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*Latifundia* Revisited. Market Power, Land Inequality  
and Efficiency in Interwar Italian Agriculture

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**Abstract**

This paper explores a simple though neglected mechanism linking land inequality and inefficiency: market power. In underdeveloped economies with serious constraints on labour mobility, high ownership concentration will endow landowners with market power in local labour markets. The resulting equilibrium explains many of the often criticised features of pre-war Italian latifundia, without the need to factor in irrational behaviour (the preferred explanation of Italian traditional historians) or social institutions and capital market imperfections (explanations advanced by economists in different contexts). According to the model here explored the main effects of inequality are of a distributive rather than of a productive nature. The market power hypothesis is strongly supported by the available quantitative evidence provided by an unexploited dataset on all local labour markets of Italy at the end of the 1930s.

JEL codes: J42, J43, N54, O13, Q15

**Keywords:** Monopsony, Agricultural labour markets, Land distribution, Inequality, Italy

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## 1. INTRODUCTION

Land inequality is increasingly regarded as a key factor in the shaping of the development process, but there is by no means consensus on why exactly it matters. While the effect of land inequality on economic performance is usually regarded as negative, scholars too often rely on extra-economic mechanisms. In this paper landownership inequality is found to be a source of inefficiency through a straightforward and purely economic mechanism: market power. The most basic form of market imperfection, market power has been neglected by the literature on land inequality, partly because of the formidable measurement problems which it presents. Yet it may prove to have extraordinary explanatory power in addressing the unsettled question of *latifundia* in Italian pre-WWII agriculture, which, thanks to an unusually detailed database (used here for the first time in scholarly research), will constitute the field for testing the hypothesis. The mechanism explored in this paper has the virtue of being simple, easily relatable to almost any channels already proposed (either in the static form of capital market failures or in the long run dynamic form of rent-extractive institutions) and, last but not least, unambiguously testable, provided the required data is available.

The core hypothesis proposed here is that market power in local rural labour markets may emerge in areas where there is a high concentration of land ownership. Factor markets are confined to relatively local dimensions if there are economic or institutional barriers to free mobility of productive factors. In such contexts, a high concentration of non-reproducible assets (such as land) will result in their owners being relevant agents in the considered market. As a consequence, their economic decisions will have an impact on the resulting market equilibrium. Such agents will not be price-taking, they will be aware of the fact and they will act accordingly. In such cases, landowners will have an incentive to demand less labour than those in competitive markets. Productive inefficiency will emerge in such an economy, but in a general equilibrium approach aggregate welfare losses will be relatively reduced, as foregone employment in the dominant estates will be partially compensated for by increased employment in the non-agricultural sector or in price-taking farms. Nonetheless, the economy will be characterized by strong distributive inefficiencies. Factor allocation among sectors will nonetheless be suboptimal and there will be strong incentives for the landed elite to block the development of the non-agricultural sector. Conversely, in a competitive economy, landowners are price-taking, and thus their productive decisions have no impact on relative factor prices. Asset distribution within one class of factor owners shall not affect income distribution between different classes of factor owners. These facts will provide a clear guidance to test the theory, as far as some predictions derived from theory will

be true in only one of the two considered cases (i.e., competition and inequality causing market power).

The thesis proposed in this paper is that the main source of inefficiency is inequality itself and not operational size. While there is literature which considers market failures as a relevant source of inefficiency in the agricultural sector, they are generally modelled in relation to farm size. This literature can be summarized in two points: firstly, if there are imperfections in capital markets, farmers may be unable to adjust to the optimal operational size; and secondly, if labour markets are incomplete, labour may fail to be optimally allocated across farms. Although different combinations of these market failures are claimed (Barrett et al. 2010, Carter, 1984 and 2000, and Feder, 1985) to be the primary cause of the so-called inverse size-productivity relationship (ISPR), there is no consensus on the existence of the ISPR itself. Other authors (Benjamin, 1995, Lamb 2003) claim that if one controls for land quality, the ISPR significance disappears. In general, the evidence is mixed<sup>1</sup>. Paradoxically, despite the lack of conclusive evidence on the existence of the ISPR itself, there seems to be evidence of a relationship between aggregate inequality and aggregate efficiency. Vollrath (2007) finds a negative relationship between land inequality and agricultural productivity; according to his estimates, market imperfections (and therefore resource misallocations) may also account for most of the productivity differences between agricultural productivity in developed and developing countries. The approach adopted in this paper, implying that the main inefficiency can be found in the factor allocation between sectors and in factor returns, may help to explain the apparent contradiction between the results from aggregate-based and individual-based estimates (the latter being more uncertain than the former). Other approaches consider the negative impact of land inequality through channels other than efficiency in agriculture, notably its effects on long run growth. Deininger and Squire (1998), using the available (but qualitatively limited) data from the FAO's international agricultural census databases, find a negative relationship between land inequality and growth. Nonetheless, the exact channel through which land inequality works is again unclear. The factors proposed include: excessive, which is to say redistributive and growth-inhibiting, taxation (Alesina and Rodrik, 1994, Persson and Tabellini, 1994); insufficient taxation leading to the under-provision of public goods as education (Galor, Moav and Vollrath, 2009); trade policy protecting rent extraction in agriculture (Adamopoulos, 2008); individual underinvestment in education as a consequence of capital market imperfections (Deininger and Squire, 1998); and extractive institutions (Acemoglu and Robinson, 2002 and Engermann and Sokoloff, 2000, both with a very long run perspective). Though there is no need for many of these models to assume imperfect competition, doing so would strengthen their

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<sup>1</sup> See a review in Federico (2005) and, for the prosecution of the debate, Barrett et al. (2010) itself.

conclusions. A recurring argument in the literature is that of the political channel, which proposes that land inequality creates strong incentives for the landed elite to distort optimal policy paths. Although in some cases these incentives are clearly defined and micro-founded, in others they are expressed vaguely, for example in the case of “extractive institutions”. This paper provides evidence of such rent extraction, thereby providing an additional formal and quantified base for the aforementioned arguments.

While economic development, reduction in information and transport costs, and market integration are likely to erode local market power positions, reduced factor mobility is often considered to have been a rather frequent situation in the past, and may still be in areas weakly affected by world economic integration or where authorities deliberately restrict free movements of capital and labour. The local market power model thus seems particularly suited to historical analysis.

The Italian interwar agriculture constitutes an exceptional field for testing the hypothesis. Politically, land distribution was a highly controversial issue and a source of rural distress until the land reform implemented after World War II. Scholarly work reflected this controversy. Traditional historiography considered Southern *latifundia* in a very negative manner. Modern economic history has successfully (and convincingly) criticized the traditional view, which essentially assumed that landowners behaved irrationally. However, modern economic historians have failed to explain the widespread discontent with the issue in the late nineteenth and early twentieth century. A dismissive approach is also inconsistent with economists’ increasing concerns about the role of land inequality. Relying on a market power model, this paper explains many of the features of Italian *latifundia* by the simple use of economic theory and assuming the rational behaviour of agents. Contrary to the traditional Italian historiography, land inequality is not seen as a source of technical inefficiency in agricultural production, but caused important distributive distortions through factor misallocation among sectors. Reduced wages, extensive technical mixes (but not lower TFP), agricultural underemployment and Pigouvian exploitation arise as an equilibrium from the model without the need to introduce restrictive assumptions on agents’ behaviour. Whether land reform is the best means of addressing these issues as against other forms of fostering labour market integration remains an open question, which this paper does not set out to address.

The paper proceeds as follows. In Section 3 I present the historical controversies that surrounded Italian *latifundia* and explain why the particular Italian case at the end of the 1930s is a proper field to test the theory. In Section 4 I briefly present a stylized two-sector closed economy

model, which provides a testable equation for the market power hypothesis and describes the main features of the case. A different equation is also derived from the same model in order to obtain an independent testable research strategy. Finally, the results of the benchmark regressions and various robustness checks are presented and discussed in Section 5. The Appendix A presents the main data and sources used. Land inequality measurement is also discussed. Specifically, I discuss several empirical problems usually neglected by literature and I present an exceptional database, used here for the first time, on land inequality in Italy around the late 30s and early 40s, which is not affected by these problems. The econometric evidence is assembled in the Appendix B.

### 3. LAND INEQUALITY AND THE ITALIAN ECONOMY BEFORE WWII

Land inequality has traditionally been an issue which has stoked political controversy in Italy. Its origins can be traced back to the end of the nineteenth century. *Latifundia*, as the large estates (mainly in Southern Italy) were called, were often at the centre of political projects to improve the conditions of the Southern economy, ranging from state-built roads and irrigation infrastructure to compulsory renting out of estates<sup>2</sup>. These projects were constantly a topic of debate in Italian politics during the first half of the twentieth century, but none of them were significantly implemented. The emergence of unionism and workers' political organizations at the turn of the century led to a qualitative shift in the public debate (Zaninelli, 1971). Workers' demands usually went beyond wage increases. According to a parliamentary inquiry on the conditions of Southern peasantry (Inchiesta Faina 1909), in *latifundia* areas the main concern of rural labourers was seasonal and chronic unemployment, attributed to excessively extensive agriculture. Thus, one of the main aims of workers' agitations during this period was to impose on landowners a minimum level of yearly employment (the so-called *imponibile di mano d'opera*). After WWI the level of social conflict in the countryside dramatically increased, and there was a widespread occupation of allegedly idle land in many *latifundia* during the revolutionary upsurge of 1919-1921. That movement was brought to a violent end with the rise of Fascism in October 1922. In 1935, a project for making compulsory agricultural intensification in some *latifundia* areas was so strongly and successfully contested by large landowners that its reversion caused the political fall of its foremost proponent, the government official for the so-called "integral land-reclamation" Arrigo Serpieri (Orlando, 1984). As soon as WWII ended, social conflict in the countryside, strikes and land

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<sup>2</sup> See Lupo (1990) for a summary of the controversies at the end of the XIX<sup>th</sup> century and Molé (1929) for the persistence over time of many of such analysis and seldom realized proposals.

occupations resumed, until eventually a selective form of land reform took place at the end of the 1940s and the beginning of the 1950s.

