** **	**1.206*** **	**0.681*** **	**0.565*** **	**0.589*** **
	(0.187)	(0.186)	(0.255)	(0.193)	(0.189)
					[0.215]
Dummy <20km from a precolonial track		-0.170	-0.105	-0.0617	-0.0477
		(0.111)	(0.110)	(0.0969)	(0.0953)
Population density in 1920		0.168***	0.134**	0.111**	0.115***
		(0.0627)	(0.0566)	(0.0434)	(0.0436)
Population density in 1930		-0.149**	-0.118**	-0.0982**	-0.102**
		(0.0593)	(0.0531)	(0.0410)	(0.0411)
Dummy <20km from a colonial railroad			1.374***	0.850***	0.813***
			(0.451)	(0.290)	(0.286)
Dummy <20km from a colonial paved road			0.0498	-0.107	-0.0816
			(0.156)	(0.122)	(0.122)
Dummy <20km from colonial unpaved road			-0.288**	-0.310***	-0.263**
			(0.136)	(0.115)	(0.123)
Dummy <10 km from colonial district capital			0.507***	0.0120	-0.0130
			(0.189)	(0.141)	(0.137)
Dummy <20 km from primary colonial hospital			0.0983	-0.202	-0.202
			(0.321)	(0.244)	(0.240)
Dummy <10 km from a secondary colonial hospital			-0.127	-0.145	-0.160*
			(0.104)	(0.0949)	(0.0953)
Respondent's current age				0.270***	0.270***
				(0.0195)	(0.0194)
Age squared				-0.00356***	-0.00356***
				(0.000311)	(0.000311)
Dummy for being in an urban area				1.271***	1.245***
				(0.124)	(0.128)
Total children ever born				-0.0439**	-0.0443**
				(0.0176)	(0.0177)
Observations	15,281	15,281	15,281	15,281	15,281
R-squared	0.110	0.112	0.115	0.168	0.170
Regional FE	YES	YES	YES	YES	YES
Precolonial Controls	NO	YES	YES	YES	YES
Colonial Controls	NO	NO	YES	YES	YES
Individual Controls	NO	NO	NO	YES	YES
Baseline Controls	NO	NO	NO	NO	YES

Note: OLS estimation, the dependent variable is women's BMI. Standard errors clustered by DHS village. Colonial regional fixed (59 commissariati) effects from columns 1 to 5. Precolonial controls: population density in 1920 and 1930, dummny <20km from a pre-colonial track. Colonial controls: dummies <20km from colonial paved roads, unpaved roads and railroads, dummy <10km from colonial district capital, dummy <10km from a colonial clinic and dummy <10km from primary hospital. Individual controls: age of the respondent, age squared, dummy for being in an urban area, total children ever born, ethnic group and confession. Environmental and geographical controls: latitude, longitude, altitude, annual rainfall average, FAO land propensity score, euclideian distances from mining areas, coasts and perennial rivers and malaria rate. *** p<0.01, ** p<0.05, * p<0.1

Table 3.3 shows the effect of colonial schools on women's BMI, which is a variable largely employed in anthropometrics to measure individuals' well being.[185] BMI is also often interpreted, as in this research, as a proxy for women's health. Especially in developing countries, like Ethiopia, an increase in BMI is commonly associated with better nutrition, health and living standards.[186] This is an OLS estimation with a scale variable as dependent. Similarly to table 3.2, pre-colonial, colonial, individual and geographical controls have been added in columns 2, 3, 4 and 5 respectively. Regional fixed effects are employed in columns 1 to 5 and the standard errors are clustered at DHS village level.

As it is visible in column 1, regressing women's BMI on my variable of interest, a dummy for being located within 10km from a colonial school for blacks, suggests the living in the treated areas increases BMI by 1.3 points. Adding the various sets of controls lowers the magnitude of the coefficient by 50%, but, as is visible in column 5, this remains positive, large and statistically significant at the 1% level. From these estimates it is observable that women located next to colonial schools have, on average, roughly a 0.6 points higher Body Mass Index, which is a significant difference considering that the sample's average, when the coding outliers are removed (code 99), equals 20.38. The Conley standard error, reported in squared brackets in column 5[187], does not yield a significantly different estimation, which is reassuring for possible problems of spatial correlation.

Table 3.4 reports the estimates regarding the impact of proximity to colonial secondary hospitals on the probability that the child has been given a sanitary card. I have run a probit model and I report marginal effects in order to measure the likelihood of observing children with sanitary cards in areas located within 10km from secondary colonial hospitals. In column 1, no controls are

[185] Horrell, S., Meredith, D., Oxley, D., *Measuring Misery: Body Mass, Ageing and Gender Inequality in Victorian London, Explorations in Economic History*, 46 (2009), pp. 93-119; Floud, R. *et al*, *The Changing Body: Health, Nutrition and Human Development in the Western World since 1700* (Cambridge, 2011).

[186] Bhalotra, S. and Rawlings, S. B., 'Intergenerational persistence in health in developing countries: The penalty of gender inequality?', *Journal of Public Economics*, 95 (2011), pp. 286–299; Neggars, Y., Goldenberg, R., 'Some thoughts on body mass index, micronutrient intakes and pregnancy outcome.' *The Journal of Nutrition* 133 (2003), pp. 1737S–1740S

[187] Conley standard error estimation has been performed only for the model with the full set of controls, due amount of time the code takes to run

TABLE 3.4. IMPACT OF COLONIAL SECONDARY HOSPITALS ON HEALTHCARE FOR CHILDREN

	(1)	(2)	(3)	(4)	(5)	(6)
DEPENDENT:binary variable for whether a child has a sanitary card	sanitary card	sanitary card	sanitary card	sanitary card	sanitary card	sanitary card
Dummy <10 km from a secondary colonial hospital	**0.231*** **	**0.176*** **	**0.0710*** **	**0.0774*** **	**0.0821*** **	**0.0925*** **
	(0.0270)	(0.0265)	(0.0264)	(0.0292)	(0.0265)	(0.0253)
Dummy <20km from a precolonial track		0.0858***	0.0270	0.0290	0.0251	0.0143
		(0.0194)	(0.0193)	(0.0215)	(0.0215)	(0.0211)
popd_1920		0.00450	0.00691	0.00795	-0.00185	-0.00132
		(0.0110)	(0.00994)	(0.0112)	(0.00960)	(0.00916)
popd_1930		-0.000269	-0.00275	-0.00327	0.00486	0.00245
		(0.0101)	(0.00916)	(0.0103)	(0.00902)	(0.00879)
Dummy <20km from a colonial railroad			0.0845**	0.104**	0.120**	0.00398
			(0.0394)	(0.0452)	(0.0561)	(0.0853)
Dummy <20km from a colonial paved road			0.0994***	0.116***	0.0945***	0.102***
			(0.0295)	(0.0330)	(0.0309)	(0.0283)
Dummy <20km from colonial unpaved road			0.0105	0.0119	0.0287	-0.00270
			(0.0266)	(0.0299)	(0.0282)	(0.0251)
Dummy <20 km from primary colonial hospital			-0.0234	-0.0296	0.0615	0.163**
			(0.0428)	(0.0468)	(0.0487)	(0.0652)
Dummy < 20km from a colonial school for natives			0.0770*	0.0807*	0.00444	-0.0470*
			(0.0416)	(0.0451)	(0.0345)	(0.0270)
Child's age in months				-0.00385***	-0.00387***	-0.00394***
				(0.000291)	(0.000283)	(0.000280)
Dummy for male				-0.0137	-0.0121	-0.0125
				(0.00870)	(0.00856)	(0.00835)
Dummy for twins				0.0211	0.0173	0.0183
				(0.0373)	(0.0357)	(0.0359)
Observations	11,253	11,253	11,253	10,130	10,130	10,130
Regional FE	NO	NO	NO	NO	NO	YES
Precolonial Controls	NO	YES	YES	YES	YES	YES
Colonial Controls	NO	NO	YES	YES	YES	YES
Individual Controls	NO	NO	NO	YES	YES	YES
Baseline Controls	NO	NO	NO	NO	YES	YES