Italian traditional historiography reflected the controversy surrounding the historical role of land inequality, but it has nonetheless failed to provide a coherent interpretative benchmark founded in economic concepts and has seldom integrated quantitative evidence into the discussion. The conventional wisdom was stated in its clearest form in the seminal work of the Marxist scholar Emilio Sereni (1977 [1947]). It attributed a central role in the Post-Unitary Italian growth story to large Southern estates. Their landowners' absenteeism was at the root of the chronic underemployment of the labour force in the countryside, the low productivity of the *latifundia* agriculture, and the failure to introduce new crops or new productive techniques. The short-term rent contracts prevented tenants from investing in land improvements. "Pre-capitalistic" and "feudal" survivals pervaded contractual agreements and characterised agents' behaviour. The persistence of sharecropping agreements also reflected the low degree of capitalist development in the Italian countryside (Sereni, 1977 and Giorgetti, 1974 and 1977). Collectively, these factors precluded the introduction of new kinds of rotations allowing for the expansion of livestock and the implementation of mixed husbandry as had been done in North-Western European countries. Only the capitalist farming of the Po Valley was considered "modern" and "advanced", but it was not sufficiently widespread to boost modern economic growth across the country. As a consequence, both agricultural production and agricultural productivity languished, and in turn this damaged industrial growth. Agriculture was thus at the core of both the enduring Italian regional divide and the slow growth rate of the Italian economy prior to the "economic miracle" (1951-1963). In successive years, non-Marxist scholars have stressed that there were further reasons behind Southern Italy's backwardness, but the negative interpretation on the role of *latifundia* and Southern landowners has persisted over time (Toniolo, 1980, and Zamagni, 1993).

In recent decades, a revisionist body of literature on these picture has emerged. First, large landowners' behaviour has been radically reconsidered. Some case studies (Petruszewicz, 1989, Placanica, 1990) stress that, regardless of their social origin (aristocratic or bourgeois), they were acting as profit-maximizing and rational economic agents, especially if one considers that the environmental conditions typical to Southern Italy, for example the lack of rain in summer, largely preclude the implementation of the Po Valley crop mixes (Lupo, 1990, Bevilacqua 1990). Many contractual agreements - once negatively considered by literature - are now seen as satisfactory solutions to specific risk-bearing problems (Galassi and Cohen, 1994 and Cohen and Galassi,



1990)<sup>3</sup>. Secondly, the important quantitative reconstruction of the Italian historical national accounts has substantially shaped scholars' view of Italy's growth<sup>4</sup>. This revision corrected the myriad shortcomings of the traditional ISTAT-Fuà estimate but also provided the basis for national accounts estimates at the regional level in historical perspective, at least for some branches in some benchmark years, thus providing the only serious ground for any discussion on the matter. The main results are as follows: overall GDP growth was somewhat more satisfactory in the fifty post-Unity years than was previously thought (especially thanks to agriculture); there were noticeable, although not radical, differences in industrialization levels between North and South as a whole at the time of Unification (and in the few decades following 1861); agricultural labour productivity was similar (with some Southern regions performing particularly well) until WWI and only started diverging in the interwar years. As differential rates of agricultural TFP growth are likely to have caused this divergence in the agricultural branch (Federico, 2007), determinants of efficiency in agriculture are worth exploring. As a consequence, the GDP divergence between the Northern and the Southern sections of the country is now considered much more of an issue in the first half of the XX<sup>th</sup> century than in the XIX<sup>th</sup>, and it is due at least as much to agriculture as to industry.

Three elements emerge from these developments. Firstly, land inequality has lost its central role in contemporary Italian history. We no longer see *latifundia* as feudal residuals causing the Italian regional divide, but, after the loss of its predominant position in the discourse, land inequality is searching for its place in Italian economic history. Secondly, we have to accommodate this story with the fact that many early twentieth century Italians (observers, politicians, intellectuals and, above all, rural labourers) were really concerned with land inequality (as many present-day economists are) - so concerned in fact, that a land reform was eventually implemented after WWII. Thirdly, the interwar years seem to deserve special attention, much more than previous research, which mainly focused on the 1861-1911 period, has paid. Whatever role land inequality played in Italian agriculture, it is likely that its effects peaked between the wars. Addressing such questions may require that we avoid the approach of traditional historians, i.e. to look for *ad hoc* sociological or psychological explanations about landowners' absenteeism or about their propensity to engage in market transactions.

In this context, the market power hypothesis, fully-rooted in economic theory, may help to fill this gap in Italian economic history. Moreover, beyond the desirable property of data availability, there are reasons for considering the Italian economy at the end of the 1930s as a

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<sup>3</sup> See Cohen and Federico (2001) for a full account of the new trends of the history of Italian agriculture in general and of this brand of revisionist literature in particular.

<sup>4</sup> See Rey (ed.), 1992 and 2000, and different spillovers as Federico, 2003a, 2003b and 2007, Felice, 2005 and Felice, 2011, Ciccarelli and Fenoaltea, 2010).

proper field in which to test the market power hypothesis. The Italian economy was, at that time, a semi-industrialized one. Agriculture still employed 52% of the labour force according to the Population Census of 1936. Despite the fact that a slow process of industrialization had begun some decades earlier and the building of a railroad network had already been completed by the beginning of the twentieth century, the modern sector was mainly confined to few industrial cities in the North-Western part of the country - the so-called industrial triangle with vertices at Milan, Turin and Genoa. In addition to Italy largely qualifying as a developing country before WWII, the country possessed some specific characteristics that are likely to have enhanced landowners' market power. Free unionism had been banned in the 1920s by the Fascist dictatorship, and the bargaining power of landowners was consequently enhanced (Cohen, 1976). Industry was severely hit by the crisis, and thus its role as a potential alternative occupation was strongly affected. Industrial employment fell by 22% between 1929 and 1932, and the pre-crisis occupational peak, 1926, was reached again only in 1937 (Zamagni, 1976). The Great Depression and US's restrictive post-WWI immigration policy effectively blocked emigration as an alternative. Gross international migration fell to close to the historical minimum of the WWI years and net migration was actually negative in the late 1930s (ISTAT, 1958). Railroad movement of passengers remained stable throughout the 1920s and 30s (ISTAT, 1968). Mass motorization had not yet started, and where communication was concerned, many *latifundia* areas were poorly connected with the rest of the country (Molè, 1929). Land inequality may itself be a barrier to migration in a context of diffused rural poverty and credit constraints. Aside from the economic and structural features of the Italian economy, the Fascist regime implemented allegedly "ruralist" policies and tried to push people to the countryside<sup>5</sup>, trying to avoid free internal migrations and "urbanism". Along with other minor regulations enacted during the 1930s, migration from one province to another in search of an occupation required official authorization (1931) and migration to municipalities of more than 25,000 inhabitants was virtually prohibited (1939).

Thus, the institutional and economic shock to which the Italian economy was subjected in the interwar years constitutes a natural experiment that allows us to test whether or not land ownership inequality leads to market power in the context of low mobility of labour and weakly integrated internal labour markets. This approach, moreover, will help to shed light on the role played by land inequality in Italian development during this period, an issue so keenly debated by Italian historians.

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<sup>5</sup> See Treves (1976). Despite the fact that the effectiveness of such policies may have been mixed, it substantially increased the cost of internal migration and was deemed as "a sort of new feudalism" by the leading liberal economist (and later president of the Italian Republic) Luigi Einaudi.

#### 4. ANALYTICAL FRAMEWORK: LAND INEQUALITY AND MARKET POWER

This section introduces an analytical benchmark to cope with land inequality and market power, and derives a testable equation from that benchmark.

As noted in the introduction, the main hypothesis to be tested here is that, if factor markets are relatively local, a high concentration of land ownership may endow landowners with market power. This means that as a consequence of landowners being relevant agents in factor markets, factor prices will be affected by their factor demand and supply decisions. For illustrative purposes, the main features characterizing such a situation can be described by a simple model of monopsony in the labour market. This is admittedly the extreme case of market power; far from being a common situation, it constitutes the upper bound to which extreme land inequality can tend. Perfect competition is the lower bound. For analytical purposes, comparing the two extremes will prove useful.

Let us start with a very stylized two-sector economy. Sector A is agriculture and sector B is non-agriculture. Assume each sector has a simple Cobb-Douglas production function with a single output and let us consider the relative output prices exogenously fixed by international trade and normalized to 1.

$$Y_A = F_A(T_A, L_A, K_A, E_A) = E_A T_A^\alpha L_A^\beta K_A^\gamma \quad (1)$$

$$Y_B = F_B(L_B, K_B, E_B) = E_B L_B^\eta K_B^\theta \quad (2)$$

$Y_A$  and  $Y_B$  are, respectively, the output levels of the agricultural and non-agricultural sectors.  $E_A$  and  $E_B$  measure technology and other scaling factors, such as environment in the case of agriculture.  $T_A$  is the total amount of land in the economy, totally devoted to agricultural production.  $L_A$  and  $L_B$  are the labour inputs allocated in the agricultural and in the non-agricultural sector respectively.  $K_A$  and  $K_B$  are the capital inputs (considered fixed and sector-specific) in agriculture and in non-agriculture. The total endowment of each factor is exogenously given. In competitive equilibrium, agents maximize output and the full use of resources is granted. Workers can move freely between agriculture and non-agriculture, and the same wage rate  $w$  is paid in the two sectors. The competitive equilibrium solution to such a system is given by the standard first order equations that maximize profits in the two sectors and by the factor markets clearing conditions.

In the standard framework of monopsony in the labour market, a single landowner owns all the land in the economy. Thus he is the single employer in agriculture and is a relevant employer in the whole economy, which is to say that his employment decisions have a significant impact on the

wage rate paid in the whole economy. As a consequence, he faces the maximization problem in which the wage rate represents the inverse labour supply to agriculture; i.e. the landowner faces the problem of maximizing  $Y_A - RT_A - w(L_A)L_A - rK_A$  with respect to  $T_A$ ,  $L_A$  and  $K_A$  (where  $R$ ,  $w(L_A)$  and  $r$  are respectively unitary rent, wage and capital return rates).

The usual first order conditions, together with the market clearing ones, define the equilibrium in this economy. The demand for agricultural labour is implicitly given by:

$$\frac{\partial F_A}{\partial L_A} = \beta E_A T_A^\alpha L_A^{\beta-1} K_A^\gamma = \beta \frac{Y_A}{L_A} = \frac{\partial w}{\partial L_A} L_A + w = \left[ \frac{(1+\varepsilon)}{\varepsilon} \right] w \quad (3)$$

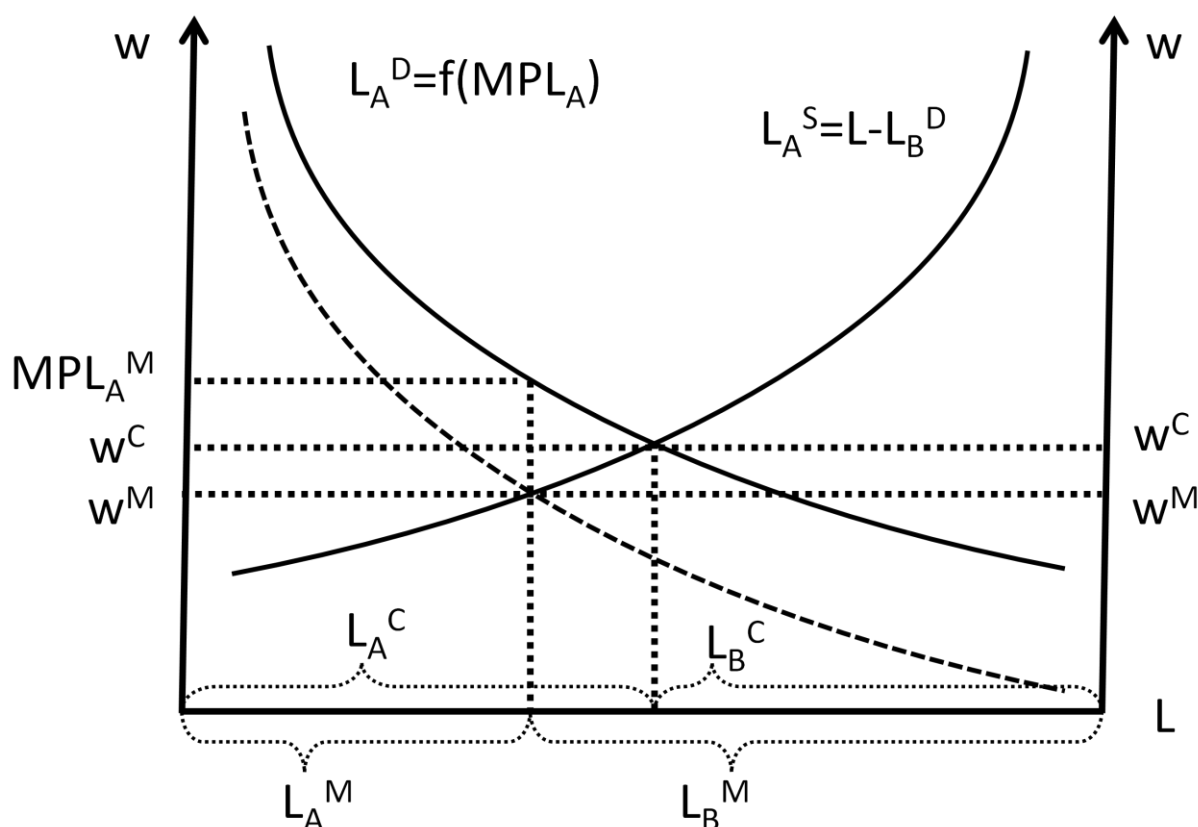
where  $\varepsilon = (\partial L_A / L_A) / (\partial w / w) > 0$  is the elasticity of the labour supply curve with respect to wage. The labour supply to agriculture is  $L_A^S = L - L_B^D = g(w)$ . At any given wage rate, the amount of labour supplied to agriculture is what is left after the non-agricultural demand for labour (given by the marginal product of labour in non-agriculture) is deducted from the total stock of labour. The resulting equilibrium is obviously inefficient because marginal product of labour does not equalize among sectors, as  $(\partial F_B / \partial L_B) = w$  but  $(\partial F_A / \partial L_A) [\varepsilon / (1+\varepsilon)] = w$ . The landowner demands less labour than he would in the competitive case and the remaining labour is absorbed by the competitive (i.e. wage-taking) non-agricultural sector. Despite the fact that agricultural output is therefore reduced, non-agriculture produces more output than it would in the competitive case. This means that, in a general equilibrium approach, aggregate welfare losses are smaller than a partial equilibrium analysis would suggest, but the distributive effects among factor owners as well as factor allocation among sectors are relevant. The whole situation can be seen graphically in Graph 1, where the superscript ‘‘C’’ and ‘‘M’’ denote the competitive and monopsonistic cases respectively.

It is not only the aggregate output which is lower than in the competitive case. Perhaps more interestingly, the agricultural labour to land ratio (the degree of intensity of agriculture) is lower in the presence of landowners’ market power than it would be in the competitive case. Equilibrium wages are lower, and aggregate welfare is also lower due to deadweight losses. Landowners are better off than in the competitive case, but now workers in both the agricultural and non-agricultural sectors earn lower wages<sup>6</sup>.

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<sup>6</sup> In order to properly interpret this result, consider that the non-agricultural sector can be thought of as an aggregate sector, which includes not only industry but also services and domestic occupations. In this sense, the labour supply to agriculture can also be thought of as capturing the reservation wage of workers.

GRAPH I: LABOUR MARKETS IN A 2-SECTOR ECONOMY. MONOPSONY AND COMPETITION.



These patterns are consistent with many features of the *latifundia* economy often criticised by observers. The resulting equilibrium arises from the rational and optimal choices of both landowners and workers. “Chronic underemployment” is a result of agricultural labour demand over the year being smaller than in the competitive case,  $L_A^C > L_A^M$ . “Extensive agriculture” is a consequence of extensive crop mixes or non-labour intensive technical mixes, demanding less labour per land unit, as  $L_A^C/T > L_A^M/T$ . Diffused “rural poverty” is explained by  $w^C > w^M$ . “Workers exploitation” in the sense of Pigou is a consequence of labour not receiving its marginal product ( $MPL_A^M > w^M$ ). Given the existing asset distribution, the equilibrium is also a result of workers' free choice, so no reductive assumptions on forced labour or similar are necessary. One can think of the non-agriculture sector as also including a competitive fraction of agriculture (i.e. price-taking farm operators), without substantially altering the results.

Landowners are thus able to extract rents from the system (as implied by the underlying reasoning in Acemoglu and Robinson, 2002) and they have strong incentives to obstruct the upward shift in the labour demand curve of the non-agriculture sector, whether through the manipulation of

trade policies (as suggested in Adamopoulos, 2008), or a reduction of the investment in public physical capital (Banerjee and Iyer, 2005) or public human capital (Engerman and Sokoloff, 2000 and Galor et al., 2009, among others). The rent-extraction activity may determine various forms of self-enforcement through the political process or may be determinant in shaping institutions. Nevertheless, these outcomes are not necessary, as inefficiencies arise directly from market equilibrium. Moreover, a situation like the one described by this model is more unstable in democracies than in dictatorships. In democracies, majorities are likely to remove obstacles to factor mobility and accumulation in the competitive sector or even asset redistribution in the event that welfare losses for the majority are huge and evident. This prediction is also consistent with the results found by Deininger and Squire (1998).