Note: probit extimation. The dependent variable is a dummy which tells whether a child has a sanitary card. Standard errors are clustered at a DHS village level. In column 6 colonial regional fixed effects (74 commissariati) are added to the equation. Precolonial controls in column 2: population density in 1920 and 1930, dummny <20km from a pre-colonial track. Colonial controls (column 3): dummies <20km from colonial paved roads, unpaved roads and railroads, dummy <20km from a colonial school for natives and dummy <20km from primary hospital. Individual controls (column 4): age of the child in moths, dummy for being a male,dummy for having a twin. Environmental and geographical controls: latitude, longitude, altitude, annual rainfall average, FAO land propensity score, euclideian distances from mining areas, coasts and perennial rivers, malaria rate. *** p<0.01, ** p<0.05, * p<0.1

added, whilst in columns 1 to 5 pre-colonial, colonial, individual and geographical controls are added respectively. In this case, due to collinearity between district capitals and secondary hospitals, the dummy for less than 10km from a district capital is not employed in table 3.4, but it is

added instead to table 3.7 as a robustness check. Regional fixed effects are introduced in column 6. The standard errors are clustered by DHS villages in columns 1 to 6.

Consistently with the results obtained from colonial schools, colonial clinics also show a strong and positive effect on living standards and, more specifically on welfare assistance on the territory. In fact, children living within 10km from a colonial secondary hospital are 23% more likely to receive a sanitary card when no controls are added, as visible in column 1, and 9% more likely when the full set of controls and the fixed effects are added to the equation, in column 6. Consistent with the results of chapter 2 and in line with tables 3.2 and 3.3 of this chapter, colonial paved roads seem to have an impact on healthcare assistance, along with colonial schools.

To conclude, although from tables 3.2, 3.3 and 3.4 it is not possible to argue for causal relationship, the estimates advocate the existence of a strong, positive and statistically significant relationship between proximity to colonial facilities and better living standards and welfare assistance at present. This suggests that colonial facilities are still driving inequalities in living standards at present.

3.5 ROBUSTNESS CHECKS

The regression analysis performed in the previous section showed the existence of a strong, positive and significant correlation between proximity to colonial Italian facilities and contemporary standards of living for both women and children. In order to address endogeneity and to argue for causal relationship between colonial investments and present-day outcomes, several robustness checks are performed in this section. The main strategy employed for the three models is a nearest neighbour matching estimation, whereas for models (1) and (2) I also perform a placebo test by exploiting data on projected colonial schools for blacks. Additionally, for each equation some relevant specific tests are performed in order to further check the robustness of the results.

Table 3.5 shows the robustness checks for table 3.2. Column 1 shows the baseline estimation from column 5 of table 3.2. In column 2 the estimation is replicated in same form, but this time employing an OLS estimation instead of a probit model, in order to verify the consistency of the

TABLE 3.5. ROBUSTNESS CHECKS FOR TABLE 3.2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent: binary CAN/CANNOT read	Baseline	OLS	PLACEBO	<100 km	<50 km	<25 km	N.N. matching estimation
Dummy < 10km from a colonial school for natives	**0.0998*** **	**0.0585** **		**0.153*** **	**0.121*** **	**0.164*** **	
	(0.0367)	(0.0281) [0.022]		(0.0372)	(0.0419)	(0.0471)	
Dummy < 10km from a projected school for natives			**-0.0402**				
			(0.0420)				
SATT							**0.134*** **
							(0.0265)
Observations	15,738	15,789	15,738	11,545	8,219	5,811	15,789
R-squared	n	0.386	n	n	n	n	n
Regional FE	YES	YES	YES	YES	YES	YES	n
Precolonial Controls	YES	YES	YES	YES	YES	YES	n
Colonial Controls	YES	YES	YES	YES	YES	YES	n
Individual Controls	YES	YES	YES	YES	YES	YES	n
Baseline Controls	YES	YES	YES	YES	YES	YES	n

Note: standard errors clustered by DHS village in columns 1 to 6. Regional colonial fixed effects (74 Commissariati) in columns 1 to 6. Column 1 is the baseline from table 3.2. Column 2: replicated calculations through OLS estimation, Conley Standard Error in squared brackets. Column 3, placebo treatment using distance from projected schools for natives not realized because of the outbreak of WWII. Columns 4 to 6: replication of the estimates in the reduced sample of individuals living <100km, <50km and <25km from colonial schools for natives. Column 7: nearest neighbor matching estimation, employed matching estimation variables are respondent's age, total children ever born, distance from colonial paved roads and distance from colonial secondary hospitals, 4 nearest neighbors employed. Controls from column 1 to 6. Precolonial controls: population density in 1920 and 1930, dummny <20km from a pre-colonial track. Colonial controls: dummies <20km from colonial paved roads, unpaved roads and railroads, dummy <10km from colonial district capital, dummy <10km from a colonial clinic and dummy <10km from primary hospital. Individual controls: age of the respondent, age squared, dummy for being in an urban area, total children ever born, ethnic group and confession. Environmental and geographical controls: latitude, longitude, altitude, annual rainfall average, FAO land propensity score, euclideian distances from mining areas, coasts and perennial rivers and malaria rate. *** p<0.01, ** p<0.05, * p<0.1

estimates. The coefficient is comparable in both size and significance to the baseline. The Conley standard error, reported in squared brackets, removes any concern about possible spatial autocorrelation of the error term. In column 3 the placebo test is reported; the negative and statistically insignificant coefficient suggests that possible unobservable characteristics of the locations are unlikely to be driving the estimates, since projected colonial schools do not affect literacy in 2011.

The nearest neighbour matching estimation in column 7 also supports my claims: in fact, the estimation which compares every treated observation with the 4 most similar neighbours in terms of age, number of children ever born, distance from colonial paved roads and distance from secondary

hospitals, shows a positive and statistically significant effect at the 1% level of the treatment on women's ability to read. Finally, columns 4, 5 and 6, show that the estimates are robust to the sample's reduction to 11,545, 8,219 and 5,811 observations, achieved by selecting individuals living within 100km, 50km and 25 km from colonial secondary hospitals respectively.