A reasonable procedure to test the theory would be to take as many local labour markets as possible and observe if higher concentration of land ownership leads to a systematic departure from the competitive case towards the monopsonistic case. In order to do so, provided there is appropriate data (see section 4 on this point), a testable equation is needed. As far as we observe  $w$  and  $L_A$ , we do not know if such values are due to market inefficiencies or to different MPLs (caused by different stocks of the other factors or by differences in the environmental-technological scalar  $E_A$ ). Demand for agricultural labour depends on the total amount of capital and land, as well as on the sector-specific technical coefficients. Thus, it is not possible to unambiguously estimate (3), as any estimate will always be suspected to be subject to omitted variables bias (as is the case with the ISPR). To avoid this kind of problems I have adopted the following strategy. Consider now that another of the first order conditions (in both the competitive and in the monopsonistic cases), namely the identity between the marginal product of land and its price (the unitary rent), is:

$$\frac{\partial F_A}{\partial T_A} = \alpha E_A T_A^{(\alpha-1)} L_A^\beta K_A^\gamma = \alpha \frac{Y_A}{T_A} = R \quad (4)$$

Dividing (4) by (3) one gets:

$$\frac{\partial F_A / \partial T_A}{\partial F_A / \partial L_A} = \frac{\alpha E_A T_A^{(\alpha-1)} L_A^\beta K_A^\gamma}{\beta E_A T_A^\alpha L_A^{(\beta-1)} K_A^\gamma} = \left(\frac{\alpha}{\beta}\right) \frac{L_A}{T_A} = \left[\frac{\varepsilon}{(1+\varepsilon)}\right] \frac{R}{w} \quad (5)$$

The analogous expression for the competitive case is:

$$\frac{\partial F_A / \partial T_A}{\partial F_A / \partial L_A} = \left(\frac{\alpha}{\beta}\right) \frac{L_A}{T_A} = \frac{R}{w} \quad (6)$$

Equations (5) and (6) are much more tractable than the general solutions to the foregone systems (and require much less data). Their interpretation is straightforward: in equilibrium, relative factor prices are inversely proportional to relative factor intensities. In the case of one sector-specific factor, as is the case of land for agriculture, this is even simpler, since relative prices are expressed in terms of the ratio of agricultural employment to the whole land endowment. Under monopsony, relative prices are systematically shifted against the “monopsonized” factor. Taking logarithms of both sides of (5) and (6) yields:

$$\ln\left(\frac{R}{w}\right) = \ln\left(\frac{\alpha}{\beta}\right) + \ln\left(\frac{L_A}{T_A}\right) + \ln\left[\frac{(1+\varepsilon)}{\varepsilon}\right] \quad (7)$$

$$\ln\left(\frac{R}{w}\right) = \ln\left(\frac{\alpha}{\beta}\right) + \ln\left(\frac{L_A}{T_A}\right) \quad (8)$$

Now, when  $\varepsilon \rightarrow \infty$ ,  $\ln[(1+\varepsilon)/\varepsilon] \rightarrow 0$  and (7)  $\rightarrow$  (8). Conversely, when  $\varepsilon \rightarrow 0$ ,  $\ln[(1+\varepsilon)/\varepsilon] \rightarrow \infty$ . When landowners lose market power, the equilibrium solution tends to the competitive case. In this sense, (8) can be interpreted as a particular case of (7).  $\ln[(1+\varepsilon)/\varepsilon]$  is a positive term which grows monotonically according to the degree of landowners’ market power.

Note that the expressions (7) and (8), as they are expressed in terms of relative prices and factor endowments, are independent of the endowments and prices of the other factors, particularly environment and capital in agriculture. In particular, if markets are competitive and the production function is Cobb-Douglas, (7) is always true irrespective of the amount of capital and the level of technology in any sector. In (8) capital and technology in non-agriculture enters the expression through  $\varepsilon$ : if there is a systematic departure from relative prices due to market power, they have an effect on the size of the departure. Admittedly, (7) and (8) are two limit cases, in which perfect competition and a single landowner operate, respectively. Other employers can be introduced into the market, allowing for more complex interaction, for example a model in which the largest landowners operate as a leader cartel and another set of wage-taker followers exists. Nonetheless, all of these cases lie somewhere in between (7) and (8). What matters here is that if land ownership concentration endows landowners with some degree of market power (i.e. their actions have some impact on market prices), an increase in land ownership concentration will systematically result in a shift of relative factor prices away from their competitive ratio (determined by factor intensity). That is to say there will be a move from the competitive case (8) to the monopsonistic case (7). The point is not so much the magnitude of the shift, but its systematic association with increasing land ownership concentrations.

One may reasonably think that a high concentration of land ownership may endow landowners with market power in the labour market as well as in the land market. Indeed, landowners may act as monopolists renting out their land rather than monopsonists hiring workers in the labour market. A combination of the two situations is also possible. Monopoly in land markets would cause rents to be higher than in a competitive environment (in a symmetric way with respect to the outcome in the monopsonistic labour market), so the rent-wage equilibrium ratio would be shifted upwards, strengthening the effect of monopsony in the labour market. Adding this situation would complicate the model without substantially altering its qualitative predictions. Nonetheless, defining a testable equation in relative rather than in absolute terms helps in bypassing this theoretical simplification. It is indeed a way to capture any shift in relative factor prices caused by market power, whether it is exercised in some cases in the labour market and in others in the land rental market. As far as the main aim of this paper is to verify if land inequality leads to some degree of market power, it is irrelevant here whether it is exercised in labour markets, land markets or a combination of the two. However, Carmona and Rosés (2012) find land markets working rather efficiently in Spain during the first third of the twentieth century, a finding that justifies to focus mainly on the functioning of labour markets.

Hence, in order to investigate whether land inequality actually leads (8) towards (7), the testable equation (9) is obtained:

$$\ln\left(\frac{R}{w}\right) = \ln a + b_1 \ln\left(\frac{L_A}{T_A}\right) + b_2 C + \mathbf{X}'\boldsymbol{\delta} + u \quad (9)$$

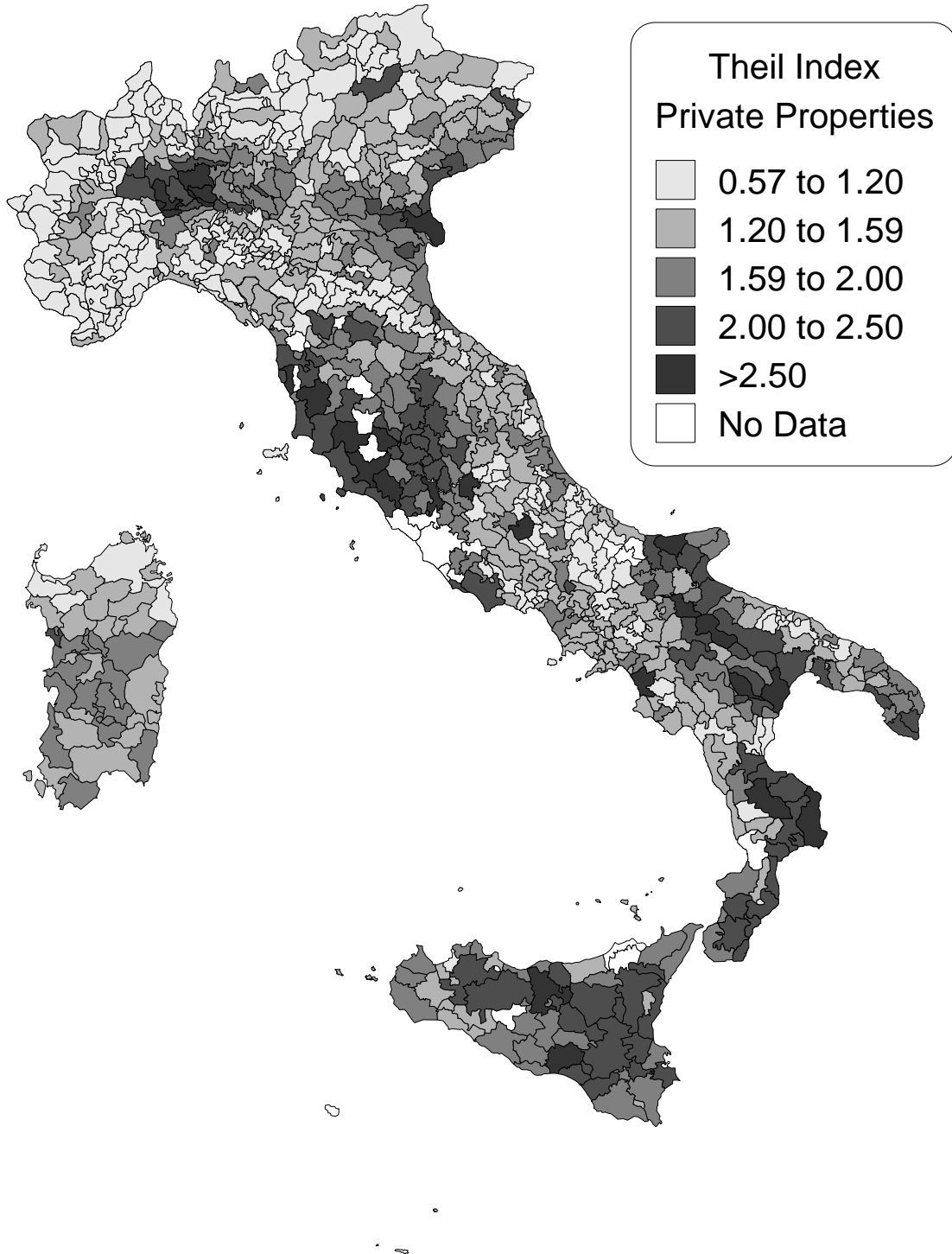
In (9),  $C$  is a measure of land ownership concentration (with a 0 lower bound),  $\mathbf{X}'$  a vector of control variables and  $u$  an i.i.d. error term. In a competitive economy, there is no reason for one factor ownership concentration to shift relative factor prices. Thus, testing whether  $b_2=0$  in (9) allows us to discriminate between the competitive (8) and the market power (7) cases, and hence assess whether land inequality is cause of inefficiencies itself. Moreover, it also seems to be the most interesting factor to test, because as we have seen the more relevant consequences of market power are on distribution rather than on aggregate output levels.