Moreover, as visible in columns 3 and 4 of table A4 from the appendix, my estimates are robust even when I substitute my independent variable of interest with a logarithmic function of distance from secondary hospitals or with a dummy for living within 5km from a colonial hospital. Finally, in column 3 of table A5, also in the appendix, I cluster by colonial regional district rather than by DHS cluster in order to make sure that the procedure of matching clusters to historical variables is not affecting the error estimation. In column 5, I replicate the results choosing cut-offs of 10km only for all the historical variables, in order to show that the choice of the distance cut-off of the control variables is not driving the results. In column 6, I exclude fertility from the controls, since this variable is not commonly used in the related literature. The estimates are robust to all these additional checks.

In table 3.6, I report a series of robustness checks for the estimates from table 3.3. Also in this case, the employed strategies yield positive results for my research hypothesis, showing that the effect of colonial schools is not spurious, but rather that colonial facilities causally affect women's BMI. In column 1 the baseline from column 5, table 3.3, is reported.

In column 2, I use women's height as the dependent variable in order to make sure that the increase of BMI in the treated areas is not due to a reduction of this parameter. The coefficient is negative, but completely insignificant, even at the 10% level, which demonstrates that no real reduction of women's height in the sample is biasing my results. In column 3 I replicate the placebo treatment from table 3.5: the coefficient is negative, suggesting that endogenous elements relating to the location of colonial schools are not biasing my estimates. The nearest neighbour matching estimation, reported in column 9, also supports my hypothesis: if, similarly to the previous case, I compare each treated cell with the four individual with the closest scores, calculated taking into

account the variables respondent's age, total children ever born, linear distance from colonial paved roads and linear distance from colonial secondary hospitals, the treatment still has a strong impact on BMI. In fact, the coefficient shows that treated individuals have, on average, a BMI 1.53 points higher than untreated women, those who live more than 10km away from a colonial school. The coefficient is also significant at the 1% level.

Furthermore, if we look at results from the sample size reduced to 11,205, 7,911 and 5,536 units of observation in columns 4, 5 and 6 (<100, 50 and 25km from colonial schools) respectively, it is obvious how the results are highly robust to this check: the coefficients remain positive, roughly of the same magnitude of the baseline equation and statistically significant at the 1% level. Finally, in columns 7 and 8 I substitute the standard set of fixed effects with colonial state fixed effects (the 6 governorships) in column 7 and with contemporary regional administrative districts (11 regional administrations) in which contemporary Ethiopia is partitioned. In both cases the coefficients do not suffer any significant change in magnitude (they remain around 0.6 points) and the statistical significance remains at the 1% level.

As for table 3.5, I perform some additional robustness checks reported in the appendix: in columns 1 and 2 of table A4 I show that the estimates are robust if I change the functional form or the cut-off distance of the independent variable of interest, while in column 1 of table A5 I check whether the effect remains positive and significant if I employ the logarithm of BMI as dependent variable. In column 2 of table A5 I cluster the standard errors by colonial regional districts and, finally, in column 4 I substitute the dummies for distances from colonial investments with uniform 10km cut-offs in order to show that the results are not driven by the chosen distances. The estimates are robust to all these tests.

In table 3.7, I perform several robustness checks for the results of table 3.4. Column 1 reports the baseline regression from column 6 of table 3.4. In column 2, I replicate the results of the probit estimation by running an OLS regression with the same model, in order to verify the consistency of

TABLE 3.6. ROBUSTNESS CHECKS FOR TABLE 3.3

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent: BMI	BASELINE	HEIGHT	PLACEBO	<100km	<50km	<25km	STATE FE	REGIONAL FE	N.N. matching estimation
Dummy < 10km from a colonial school for natives	**0.589*** **	-2.242		**0.601*** **	**0.572** **	**0.710*** **	**0.603*** **	**0.577*** **	
	(0.189)	(3.268)		(0.207)	(0.229)	(0.270)	(0.188)	(0.199)	
Dummy < 10km from a projected school for natives			**-0.484** **						
			(0.213)						
SATT									**1.527*** **
									(0.213)
Observations	15,281	15,281	15,281	11,205	7,911	5,536	15,281	15,281	15,281
R-squared	0.170	0.142	0.169	0.183	0.183	0.199	0.164	0.164	n
Regional FE	YES	YES	YES	YES	YES	YES	NO	NO	n
Precolonial Controls	YES	YES	YES	YES	YES	YES	YES	YES	n
Colonial Controls	YES	YES	YES	YES	YES	YES	YES	YES	n
Individual Controls	YES	YES	YES	YES	YES	YES	YES	YES	n
Baseline Controls	YES	YES	YES	YES	YES	YES	YES	YES	n

Note: standard errors clustered by DHS village in columns 1 to 7. Regional colonial fixed effects (74 Commissariati) in columns 1 to 6. Column 1 is the baseline from Table 3.3. In column 2 height in cm is employed as dependent variable in order to make sure the increase in BMI is not due to a reduction of height. Column 3, placebo treatment using distance from projected schools for natives not realized because of the outbreak of WWII. Columns 4 to 6: replication of the estimates in the reduced sample to individuals living <100km, <50km and <25km from colonial secondary hospitals respectively. Column 7 and 8: colonial states fixed effects (6 governi) and contemporary regions fixed effects respectively. Column 9: nearest neighbor matching estimation, employed matching estimation variables are respondent's age, total children ever born, distance from colonial paved roads and distance from colonial secondary hospitals, 4 nearest neighbors employed. Controls from column 1 to 7. Precolonial controls: population density in 1920 and 1930, dummny <20km from a pre-colonial track. Colonial controls: dummies <20km from colonial paved roads, unpaved roads and railroads, dummy <10km from colonial district capital, dummy <10km from a colonial clinic and dummy <10km from primary hospital. Individual controls: age of the respondent, age squared, dummy for being in an urban area, total children ever born, ethnic group and confession. Environmental and geographical controls: latitude, longitude, altitude, annual rainfall average, FAO land propensity score, euclideian distances from mining areas, coasts and perennial rivers and malaria rate. *** p<0.01, ** p<0.05, * p<0.1

the estimates. The fact that the coefficient from the OLS regression presents a magnitude comparable to the baseline regression, the same sign and the same level of significance, informs about the consistency of my estimates. The reported Conley standard error in squared brackets in the same column demonstrates that the standard error's estimation is not biased for problems of spatial autocorrelation.