A proper estimate of (9) would necessitate data on the involved variables for as many local labour markets as available. Fortunately, there exists an almost unique dataset for late 1930s Italian agriculture that allows us to test such an equation, taking a cross section of all local rural labour markets of Italy. Before proceeding with the estimates, a measure of land inequality that properly measures landlords' market power is also required. The origin of the data is an Italian official



inquiry, *La distribuzione della proprietà fondiaria in Italia* (1946-1948), which was carried out in the immediate aftermath of WWII. Information about every single owner all over the country was collected with such a detail and satisfying so high quality standards that the inquiry has remained unmatched by any other national dataset on land inequality ever since.

MAP I: VALUE-ADJUSTED LAND INEQUALITY (ECONOMIC RENT INEQUALITY).  
ITALY, 1940 ca.



While the dataset and further methodological points are fully discussed in the appendix, here it may be sufficient to say that it allows to compute value-adjusted landownership concentration indexes (Gini and Theil) at a fine level of disaggregation (i.e. “agrarian zones”, statistical units composed of few municipalities, homogeneous from the agronomic point of view). Landownership distribution is referred to actual ownerships, i.e. it was obtained collating all the plots and farms belonging to the same individual within a given area. Data is available for either private properties and public properties. The dataset covers all Italy and reflects the situation at the eve of WWII. Map 1 shows the results about the preferred measure of landownership concentration, a Theil index obtained from the value-adjusted land distribution of private properties.

With such concentration indexes and some additional data discussed also in the Appendix, it is possible to estimate equation (9). Panel data would obviously be preferable, but the only dataset available is a cross-section, and similar data is not likely to be regularly produced anywhere. Nonetheless, the available data enables us to test the model of market power in disintegrated labour markets previously depicted for Italy at the end of the 1930s.

## 5. REGRESSION ANALYSIS. RESULTS AND DISCUSSION

### 5. 1. *Benchmark analysis*

With the data presented in the previous section and in the Appendix, this section presents several tests of equation (9). We recall that this equation takes the form:

$$\ln\left(\frac{R}{w}\right) = \ln a + b_1 \ln\left(\frac{L_A}{T_A}\right) + b_2 C + \mathbf{X}'\boldsymbol{\delta} + u \quad (9)$$

The unit of observation is the agrarian zone, i.e. a local labour market. A cross section of nearly all local labour markets of Italy is taken as the sample<sup>7</sup>.  $R$ , the unitary rent, is the total rent divided by the total number of agricultural land in an agrarian zone.  $w$  is the yearly wage paid in the agrarian zone, as described in the Appendix (alternative measures of “yearly wage” have been produced with the available data).  $L_A$  and  $T_A$  are labour and land employed in agriculture in a given agrarian zone, respectively.  $C$  is an inequality index measured on the available value-adjusted or

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<sup>7</sup> Some agrarian zones (covering less than 10% of the country) have been excluded due to the occasional unavailability of at least one of the variables, mainly land rents. As these zones are rather equally distributed across the country, this point does not seem to introduce any predictable bias which would affect the significance of these results.

value-unadjusted land distributions. I have thus computed Gini and Theil indexes of any available distribution.

Results are shown in the Appendix B. As data are of cross sectional nature, a key assumption is that the production function is the same over all the units of observations (in this instance, agrarian zones). In a second step of the analysis, this assumption can be relaxed in order to ensure that results are not driven by differences in technology - through differences in  $\alpha$  and  $\beta$  in (8) - and in order to control for differences in the determinants of  $\varepsilon$ . The robustness of the results to such controls will be discussed. Additional data will be then presented and reported in the Appendix.

The simplest regressions (tables 3 and 4) suggest that land ownership concentration has a statistically significant explicative power in factor-price regressions, confirming the predictions of the monopsony model. The results do not depend on the particular measure of land inequality involved: the coefficients of both the Theil and the Gini indexes are statistically significant and have a positive sign (an increase in land inequality systematically shifts relative prices in favour of landowners). These results stress the importance of matching some usually neglected standards when measuring land inequality. Firstly, if value-adjusted land inequality is not considered, there is a key difference between private and public ownership. Unadjusted private land-size inequality is significant and has the same (positive) sign of value-adjusted inequality (whether private and total). When public ownerships (usually large woodlands yielding low unitary rents in mountainous areas) are merged with private properties into an unadjusted size-inequality index, the resulting coefficients are significant but turn out to be of negative sign. When a control for the share of public land is included, the coefficient turns again to be positive and significant. If inequality is computed over the value-adjusted distribution, the odd effect of large public properties is taken into account and the coefficient yields the expected sign. Public land share has a negative effect even when it is included as a control along with measures of concentration of value-adjusted private ownerships. This suggests that access to public land reduces landowners' market power<sup>8</sup>. Results do not depend on any of the available alternative definitions of wages or of labour force (table 5)<sup>9</sup>.

A reasonable caveat to the use of the OLS estimator can be raised: the relative factor allocation may be jointly determined with relative factor prices, and thus the logarithm of the agricultural labour to land ratio may be an endogenous variable. Relative prices may be caused by factor allocation, but factor allocation may also be caused by factor prices. A standard procedure in

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<sup>8</sup> In tables from 5 to 8 land inequality is measured by a Theil index for private ownerships, the natural benchmark when studying landowners market power. Nonetheless, a control for public land is also usually included.

<sup>9</sup> Thus, tables 6 to 8 show only the results for adjusted labour force and weighted wages, though they are very similar to any other combination of variables' definition.

such cases is to use lagged values of the variable suspected of endogeneity in an instrumental variables approach. The amount of agricultural land in a given agrarian zone is reasonably assumed to be exogenous; employment in agriculture in 1936 is potentially the problematic variable. In order to further reduce the potential correlation of factor intensity with the error term, the total population density in 1931, rather than agricultural employment in 1931 is used as an instrument. This was surely not determined by relative factor prices in agriculture in 1938. In 1931, population to a large extent determined how many people were available for agricultural work a few years later, while the exact allocation of labour between agriculture and other sectors (as well as factor prices) were determined in that subsequent period. Indeed, this instrument is always statistically significant in the first stage of the IV regressions, ruling out the possibility of an irrelevant instrument<sup>10</sup>. IV results (table 5), while correcting upwards all the coefficients' estimates (biased in OLS), confirm the sign and statistical significance of the three variables included, particularly land inequality, which is of primary interest here.

## 5.2. Robustness checks

Up to this point, land inequality has the predicted effect in every simple specification analyzed. In tables 3 to 5 it is assumed that the underlying production function is Cobb-Douglas and that this is the same across all agrarian zones. This may not necessarily be true, and differences in the technical coefficients ( $\alpha$  and  $\beta$ ) across the country may capture the effect of land inequality. Land inequality, although measured using a relatively reliable source, may not reflect landowners' market power properly if there were many employment opportunities outside agriculture. Even if landowners had market power, differences in the economic environment may lead to differences in  $\varepsilon$ , thus affecting the magnitude of the market power effect. For these reasons, some robustness checks have been introduced in order to look for the cause of a potentially spurious effect of land inequality in the first set of regressions.

First, (table 6, col. 2) some regional dummies are introduced<sup>11</sup>. Though many of them are significant, and despite their generally having positive coefficients, the land inequality coefficient continues to be statistically significant. In table 6, col. 3, an additional set of controls of a socio-economic nature is included. First, it is possible that land inequality is reflecting scale effects. One may also suspect that high land-values, possibly caused by high soil-qualities, lead to high value-adjusted inequalities, and that the shift in relative prices simply reflects this effect, despite theory

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<sup>10</sup> The residuals of the first stage are also statistically significant when included in an OLS estimate of the structural equation, suggesting endogeneity and, thus, the need for an IV approach.

<sup>11</sup> The regions of Umbria and Marche are the control variables.

suggesting that differences in quality may be counterbalanced by adjustments in the intensity of use of the labour factor. Nevertheless, it is preferable to control for this possibility. Moreover, zones with ownerships of higher value may have easier access to capital. Although the amount of agricultural capital may not affect the price of land relative to that of labour if the production function is Cobb-Douglas (see equation 5), this may be the case if the production function is of a different type. Thus, the average rent per private property<sup>12</sup> is included as an explicative variable. Second, landowners may have not managed the land they owned. It seems reasonable to control for potential biases associated to cases in which the main economic decision maker of the production process is not the owner<sup>13</sup>, whether they are due to moral hazard, shifts in the optimal crop choice, biases in the optimal incentive structure or any other concern raised by the literature on contracts. Thus, the share of sharecroppers and of tenant holders on the agricultural population (as reported by the 1936 Population Census) are both included. Third, since 1925 the fascist regime had been waging the sensationally titled “battle for grain”. This was a policy agenda aimed at attaining self-sufficiency in wheat production, through increases in import tariffs, production subsidies, making it easier to secure credit, and stimulating mechanization and biological innovations<sup>14</sup>. As a consequence, output prices were severely distorted. Though in equilibrium factor prices and factor allocation may have adjusted to such changes, it is likely that at the end of the thirties they had not yet done so, especially if barriers to labour reallocation across Italy are taken into account. Thus, landowners from wheat-growing areas or from areas particularly suited for wheat growing are expected to have perceived a kind of wheat-premium, which may have shifted upwards the rent-to-wage ratio in these areas. As wheat was one of the main mechanized crops of the period, controlling for wheat production may also enable us to further control for the capital stock in agriculture (together with the average value of ownership). Thus, both the share of agricultural land devoted to wheat production and the wheat yield in 1936<sup>15</sup> are included as controls. Fourth, it is necessary to control for the availability of alternative employments outside of agriculture, in order to better approximate landowners’ market power through land ownership concentration. Thus, the share of non agricultural employment in 1936 is included.

Most of the coefficients of such control variables are significant (table 6, col. 4) and of the expected sign (as wheat share and wheat yield); some are revealing (in the case of the negative and statistically significant coefficient of sharecropping, or the positive and significant sign of the

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<sup>12</sup> We should recall that the average rent per property in a single agrarian zone is equivalent to the average size multiplied (and, thus, corrected) by the average rent per hectare. It is a measure of the economic size of the average ownership.

<sup>13</sup> Though Cohen and Galassi (1990) claim that some of them, namely sharecropping, are unlikely to have had large impacts on productivity differentials across Italian regions at the beginning of the twentieth century.

<sup>14</sup> See Cohen (1976).

<sup>15</sup> This is the closest year for which such data is available at agrarian zone level. The source is De Vergottini (1938).

average rent per ownership) and others are puzzling (in the case of non agricultural employment). However, none of these socio-economic control variables, estimated together with regional dummies, affected the statistical significance of land inequality, though the magnitude of its coefficient was reduced.

Although the physical quality of the terrain should be captured by rents, it is possible that other physical variables, not ownership-specific, are driving the results. Practically, the more relevant variable with such characteristics is the rainfall regime, including rainfall shocks during the considered period. This may be the case if, for example, there is some relationship between certain patterns of land distribution and environmental shocks or between land values in 1937-1939 and an environmental shock in the same period: the attributed role of land inequality can, in such a case, capture the effect of such shocks. In order to better control for a potential interaction with any other variable (especially land inequality), I looked for environmental data which referred to the same benchmark period as rents were computed and to which land inequality refers (the late 1930s). With more than 400,000 observations registered between 1936 and 1939, the rainfall regime all over Italy has been reconstructed (see the Appendix for further details). Despite the inclusion of such a detailed dataset on the subject, the coefficient of land inequality is persistently positive and statistically significant.

Finally, a further control is implemented. It could be suggested that the results may not be relevant because the unit of observations (agrarian zones) do not correspond to the relevant labour market faced by economic agents. An agrarian zone may have had highly concentrated land ownership, but it may have been very small and the neighbouring zones may have had a highly competitive labour market. Labour mobility may have been reduced across the country, but it may have not been nil between bordering agrarian zones. In such a case, statistical results presented up to this point may be spurious. In order to explore this possibility, the relevant labour market considered is widened from the original agrarian zone level to a set of neighbouring agrarian zones, in order to allow for commutation of labour force between zones. The relevant labour market for an individual living in a given agrarian zone is defined as the set of agrarian zones whose gravity centre<sup>16</sup> was situated no further than 50 km from the agrarian zone's own gravity centre (different thresholds, from 25 to 75 km, have been considered without changing the main results). 50km is slightly longer than the distance which an individual can walk and return in a single working day. It defines a circle of 100 km diameter around the centre of each agrarian zone. Due to the

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<sup>16</sup> Defined as the latitude-longitude coordinates obtained as a municipality-weighted mean. Municipality center coordinates in 1929, estimated by the Geographic Military Institute, were published in the provincial volumes of the Agrarian Cadastre. When computing distances, the system of coordinates has been corrected in order to account for the curvature of the Earth.

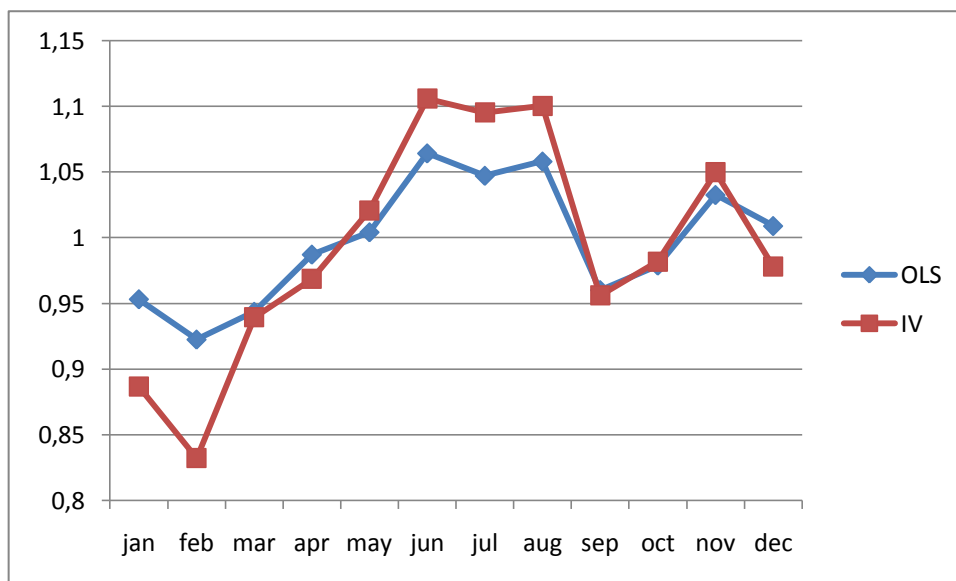
decomposability properties of the Theil index, the actual land inequality (and not simply a weighted average) for every relevant market relative to every agrarian zone can be computed. All the other variables have been computed as weighted averages, taking agricultural employment, agricultural land or the number of observations as weights, depending on the nature of the variable considered.

Table 7 shows that the effects of land ownership inequality persist when the relevant market is considered. Table 8 shows the definitive results, with all available controls included. Additional environmental variables have also been considered, such as the average altitude, the average spread in altitude levels within the considered unit of analysis and a proxy for the average slope of the terrain. For comparison, the results at agrarian zone level are also included (columns 1 to 3), as well as OLS estimates (columns 1 and 4). The results we see are as follows. First, more environmental variables are statistically significant in the relevant market case, estimating (9) both through OLS and through IV. This suggests that climatic observations at single points may not properly reflect the climatic conditions of the surrounding area, but also that an area's environment can be better captured taking into account the information of neighbouring points. Second, some variables revert to the expected sign (such as the negative coefficient of employment in non-agriculture, despite it not being significant) or appear to be significant, as intuition would suggest they should be, for example the negative effect of rain instability in summer on the relative return to land. Third, it can be observed that in equation (9),  $b_1$  is actually a pseudo-coefficient which must equate to 1 if the theory and the specification are correct. Indeed, the coefficient of the log of labour-to-land ratio is of a comparable magnitude in almost all regressions, despite failing to pass a Wald test for  $b_1=1$  in some of those regressions. In the relevant market specification with all available controls, the coefficient of the log of labour-to-land ratio is 1.003, and the null hypothesis of it being statistically equal to 1 cannot be rejected at any conventional level. All these features suggest that the relevant market as previously defined is a more appropriate level of analysis than the agrarian zone. Nonetheless, the explicative power of land ownership concentration remains significant, as predicted. The inclusion of all those controls affects at the magnitude of the land inequality coefficient, rather than at its statistical significance. This is consistent with a situation such as that depicted by equation (7), rather than with (8), confirming the hypothesis of land inequality resulting in landlords' market power.

As an additional control, it is desirable to check the seasonal patterns of market power. If a positive coefficient of land concentration is heavily reliant on the wage levels paid during the off-seasons, claims of spurious correlation could be raised. If large landowners were endowed with market power, one would expect its effect to be particularly strong during the peak season. As far as hourly wages and daily working hours are available on a monthly basis, the regressions of table 8

can be run taking monthly rather than yearly wages as the denominator of the dependent variable. Taking the relevant market specifications as a benchmark (columns 4 to 6 in table 8), the results of the monthly regressions roughly confirm the intuition about seasonality and suggest that it may be possible to rule out any suggestion of a spurious seasonal correlation. In order to keep the paper readable, these results are summarised in graph 2, which includes the information relevant to the present discussion. The graph shows the estimated coefficients of landownership concentration obtained using monthly rather than yearly wages relative to the original coefficients obtained in yearly regressions (i.e., relative to the coefficients of land inequality in column 4 and column 6 of table 8). The numerator of the dependent variable (the rent per hectare) has been divided by 12 in order to convert it into a comparable order of magnitude. The graph shows that the coefficients follow a seasonal pattern consistent with the market power hypothesis, reaching a maximum during the peak season. Such a result is especially notable given the seasonal pattern of wages (rising from January to June and July and then decreasing again) and taking into account that wages constitute the denominator of the dependent variable in the regressions. Thus, the evolution of the land inequality coefficient suggests that the distortive effects of market power on factor prices reached their maximum during the harvest: landowners were more able to avoid or to limit wage increases during the peak season where landownership was highly concentrated.