As mentioned before, the unavailability of data about possible projected colonial hospitals prohibited any placebo along the lines of those performed for equations (1) and (2). Nonetheless, the nearest neighbour matching estimation in column 8, gives evidence of the causal relationship linking placement of colonial hospitals to better performance at present in terms of healthcare assistance for children, proxied by holding of nominal sanitary card, in the treated areas. In fact, if I compare each treated child with the four untreated observations with the closest characteristics in terms of age, gender, linear distance from colonial paved roads and linear distance from colonial schools, I measure a strong and statistically significant effect of the treatment on the likelihood of

TABLE 3.7. ROBUSTNESS CHECKS FOR TABLE 3.4

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DEPENDENT: binary variable for having a sanitary card	BASELINE	OLS	<100km	<50km	<25km	STATE FE	COL. DISTR. CAPITAL	N.N. matching estimation
Dummy <10 km from a secondary colonial hospital	**0.0925*** **	**0.0951*** **	**0.0939*** **	**0.0959*** **	**0.0664** **	**0.0754*** **	**0.0855***	
	(0.0253)	(0.0232) [0.025]	(0.0257)	(0.0270)	(0.0309)	(0.0259)	(0.0462)	
Dummy <10 km from colonial district capital							0.00884	
							(0.0422)	
SATT								**0.169*** **
								(0.0232)
Observations	10,130	10,130	9,432	7,659	4,507	10,130	10,130	10,130
R-squared	n	0.211	n	n	n	n	n	n
Regional FE	YES	YES	YES	YES	YES	YES	YES	n
Precolonial Controls	YES	YES	YES	YES	YES	YES	YES	n
Colonial Controls	YES	YES	YES	YES	YES	YES	YES	n
Individual Controls	YES	YES	YES	YES	YES	YES	YES	n
Baseline Controls	YES	YES	YES	YES	YES	YES	YES	n

Note: probit estimation where not differently specified. Standard errors clustered by DHS village in columns 1 to 7. Regional colonial fixed effects (74 Commissariati) in columns 1 to 7. Column 1 is the baseline from table 3.4. Column 2, is the OLS estmation of the probit model. Columns 3 to 5: replication of the estimates in the reduced sample to individuals living <100km, <50km and <25km from colonial schools for natives respectively. Column 6: colonial states fixed effects (6 governi). In column 7 I add distance from colonial district capitals as a control. Column 8: nearest neighbor matching estimation, employed matching estimation variables are respondent's age in month, gender, distance from colonial paved roads and distance from school for natives, 4 nearest neighbors employed. Controls from column 1 to 7. Precolonial controls: population density in 1920 and 1930, dummny <20km from a pre-colonial track. Colonial controls: dummies <20km from colonial paved roads, unpaved roads and railroads, dummy <20km from a colonial school for natives, <10km from primary hospital. Individual controls: age of the respondent in months, dummy for gender and dummy for twins. Environmental and geographical controls: latitude, longitude, altitude, annual rainfall average, FAO land propensity score, euclideian distances from mining areas, coasts and perennial rivers and malaria rate. *** p<0.01, ** p<0.05, * p<0.1

holding a sanitary card; the coefficient, in fact, equals roughly 1.7 points and is significant at the 1% level.

The reduction of the sample size to individuals living within 100, 50 and 25 km from secondary colonial hospitals, which diminishes the sample size to 9,432, 7,659 and 4,507 respectively, does not eliminate the effect of colonial secondary hospitals. In all the three cases the coefficients remain of comparable magnitude and significant between 5 and 1%. The estimates are also highly robust to the introduction of the colonial state fixed effects in column 7, with the coefficient showing a 7.5% higher likelihood, also statistically significant at the 1% level. Finally the fact that the introduction of a dummy for being within less than 10km from a colonial district capital does not kill the estimates, as visible in column 7, is extremely reassuring. In fact, despite the fact that the dependent and the new control variable are highly collinear, due to the general tendency to locate colonial hospitals in district capitals, the coefficient remains positive and of about the same magnitude of the baseline, with a statistical significance at the 1% level.

Furthermore, as shown in the appendix, I employ additional tests to verify the robustness of my results. In columns 5 and 6 of table A4, I substitute the dummy of interest with the logarithmic distance from colonial secondary hospitals and a dummy for being less than 5km away from a colonial hospital. The coefficients show that the results are not driven by the cut-off of the main specification. In column 7 of table A5, I cluster the standard errors by colonial regional district, in order to verify that the estimates are not driven by error serial correlation within any historical administrative unit. Finally, in column 8 of table A5 I make the cut-offs of the various dummies that account for distance from a colonial investment uniform at 10km, in order to show that the estimates are not driven by the chosen cut-offs. These results strongly point out how the placement of colonial facilities such as hospitals and colonial schools is still playing a major role in shaping welfare and living standards inequalities across Ethiopia. The robustness checks demonstrate the exogenous casual effect on present-day outcomes. In the next section I will empirically explore the mechanisms through which this effect persisted over time.

3.6 PERSISTENCE MECHANISM

In sections 3.4 the strong positive and statistically significant correlation between colonial facilities placement and long-term standards of living has been shown, whereas in section 3.5 the relationship has been demonstrated to be of causal type. In this section, I want to empirically explore the mechanisms than can explain the persistence of the effect. In other words, I want to understand through which channels of persistence investments in colonial schools and secondary hospitals in Ethiopia between 1936 and 1941 are still causing unequal living standards and different levels of access to welfare services nowadays. Unfortunately, due to the scarcity of data for post-colonial Ethiopia, it has not been feasible to satisfactorily test all the possible hypotheses. Further research and data collection would necessary for this part. I always employ the female respondents dataset in this section.

Firstly, I want to account for the impact of colonial schools for blacks on women's literacy. I will test two hypotheses to account for this relationship: on the one hand, I will argue that more women

TABLE 3.8. PERSISTENCE MECHANISMS 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	<10km from contemporary school	<10km from contemporary school	<10km from contemporary secondary schools	<10km from contemporary secondary schools	Able to read YES/NO	Higher & Superior	Higher & Superior
Dummy < 10km from a colonial school for natives	**0.361*** **	**0.389*** **	**0.308*** **	**0.333*** **		**0.0385*** **	**0.0379*** **
	(0.102)	(0.105)	(0.101)	(0.105)		(0.0142)	(0.0143)
Standardized population density in 2000		**-0.0188**		**-0.0107**			**0.00431*** **
		(0.0154)		(0.0102)			(0.00167)
Dummy <10km from colonial school for white					**0.0287**		
					(0.0430)		
Observations	15,789	15,789	13,459	13,459	15,738	14,439	14,439
Precolonial Controls	YES	YES	YES	YES	YES	YES	YES
Colonial Controls	YES	YES	YES	YES	YES	YES	YES
Individual Controls	NO	NO	NO	NO	YES	YES	YES
Environmental Controls	YES	YES	YES	YES	YES	YES	YES
Contemporary regional FE	YES	YES	YES	YES	NO	NO	NO
Colonial regional FE	NO	NO	NO	NO	YES	YES	YES

Robust standard errors clustered by 650 DHS village cluster in columns 1 to 7. Contemporary regional fixed effects (11 districts) in columns 1 to 4. Colonial regional fixed effects (59 commissariati) in columns 5 to 7. Probit models from columns 1 to 7, marginal effects are reported. In columns 1 and 2 a dummy for living within 10km from a contemporary school is employed as dependent variable; in column 2 population in 2000 has been added as control variable in the same model. In columns 3 and 4 a dummy for living within 10km from a secondary or superior contemporary schools is employed as dependent variable and popualtion density in 2000 is added in column 4. In column 5 I employ a dummy for living within 10km from a colonial school for white people as explanatory variable of interest. In columns 6 and 7 a dummy for having attended high school or university is used as dependent variable, population density in 2000 is introduced in the model in column 7. In columns 1 to 4 pre-colonial, colonial (not dummy for colonial district capital) and environmental controls are employed, whereas in columns 5 to 7 also individual controls have been added. Precolonial controls: population density in 1920 and 1930, dummny <20km from a pre-colonial track. Colonial controls: dummies <20km from colonial paved roads, unpaved roads and railroads, dummy <10km from colonial district capital, dummy <10km from a colonial clinic and dummy <10km from primary hospital. Individual controls: age of the respondent, age squared, dummy for being in an urban area, total children ever born, ethnic group and confession. Environmental and geographical controls: latitude, longitude, altitude, annual rainfall average, FAO land propensity score, euclideian distances from mining areas, coasts and perennial rivers and malaria rate.*** p<0.01, ** p<0.05, * p<0.1

are able to read next to colonial schools, because of a phenomenon of school re-location in the post-colonial period. On the other, I will show that colonial schools have triggered the formation of a more educated human environment that could have been in the position to ask and obtain more educational endowments from the post-colonial government. Two elements could have contributed to make colonial schools sunk investments with low diminishing returns and therefore convenient places where to place post-colonial schools: firstly the existence of apt buildings that could be easily readapted and, secondly, the existence of scholastic personnel, formed during the occupation, that could constitute the bulk of the teaching personnel after independence.

In table 3.8, I empirically test whether a phenomenon of facility relocation is in place. In column 1, I run a probit model, with a dummy for living within 10km from a contemporary school as dependent variable and my historical explanatory variable of interest, the dummy for being located within 10km from a colonial school. I exclude individual controls from this equation since

they are conceptually not relevant for facilities location. The result supports the hypothesis of relocation mechanism: the estimates show that it is 36% more likely for a women to live next to a school nowadays if the village where she lives is located within 10km from a colonial school operational between 1936 and 1941. The coefficient is statistically significant at the 1% level. In column 2 I verify that the estimates are not capturing the effect of population density in 2000, which is not the case, as pinpointed by the coefficient that remains positive, significant and roughly of the same magnitude. Both columns 1 and 2 report estimates with contemporary regional fixed effects in the equation, in order to verify that the results are not capturing different endowments at a post-independence regional level.

In columns 3 to 7 I run several regressions in order to test whether the creation of a more educated environment could also constitute a channel of persistence. In columns 3 and 4, I run a probit model and I report the marginal effects. A dummy for living less than 10km away from a contemporary secondary, high or superior school, is employed as dependent variable. The estimates show that not only women living next to colonial schools are more likely to have a generic school next their village, but also that it is more than 30% more likely for them to live next to a secondary or higher institution. This result, which suggests that areas that were more endowed with investments in education during the colonial period received more secondary and high schools in the post-colonial era is also not driven by contemporary population density, as shown in columns 4.

Column 5 suggests that the persistence of the effect over time cannot be simply explained by the existence of buildings, but rather through a combination of buildings, human capital higher demand for education from the population. In fact, here I replicate the estimates of the baseline model (table 3.2, column 5), substituting the explanatory variable of interest with a dummy for being within 10km from a colonial school reserved for the white population. This can be considered as a placebo test. Since the effect is very small and not statistically significant, despite the fact that these buildings were qualitatively superior to those destined to the black population, this suggests that buildings as sunk investments are not a sufficient mechanism to explain the persistence.

Columns 6 and 7 support the results of columns 3 and 4: if I run a probit with a binary variable for having received high or university level education, it turns out that women located next to colonial schools are more likely to have studied for longer and at an higher level. I report the marginal effects. The fact that people are the 4% more likely to have superior education next to colonial schools supports the hypothesis of persistence due to relocation of schools, triggered by higher demand for education. Once more, population density does not capture the effect, as shown in column 7. Clearly these results are mere hypotheses that cannot be further checked due to unavailability of historical data for the post-independent period, but none the less represent possible explanation to the phenomenon.

Secondly I want to account for the effect of colonial schools on Body Mass Index. In fact, as opposed to the relationship between schools and literacy, this particular effect is more complex to explain.

I formulate two distinct hypotheses for the persistence phenomenon: on the one hand I believe colonial schools affect women's BMI, proxy for physical well-being, through the creation of a more hygienic environment due to the strong emphasis given to hygiene in the colonial scholastic program for locals. On the other, I believe that a more educated environment could have increased the material wealth in these areas through an increase of the household income, which would in turn translate in better nutrition and ultimately higher BMI.

With regard to the first hypothesis, as pointed out in the historical context section, it is explained by the fact that the Italian schooling program put a particular emphasis on the hygienic education as emerges from the available textbooks. This higher level of awareness about hygienic rules and habits could have triggered more hygienic living habits next to colonial schools, which would have in turn reduced the level of endemic diseases and ultimately affected BMI. If this is the case, I expect colonial schools to have a positive and statistically significant effect on proxies for hygienic conditions. In order to test this hypothesis, in columns 1 and 2 of table 3.9 I run a probit

TABLE 3.9. PERSISTENCE MECHANISMS 2

	(1)	(2)	(3)	(4)	(5)	(6)
	disposing of toilet facility	disposing of toilet facility	wealth index factor score	wealth index factor score	<20km from contemporary hospital	<20km from contemporary hospital
Dummy < 10km from a colonial school for natives	**0.0715*** **	**0.0772*** **	**46,512*** **	**46,421*** **		
	(0.0274)	(0.0282)	(10,404)	(10,409)		
Dummy <10 km from a secondary colonial hospital	0.0219	0.0219	7,744**	7,891**	**0.140*** **	**0.110*** **
	(0.0153)	(0.0153)	(3,934)	(3,907)	(0.0360)	(0.0371)
Standardized population desnity in 2000		-0.00548		906.5		2.240*
		(0.00538)		(1,977)		(1.173)
Observations	15,643	15,643	15,789	15,789	11,751	11,751
R-squared	n	n	0.828	0.828	n	n
Precolonial Controls	YES	YES	YES	YES	YES	YES
Colonial Controls	YES	YES	YES	YES	YES	YES
Individual Controls	YES	YES	YES	YES	YES	YES
Baseline Controls	YES	YES	YES	YES	YES	YES
Contemporary Regional FE	NO	NO	NO	NO	YES	YES
Colonial Regional FE	YES	YES	YES	YES	NO	NO

Robust standard errors clustered by 650 DHS village cluster in columns 1 to 6. Contemporary regional fixed effects (11 districts) in columns5 and 6. Colonial regional fixed effects (59 commissariati) in columns 1 to 4. Probit models in columns 1, 2, 5 and 6, marginal effects are reported. OLS estimation in columns 3 and 4. In columns 1 and 2 a dummy for disposing of hygienic modern toilet facility is employed as dependent variable; in column 2 population in 2000 has been added as control variable in the same model. In columns 3 and 4 a scale wealth index from the DHS survey is employed as dependent variable, popualtion density in 2000 is added in column 4. In columns 5 and 6 a dummy for living within 20km from a contemporary hospital is employed as dependent variable, population density in 2000 has been added in column 6. In columns 1 to 4 pre-colonial, colonial (not dummy for colonial district capital) and environmental controls are employed, whereas in columns 5 and 6 also individual controls have been added. Precolonial controls: population density in 1920 and 1930, dummny <20km from a pre-colonial track. Colonial controls: dummies <20km from colonial paved roads, unpaved roads and railroads, dummy <10km from a colonial clinic and dummy <10km from primary hospital. Individual controls: age of the respondent, age squared, dummy for being in an urban area, total children ever born, ethnic group and confession. Environmental and geographical controls: latitude, longitude, altitude, annual rainfall average, FAO land propensity score, euclideian distances from mining areas, coasts and perennial rivers and malaria rate.*** p<0.01, ** p<0.05, * p<0.1

model in which I employ a dummy for having modern toilets available in the household as dependent variable. Marginal effects are reported. The explanatory variable of interest is the binary variable for living next to colonial schools, while for the set of baseline controls individual controls are removed since they are not expected to affect geographical location of facilities. Colonial regional fixed effects are added to the equation. The estimates support the improved hygienic conditions persistence channel hypothesis: living next to colonial schools, in fact, increases the likelihood of disposing of an hygienic toilet facility by more than 7%, a result which is also robust when controlling for population density in 2000 in column 2. Both coefficients are statistically significant at the 1% level.