GRAPH II: SEASONAL PATTERNS OF MARKET POWER



Notes: Ratio of the coefficient estimated in monthly regressions relative to the coefficients of table 8 (column 4 and 6), estimated considering yearly wages.

### 5.3. Strengthening the results: an independent check.



So far land inequality has been shown to be a significant variable in explaining deviations of relative factor prices from its competitive equilibrium levels, a feature consistent with the existence of market power in agricultural labour markets. In this section I implement an additional, independent check in order to verify the explicative power of the monopsony model, in the context of the case at hand. The check is said to be “independent” in the sense that, rather than testing alternative specifications of the same theoretical equation, a different testable equation is derived from the same theoretical model. As far as data are found to validate another prediction of the model, its explicative power is certainly reinforced.

Let us briefly revisit the testing strategy pursued so far. After some manipulation, the simplified two-sector model presented in section 3 yields the following expression:

$$\ln\left(\frac{R}{w}\right) = \ln a + b_1 \ln\left(\frac{L_A}{T_A}\right) + b_2 C + \mathbf{X}'\boldsymbol{\delta} + u \quad (9)$$

In this expression, relative prices are stated in terms of relative factor endowments. The existence of market power has been tested via the impact of land inequality on systematic relative prices shifts (whose direction is stated by the theoretical model), after some controls have been included. However, from the first order conditions for the agricultural sector we can derive a different equation, one in which absolute prices are now stated in terms of average output per worker. In particular, it is worth noting that the competitive and monopsonistic cases are respectively:

$$\frac{\partial F_A}{\partial L_A} = \beta E_A T_A^\alpha L_A^{(\beta-1)} K_A^\gamma = \beta \frac{Y_A}{L_A} = w \quad (10)$$

And

$$\frac{\partial F_A}{\partial L_A} = \beta E_A T_A^\alpha L_A^{(\beta-1)} K_A^\gamma = \beta \frac{Y_A}{L_A} = \frac{\partial w}{\partial L_A} L_A + w = \left[\frac{(1+\varepsilon)}{\varepsilon}\right] w \quad (3)'$$

Again, it is standard to see that expression (3)' collapses to (10) as  $\varepsilon \rightarrow \infty$ . Taking logarithms and rearranging, we obtain:

$$gap = \ln\left(\frac{Y_A}{L_A}\right) - \ln w = -\ln\beta + \ln\left[\frac{(1+\varepsilon)}{\varepsilon}\right] \quad (11)$$

Hence, there is a linear relationship between the average output per worker in the agricultural sector and the equilibrium wage, as stated in (10). This means that, in the presence of market power, land inequality causes a gap between the average product of labour and the ongoing wage rate. The simple intuition behind such a result is that, with diminishing returns to labour and in the presence of monopsony, landowners will stop hiring labour before marginal productivity equals the ongoing wage rate. While in competition marginal productivities (and hence partial labour productivities) equalize wages, in monopsony the former is always greater than the latter. If land inequality endows landowners with market power, the gap between partial productivity and the wage rate will increase as landownership becomes more concentrated. Allowing for the same set of controls considered in the previous section, a further testable equation is thus obtained:

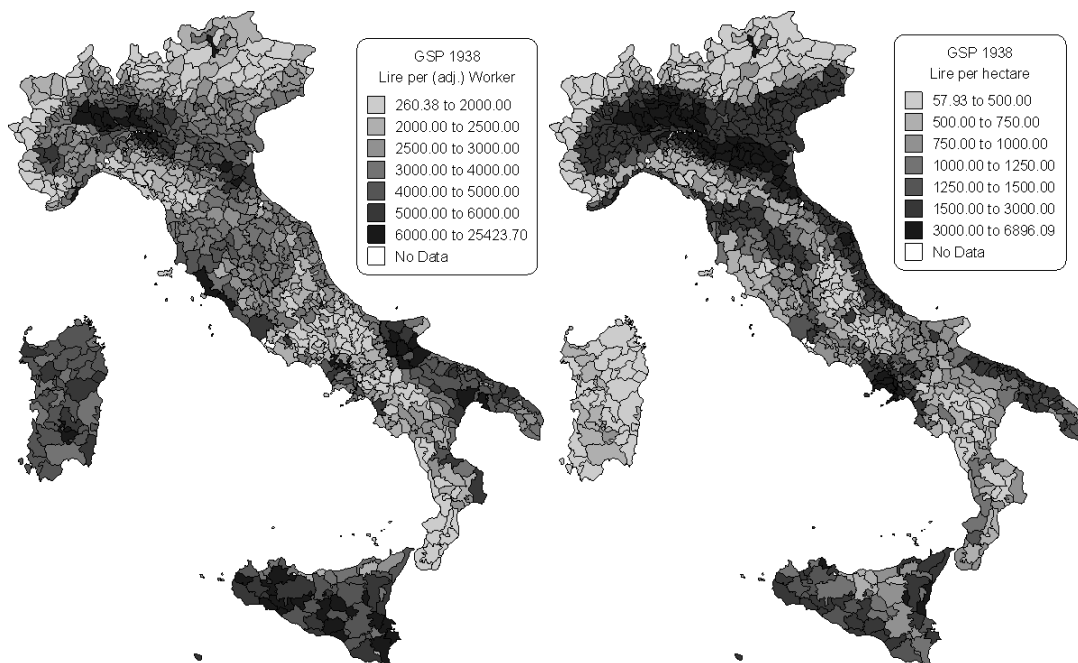
$$gap = \ln\left(\frac{Y_A}{L_A}\right) - \ln w = \alpha + b_3C + \mathbf{x}'\boldsymbol{\delta} + u \quad (12)$$

Whatever specification of the testable equation we consider, what it is worth noting here is that a different equation involving partially different variables has been derived from the same model. While before the research strategy was to test the effect of land inequality on shifts of relative prices given relative factor endowments, now it is possible to test its effects on deviations of the absolute price of one factor (labour) from its average output. Finding statistical evidence for two different (though interrelated) predictions arising from the same theoretical model certainly strengthens the validity of the model itself as a representation of reality.

Data for all variables, with the notable exception of agricultural output per worker, has already been presented. There is not ready made data on agricultural output at agrarian zone level for 1938 (we only have data for the 18 Italian regions from Federico, 2003a), but it is possible to produce a reasonable estimate relying on contemporary official statistics at a provincial level (for 1938) and on a very detailed survey on all kinds of crops and agricultural products carried out in 1929 at agrarian zone level (the Agrarian Cadastre of 1929). I have described elsewhere the details of the estimate, and they require no repetition here (Martinelli, 2012). It is sufficient, for the purposes of this paper, to say that it is an estimate of the gross sealable production at agrarian zone level (net of seeds inputs) valued at 1938 prices and obtained following the procedures outlined in Federico (2000). The results of the estimate, in terms of output per hectare and per worker, are shown in maps 2 and 3. I have included in this estimate 66 products, which account for almost 85% of agricultural gross sealable production as estimated in Federico (2000), the only important

products not yet included in the estimate being poultry and eggs (approximately 7%) and forestry products (approximately 5%). It ought to be stressed that these two groups of products are associated with small-holding production, according to contemporary accounts. If the use of such an incomplete output estimate introduces any bias, it does so against the hypothesis of finding a positive correlation between the output-wage gap and land inequality. If statistical results prove such a correlation to exist, a more complete estimate of output may necessarily strengthen such a correlation.

MAPS 2 AND 3: LABOUR PRODUCTIVITY AND LAND PRODUCTIVITY IN ITALIAN AGRICULTURE (1938)



Equation (12) is tested with the same range of specifications used in estimating equation (9). I have introduced the same controls that were used to estimate the relative prices equation. The results are shown in tables A9 and A10. Again, the coefficient of land inequality is, as predicted by the theory, of positive sign and is statistically significant in all of the available specifications. Higher land inequality causes a wider gap between labour productivity and wages, as predicted by the market power model. In view of the fact that the results in tables A9 and A10 constitute an independent check, they provide substantive support for the results reached in the previous section. We can therefore say that all of the available quantitative evidence, with the variables of interest behaving exactly and significantly as predicted by the model, points towards land inequality causing market power in local labour markets, a causality confirmed by two different ways.

## 6. CONCLUSIONS

Although the issue land inequality is of increasing interest to scholars for its effects on growth and development, an array of explanations have been proposed as mechanisms. In this paper a new channel is explored: the association of land inequality with market power in poorly integrated factor markets of underdeveloped economies. Rent-extraction arises directly from interactions within the economic system and from the decentralized decisions of agents, without the need to assume extractive institutions. This approach allows us to connect the main mechanisms proposed by literature, namely the market failure channel and the institutional channel, by linking a source of static inefficiency with rent-extraction activities. Thanks to an extraordinary database on actual land distribution obtained by collating all plots and farms belonging to the same individual in each local labour market of Italy around the end of the 1930s, the hypothesis can be tested. With the model at hand, our understanding of pre-war Italian *latifundia* is reshaped. Extensive agriculture, low wages and rural underemployment are explained without need to factor in pre-capitalistic behaviour, but the resulting equilibrium is nonetheless inefficient (especially in its distributive aspects) and may have justified rural masses' discontent.