With regard to the second hypothesis, thus that more educated locations increased the average income and therefore nutrition and BMI, I run an OLS regression with DHS wealth index as dependent variable. The wealth index is calculated by taking into account different proxies of the individuals' wealth, such as having electric appliances, having bicycles or cars and different type of house construction materials. As expected, treated areas perform well in terms of wealth: individuals located within 10km from colonial schools have, on average, 46.5 higher wealth index as opposed to the rest of the sample. The coefficient is statistically significant at the 1% level and it is robust to the introduction of population density in 2000 in column 4. This means that effectively the treated locations are wealthier, an element that could trigger better BMI through better nutrition.

Finally, in columns 5 and 6 I focus on the persistence mechanism of the colonial secondary hospitals effect on welfare assistance on the territory. As previously pinpointed, the scarce available data reduces the possibilities to deeply enquire about this phenomenon. Similarly to colonial schools, I hypothesise that the most likely mechanism to explain the persistence is facility relocation in the same position, due to sunk investments and diminishing returns.

In order to test this hypothesis, I run a probit regression with a dummy variable for living within 20km from a contemporary hospital or sanitary facility. In this case I use a larger radius (20km as opposed to 10km) to construct my dependent variable since hospitals are not facilities that require daily access and therefore I consider the area of influence of each of those larger than that for schools. Consistent with my hypothesis, the results show a statistically significant at the 1% level increased likelihood for a women living in an area less than 10km away from a colonial secondary hospital to be located next (<20km) from a contemporary sanitary facility. In column 5, one can observe how women located less than 10km away from a colonial secondary hospital are 14% more likely to be close to a modern sanitary structure. In column 6, I show how this is not simply due to higher population density in 2000. We can think that the presence of a contemporary hospital next to a village can increase the activity of the national healthcare assistance on the territory, and in turn the likelihood to observe children with sanitary cards.

CONCLUSION

In this research, I have used the case study of the Italian colonies in the Horn of Africa to argue that colonial investments during the colonial era can go a long way in explaining present-day inequalities in economic development and living standards. Firstly, I have shown that areas located near colonial roads have an higher level of economic development (proxied by population density and light density). Secondly, I have demonstrated that those women who live less than 10km away from colonial schools perform better in terms of literacy and physical health (proxied by BMI). Thirdly, I pointed out how children located within 10km from a colonial hospital are more likely to receive governmental healthcare assistance (proxied by holding a sanitary card).

Aware of the possible endogenous placement of these infrastructures, I employed different methods to demonstrate that the relationship linking colonial investments to present-day outcomes is a causal one. Firstly, I employed several controls in order to capture the possible confounding factors that might bias my estimates. These include pre-colonial factors, other colonial investments, environmental & geographic controls and, for the individual datasets in chapter 3, individual controls. Secondly, with regard to investments in colonial roads, I used a placebo treatment (projected roads) and a IV strategy (straight lines connecting major cities). Thirdly, for colonial schools I used both a placebo treatment (projected schools) and a nearest neighbor matching strategy. Finally, I employed a nearest neighbor matching estimation for colonial hospitals.

As a second step, I explored the channels of persistence that explain the endurance of the effect of colonial investments over time. For colonial roads, I discovered that their effect on population density persisted due to a combination of factors. Firstly, I showed that the re-building of these arteries in the post-colonial period played a central role; secondly I demonstrated that a phenomenon of people co-location in the same areas contributed as well; and, thirdly, I pointed out that sunk investments in the form of colonial hospitals and schools attracted more people near this infrastructure. Finally, I not only showed that areas near colonial roads are more densely populated and more luminous at night, but I also empirically illustrated how their population presents urban

characteristics. This suggests that colonial roads attracted people in the neighboring area, which in turn triggered the creation of urban areas that explains the higher level of development, similar to the mechanism pointed out by Bleakley and Lin.[188] For colonial schools and hospitals, the estimates suggest that the persistence of the effect over time can mainly be explained through a phenomenon of the relocation of facilities in the same areas during the post-colonial period.

The main limitations to my analysis come from the lack of more detailed micro-level data on post-colonial investments and present-day measures. In particular, in chapter 2, I have been forced to employ proxies for economic development due to the unavailability of household or individual-level data on income for Eritrea, Somalia and Ethiopia. In chapter 3, I had to limit my analysis to Ethiopia only, due to the fact that the DHS survey for Eritrea and Somalia is not available. Finally, throughout chapter 3, I was not able to explore the persistence mechanisms satisfactorily because there is no available data on post-colonial governmental investments in sanitary and schooling facilities, teachers allocations and medical personnel. Also the data about the contemporary location of schools and hospitals is not particularly accurate and had to be collected from non-official sources.

My study added to the existing empirical literature on the relationship between colonial investments on long-term inequalities. On the one hand, by focusing on colonial roads, schools and hospitals I explored the impact of specific investments that have been widely overlooked by the related literature. In fact, this tended to focus on institutions, missionary activity, land tenure system and railroads. On the other, by employing micro-level data, I have been able to measure the impact of colonial activities at a sub-district level, which allows one to appreciate relationships and mechanisms that cannot be captured through the district level analysis performed by other authors. In fact, district level analysis cannot accurately describe the impact that colonial investments had locally on population distribution patterns, and on inequalities in living standards. As opposed to a district level analysis, my analysis allowed comparison within a district between different zones,

[188] Bleakley, H., & Lin, J. 'Portage…*Op. Cit.*

and showed that inequalities are observable close to colonial facilities, regardless of the administrative area in which they fall. By doing this, my work noticeably enlarges our understanding of the relationship between colonial experience and development.

My research also added to the body of qualitative literature that looks at the Italian activities in Eritrea, Somalia and Ethiopia. By looking at several primary sources, this research provided new evidence on Italian colonial public investment in the Horn of Africa and accurately described the process of road building, and the creation of schools and hospitals. Moreover, as opposed to the argument of several contributions, this study also demonstrated that despite the relatively short duration of the occupation, the Italian colonial experience did affect, economically and in the long term, Eritrea, Somalia and Ethiopia. Specifically, if one looks at the long-term effect of colonial infrastructure and facilities, this research pointed out that their effect was significantly positive at a sub-district level.

Additional research is necessary in order to extend the validity of my results to other sub-Saharan countries. This would mean to create a larger geo-referenced dataset by matching historical data on colonial investments to contemporary micro-level data and would involve challenging work on primary sources in order to collect data on colonial investments over time across areas dominated by different colonial powers. This could not only extend the validity of the results obtained from my case study, but it would also allow one to put the analysis in a comparative perspective and in this way it would allow to appreciate the differences between the various European colonial policies.

This said, given the consistency of my results with other contributions that look, for instance, at the long-term impact of transportation infrastructure in Kenya[189] and Ghana[190] and at the district-level impact of colonial investments in human capital in French West Africa[191] and

[189] Jedwab, R. and Moradi, A., 'Transportation…*Op. Cit.*
[190] Jedwab, R. and Moradi, A., 'Transportation Infrastructure and Development in Ghana',2011)
[191] Huillery, E., 'History matters…*Op. Cit.*

Madagascar[192], I am convinced that the mechanisms pinpointed in the example of the Italian colonies are representative of a more general pattern. In fact, since the empirical analysis underscored the theory that lies behind the emergence and persistence of the effect of colonial investment, it is possible to predict that, in similar conditions, the relationship between colonial investment and long-term development would be the same also in other colonial contexts.

[192] Wietzke, Frank-Borge. "Long-Term Consequences…*Op. Cit.*

APPENDIX

TABLE A1. ADDITIONAL SET OF ROBUSTNESS CHECKS FOR TABLE 2.2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent: population density in 1940 where not differently specified	BASELINE	POP. DENS. 1930	excluding cities	REDUCED <200km	REDUCED <100km	Provincial FE	State FE
Dummy <20km from a colonial paved road	**0.132*** **	**0.014**	**0.140*** **	**0.117*** **	**0.082** **	**0.063***	**0.220*** **
	(0.043)	(0.067)	(0.043)	(0.041)	(0.033)	(0.036)	(0.078)
Dummy <20km from colonial unpaved road	0.004	0.039	0.007	-0.000	-0.050	-0.003	0.077
	(0.025)	(0.034)	(0.021)	(0.034)	(0.044)	(0.024)	(0.048)
Dummy <20km from a precolonial track	0.005	-0.002	-0.003	0.012	-0.010	-0.009	-0.033
	(0.023)	(0.013)	(0.023)	(0.031)	(0.035)	(0.024)	(0.040)
Standardized values of population density in 1920	0.084	-0.201*	0.074	0.081	0.058	0.054	0.108
	(0.056)	(0.117)	(0.047)	(0.054)	(0.035)	(0.038)	(0.087)
Standardized values of population density in 1930	0.068		0.058	0.065	0.043	0.038	0.091
	(0.057)		(0.049)	(0.055)	(0.038)	(0.040)	(0.084)
Observations	15,204	15,204	15,048	11,220	6,708	15,204	15,204
R-squared	0.81	0.31	0.83	0.79	0.81	0.84	0.68
Regional FE	YES	YES	YES	YES	YES	NO	NO
Pre-colonial controls	YES	YES	YES	YES	YES	YES	YES
Other colonial controls	YES	YES	YES	YES	YES	YES	YES
Geographical Controls	YES	YES	YES	YES	YES	YES	YES

Note: robust standard errors clustered by colonial provinces (202 'Residenze') in parentheses. The full set of controls from table 2.2 has been added from column 1 to 7. Pre-colonial controls: dummy <20km from precolonial tracks and standardized population density in 1920 and 1930. Other colonial investments: dummy <20km from colonial railroads, dummy<10km from colonial district capital and dummy <10 km from colonial school for natives, dummy <10km from secondary colonial hospitals and clinics, dummy <20km from primary colonial hospital. Geographical and environmental controls: dummy <20km from perennial waterways, rainfall annual average, elevation, malaria rate, FAO land propensity score, latitude, longitude, dummy <10km from contemporary roads, dummy for being in a mineral area, dummy for being within less than 30 km from the coast. In column 1 the baseline regression from table 1 is reported, in column 2 population density in 1930 is employed as dependent variable. In column 3 cells with population density higher than 50 in 1940 are excluded, proxying for towns. In column 4 and 5 the sample is reduced to cells within 200 and 100km from colonial paved roads respectively. In columns 6 and 7 provincial fixed effects (202 residenze) and state fixed effects (6 governi) are added respectively. *** p<0.01, ** p<0.05, * p<0.1.

TABLE A2. ADDITIONAL ROBUSTNESS CHECKS FOR TABLE 2.3

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	BASELINE	< 200km	<100km	Province FE	State FE	Ethnic FE
Dummy <20km from a colonial paved road	**0.130*** **	**0.115** **	**0.099** **	**0.131** **	**0.104***	**0.086**
	(0.048)	(0.050)	(0.050)	(0.054)	(0.063)	(0.055)
Dummy <20km from colonial unpaved road	0.122**	0.133**	0.144**	0.110**	0.150**	0.120*
	(0.048)	(0.067)	(0.072)	(0.047)	(0.072)	(0.062)
Dummy <20km from a precolonial track	0.100***	0.126***	0.116***	0.110***	0.111***	0.109***
	(0.026)	(0.033)	(0.033)	(0.028)	(0.038)	(0.028)
Standardized values of population density in 1920	0.109***	0.107***	0.095***	0.138***	0.172***	0.163***
	(0.037)	(0.037)	(0.031)	(0.009)	(0.023)	(0.015)
Standardized values of population density in 1930	-0.055	-0.057	-0.069**	-0.029***	0.004	-0.006
	(0.039)	(0.038)	(0.031)	(0.009)	(0.024)	(0.015)
Observations	15,204	11,220	6,708	15,204	15,204	15,204
R-squared	0.28	0.27	0.25	0.30	0.20	0.25
Regional FE	YES	YES	YES	NO	NO	NO
Pre-colonial controls	YES	YES	YES	YES	YES	YES
Other colonial investments	YES	YES	YES	YES	YES	YES
Geographical Controls	YES	YES	YES	YES	YES	YES

Note: robust standard errors clustered by colonial provinces (202 'Residenze') in parentheses. The full set of controls from table 2.3 has been added from column 1 to 6. Pre-colonial controls: dummy <20km from precolonial tracks and standardized population density in 1920 and 1930. Other colonial investments: dummy <20km from colonial railroads, dummy<10km from colonial district capital and dummy <10 km from colonial school for natives, dummy <10km from secondary colonial hospitals and clinics, dummy <20km from primary colonial hospital. Geographical and environmental controls: dummy <20km from perennial waterways, rainfall annual average, elevation, malaria rate, FAO land propensity score, latitude, longitude, dummy <10km from contemporary roads, dummy for being in a mineral area, dummy for being within less than 30 km from the coast. In column 1 the baseline regression from table 1 is reported, in columns 2 and 3 the sample is reduced to cells within 200 and 100km from a colonial paved road respectively. In columns 5, 6 and 7 provincial fixed effects (202 residenze), state fixed effects (6 governi) and ethnic fixed effects are added respectively. *** p<0.01, ** p<0.05, * p<0.1.

TABLE A3. LOCATION OF COLONIAL FACILITIES

		Primary hospitals	Secondary Hospitals	Colonial Schools
Regions placed to more than	Freq	2	103	17
20 km colonial roads	(Percent)	(11.76)	(51.76)	(21.52)
Regions placed within 20 km	Freq	**15**	**96**	**62**
colonial roads	(Percent)	**(88.24)**	**(48.24)**	**(78.48)**
		17	199	79

TABLE A4. Additional robustness checks for tables 3.2, 3.3 and 3.4.

	(1)	(2)	(3)	(4)	(5)	(6)
	BMI	BMI	Able to read YES/NO	Able to read YES/NO	Sanitary card YES/NO	Sanitary card YES/NO
Dummy <5km from a colonial school for natives		0.381**		0.0739**		
		(0.157)		(0.0318)		
Log distance from colonial school for natives	-0.159**		-0.0416***			
	(0.0697)		(0.0125)			
Dummy <5km from a colonial secondary hospital						0.0804***
						(0.0304)
Log distance from colonial secondary hospital					-0.0476***	
					(0.0113)	
Observations	15,281	15,281	15,226	15,226	10,130	10,130
R-squared	0.169	0.169	n	n	n	n
Regional FE	YES	YES	YES	YES	YES	YES
Precolonial Controls	YES	YES	YES	YES	YES	YES
Colonial Controls	YES	YES	YES	YES	YES	YES
Individual Controls	YES	YES	YES	YES	YES	YES
Baseline Controls	YES	YES	YES	YES	YES	YES

Alternative distance measures for the dependent variables. In columns 1 to 4 I am employing the female respondents dataset. In columns 1 and 2 I use logarithmic distance from colonial schools for blacks and a dummy for being within 5km from a school, respectively. BMI is the dependent variable. In columns 3 and 4 I employ the same dependent variables, but I have can/cannot read as dependent dummy variable. In columns 5 and 6 I employ the children dataset. In column 5 I use the logarithmic distance from secondary colonial hospitals, whereas in column 6 I use a dummy for being within 5km froma secondary sanitary hospital. In columns 1 to 4 the set of controls is the same as in table 3.2, in columns 5 and 6, the controls are the same as in table 3.4. Clustered standard errors at a DHS cluster level from columns 1 to 6. Colonial regional fixed effects from columns 1 to 6. *** p<0.01, ** p<0.05, * p<0.1

TABLE A5. Additional robustness checks for tables 3.2, 3.3 and 3.4

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	LOG BMI	Female Body Mass Index	Able to read YES/NO	Female Body Mass Index	Able to read YES/NO	Able to read YES/NO	Sanitary Card YES/NO	Sanitary Card YES/NO
Dummy < 10km from a colonial school for natives	**0.0238*** **	**0.589*** **	**0.101*** **	**0.477** **	**0.0964** **	**0.105*** **		
	(0.00863)	(0.219)	(0.0337)	(0.229)	(0.0381)	(0.0398)		
Dummy <10 km from a secondary colonial hospital	-0.00777*	-0.160	0.0613**	-0.190**	0.0638**	0.0665**	**0.0925*** **	**0.0939** **
	(0.00459)	(0.106)	(0.0261)	(0.0944)	(0.0256)	(0.0262)	(0.0277)	(0.0391)
Dummy <20km from a precolonial track	-0.000515	-0.0477	-0.0157	-0.0586	-0.00908	-0.00838	0.0143	0.0511**
	(0.00454)	(0.0920)	(0.0347)	(0.0980)	(0.0260)	(0.0269)	(0.0216)	(0.0214)
popd_1920	0.00524***	0.115**	0.000756	0.127***	-0.00438	-0.00378	-0.00132	0.00253
	(0.00202)	(0.0444)	(0.0130)	(0.0449)	(0.0105)	(0.0109)	(0.00989)	(0.00981)
popd_1930	-0.00466**	-0.102**	-0.00143	-0.115***	0.00310	0.00281	0.00245	-0.00136
	(0.00191)	(0.0419)	(0.0124)	(0.0424)	(0.00999)	(0.0103)	(0.00958)	(0.00937)
Dummy <20km from a colonial railroad	0.0363***	0.813***	-0.0587			-0.0634	0.00398	
	(0.0136)	(0.244)	(0.0662)			(0.0814)	(0.0999)	
Dummy <20km from a colonial paved road	-0.00500	-0.0816	0.0607*			0.0530*	0.102***	
	(0.00591)	(0.141)	(0.0352)			(0.0321)	(0.0321)	
Dummy <20km from colonial unpaved road	-0.0117**	-0.263**	-0.00328			-0.00675	-0.00270	
	(0.00590)	(0.110)	(0.0280)			(0.0254)	(0.0360)	
Dummy <20 km from primary colonial hospital	-0.00761	-0.202	-0.0393			-0.0323	0.163***	
	(0.0116)	(0.234)	(0.0700)			(0.0649)	(0.0627)	
Dummy < 20km from a colonial school for natives							-0.0470**	
							(0.0217)	
Dummy <10 km from colonial district capital	0.000425	-0.0130	0.0265	-0.0351	0.0241	0.0208		-0.0482
	(0.00622)	(0.127)	(0.0376)	(0.141)	(0.0318)	(0.0327)		(0.0374)
Dummy <10km from colonial railroad line				0.612**	-0.0301			0.164**
				(0.276)	(0.0693)			(0.0659)
Dummy <10km from colonial paved road				-0.0427	0.0385			0.00253
				(0.137)	(0.0285)			(0.0263)
Dummy <10km from colonial unpaved road				-0.239	-0.0581**			0.00569
				(0.152)	(0.0254)			(0.0363)
Dummy <10km from colonial primary hospital				0.126	2.49e-06			-0.0239
				(0.234)	(0.0416)			(0.0470)
Dummy <10km from colonial school for natives								0.120**
								(0.0512)
Observations	15,281	15,281	15,226	15,281	15,226	15,226	10,130	10,130
R-squared	0.174	0.170	n	0.169	n	n	n	n
Regional FE	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
Individual Controls	YES	YES	YES	YES	YES	YES	YES	YES
Baseline Controls	YES	YES	YES	YES	YES	YES	YES	YES

In columns 1 to 6, I am employing the female respondents DHS dataset, while in columns 7 and 8. In column 1 I am replicating column 5 of table 3.3 using log BMI instead of the linear measure. In columns 2 and 3 I am clustering for colonial regional district the standard errors of columns 5 from tables 3.3 and 3.2 respectively. In columns 4 and 5 I am replicating the restricted model of tables 3.3 ad 3.2 but with all cutoffs at 10km from colonial investments. In column 6 I am excluding women's fertility from the controls. In column 7 I clustered the standard errors by colonial regional districts, while in column 8 I replicate column 6 from table 3.4 with all the cutoffs at 10km for colonial investments. Colonial regional fixed eefcts from column 1 to 8. For columns 1 to 6 the full set of controls is the same as in tables 3.2 and 3.3, while for columns 7 and 8 the controls are the same as in table 3.4. *** p<0.01, ** p<0.05, * p<0.1

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