The results indicate that it is the actual ownership concentration of the value of productive land in private hands which drives the shift in relative factor prices against labour and in favour of land, as predicted by a model of market power. Such a causal mechanism for the shift is robust to the introduction into the analysis of the following factors: the relative importance of public land in the economy, scale effects, the agricultural share of employment, tenure arrangements, wheat specialization, geographical effects and environmental variables linked to altitude and rainfall regimes, different measures of wages, labour force participation, and a different definition of the relevant labour market faced by local economic agents. Deriving a different testable prediction from the same model, namely that market power causes a gap between equilibrium levels of labour productivity and wage rates, results in a strong confirmation of the model itself and of the causality channel explored in this paper.

Taking the specification estimated at table 8, column 6, an increase in one standard deviation in the Theil index causes an increase of 0,11 in the log of the rent-to-wage ratio, which is 16% of its standard deviation. Measured at variables' mean values (and transforming the logarithm of the dependent variable), a 10% increase in the mean Theil index leads to an increase of 5,4% in the rent-to-wage ratio, the maximum Theil index in the sample being 78% higher than the average. To put this another way, the increase by one standard deviation in the Theil index leads to an increase of 11.6% of the rent-to-wage ratio with respect to its mean value. Considering the

productivity-wage gap, an increase of one standard deviation in landownership concentration is associated with a widening of a 7.2% of the gap between labour productivity and wages. This gives a sense of the orders of magnitude involved.

## APPENDIX A. MEASURING LAND INEQUALITY. DATA AND SOURCES.

### A.1. *Some remarks on measuring land inequality*

Asset distribution is assumed to better reflect the underlying economic divides in a society than income distribution. Land inequality is also considered to be a fairly reliable proxy to asset inequality (Deininger and Squire, 1998). However, although the literature tends to ignore the fact, land inequality measurement is not burdened with fewer obstacles than income inequality – if anything there are more. For a dataset to be considered truly representative of the underlying land inequality of a country (or a region, continent or any other object of study) some rarely matched quality standards are a prerequisite.

- 1) Data must be based on sources with full coverage of the economy under study such as a Census or an inquiry carried out with similar procedures and coverage, avoiding both unrepresentative sampling and imputation procedures out of national account systems.
- 2) Data must yield information on actual ownership distribution, not farms, operational units or taxpayer distributions.
- 3) Data must refer to the distribution of the economic value of land or at the very least must include data that will enable an adjustment. Land is not a fungible good.
- 4) Data must specify whether a property is individually or collectively owned, as may be the case under communal tenure arrangements.

Poor datasets will lead to a misleading result. If data do not match any of the aforementioned standards, inequality measures built on it will result in a nonsense indicator. Unfortunately, the literature usually neglects this point. Standard 1 is the one more usually matched, and is in general available for many countries for the early years of the twentieth century and, in some cases, from the middle of the nineteenth century onwards. In some contexts, the failure to match a standard may be not a problem, as is the case if one is interested in the effects of operational sizes and standard 2 is violated. But in general one may not assume *a priori* that farm distributions are a straightforward indicator of ownership distributions. If rent or sharecropping is a typical arrangement, a violation of standard 2 is a serious problem. As a rare case for which information of the two distributions is available, consider that in 1930s Tuscany, where sharecropping was widespread, four thousand owners owned more than 48,000 farms held by sharecroppers or similar tenants, over an area of 886,000 hectares, which corresponds to 40% of the region. With regard to holdings, units larger

than 500 hectares constituted 16.5% of the region and if one considers properties the share doubles to 31.7% (see Albertario, 1939). For purposes of the present paper, matching of standard 2) is of crucial importance, because market power is strictly related to ownership. Standard 3) is rarely matched, despite being the most important in many problems. Considering an acre of irrigated land with tree-crops close to a city as equal to an acre in the desert is obviously unacceptable, for example. Unfortunately, detailed data is seldom available. Datasets exclusively based on rents actually paid, or on land sales are obviously unsatisfactory, as they violate standard 1) and are subject to selection bias problems. Standard 4) is inherently complicated, because it is not clear how collective ownerships are to be addressed in the case of the whole land distribution. Anyway, it is obvious that large public ownerships cannot be considered in the same manner as large private ownerships when evaluating the degree of land inequality in an economy. The problem is obviously negligible if this kind of ownership represent only a small fraction of the value of all the land in the economy.

According to these standards, inequality indexes built upon the national distribution of farms (as is the case of Agricultural Censuses provided by the FAO) are likely to be much closer to an index of geographical diversification within a country (if farms tend to adapt to the optimal operational size) than to a proxy of land inequality. The fact that many scholars prefer to ignore the lack of meaning of such indexes is hardly going to change the substance of the problem. Thus, land inequality may be more relevant for growth than income inequality, as pointed out by Deininger and Squire (1998), but it is by no means more easily ascertainable. The foregone discussion raises two issues. Firstly, when measuring land inequality it is important to know the purpose of such a measure. Secondly, the measure is more tricky than is often assumed. These reasons may help to explain why market power in rural economies as a source of inefficiency has rarely been addressed - quite simply, it is too difficult to measure.

#### *A.2. A new high-quality database on land inequality for Italy, 1930-1940*

For the purposes of this paper, I rely on an extraordinary database that adequately matches all the standard requirements to fully qualify as a proper database on land inequality. This is also the first time that such a database has been employed in research.

The source of the database is a massive national inquiry carried out by the Italian government in the immediate aftermath of WWII. The government entrusted the INEA (National Institute of Agrarian Economy, a public agency dependent on the Ministry of Agriculture) to carry out the inquiry, and between 1945 and 1946 it collected all available data on the actual distribution

of personal ownership over the whole country. Although officially it was just an informative inquiry, such a statistical effort is thought to have been a part of the preparing process of an upcoming Land Reform (the Minister of Agriculture was then a Communist). After the Communist Party, the party to which the Minister of Agriculture belonged, was expelled from the government in May 1947 the reform halted. However, political support to land reform went well beyond the Marxist parties, and eventually a moderated version of land reform was finally carried on by the Italian government at the beginning of the 1950s. Data collected by the INEA inquiry was published between 1946 and 1948 in 13 regional volumes, with the name of *La distribuzione della proprietà fondiaria in Italia* (“Land ownership distribution in Italy”). Information was collected about the ownership of every single plot in the country, its size and rent, and the institutional characteristics of the owner - whether he was an individual, a public entity, a charitable organization, etc. Data was gathered from Cadastral registers in every municipality, where all plots of the municipality were assigned to a “land-tax-payer” figure. Land rents had been estimated for fiscal purposes and included in the tax-payer register (see below on this point). When more than one individual was included in the same “tax-payer-figure”, the INEA assigned ownership to the main owner according to standard criteria (e.g. considering kinship relationships of the people involved and the share of the rights that each individual had on the single plot). This data corresponds to matching standard 1).

With this data, inquirers proceeded to cumulate all the plots owned by the same owner (whether an individual or an organization) in order to ascertain each owner’s actual ownership within the municipality. Two different distributions of ownership at municipality level were published. In the first instance, each cumulated ownership was classified by size into one of eleven intervals and the number of properties and the amount of land included in each interval for all municipalities of Italy (over 7,000 at that time) was published. In the second instance, ownerships were cumulated by the amount of rent that they yielded, and also classified into 11 intervals<sup>17</sup>. In order to provide for cases in which landowners held properties in more than one municipality, the inquirers carried out a second inquiry, called the “special inquiry”. From the within-municipality cumulated ownership distribution, they considered all owners having properties larger and/or more valuable than a reasonably low threshold<sup>18</sup>, i.e. ownerships whose merging with others could significantly alter the actual distribution. Then, such properties were counted and added to any other

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<sup>17</sup> Size classes intervals were: below 0.5 hectares, 0.5 hectares to 2 ha, from 2 to 5, 5 to 10, 10 to 25, 25 to 50, 50 to 100, 100 to 200, 200 to 500, 500 to 1,000 and over 1,000 hectares. Rent classes intervals were: below 100 lire, from 100 to 400, 400 to 1,000, 1,000 to 2,000, 2,000 to 5,000, 5,000 to 10,000, 10,000 to 20,000, 20,000 to 40,000, 40,000 to 100,000, 100,000 to 200,000 and over 200,000.

<sup>18</sup> The threshold was 50 hectares or, alternatively, an annual rent of more than 10,000 lire of 1939. According to ISTAT (2009), this was close to present-day 8,300 € per year.



property belonging to the same owner, whether it was bigger or smaller than the threshold. The accumulation was done at agrarian zone level<sup>19</sup>, then at agrarian region level (groups of agrarian zones within each province), at provincial level, at regional level and at Italy-wide level. The resulting distributions (by size and rent) were published in the second part of each regional volume, aggregated in a slightly different set of intervals<sup>20</sup>. As a result, if one landowner had a property of more than the aforementioned threshold in at least one municipality of Italy, the inquiry traced all its other ownerships owned elsewhere in Italy and summed them altogether to obtain the actual land ownership distribution of the country. Obviously, there were owners with small ownerships spread throughout different municipalities which were not cumulated into a single ownership. Nonetheless, as the thresholds were reasonably low, they are likely to have been few in number and would not have significantly changed the resulting picture. This constitutes the data matching quality standard 2). Moreover, for each agrarian zone the inquiry also published separated distributions for personal private ownerships and “entities” ownerships, which included mainly public or semi-public lands. Hence, for this level of aggregation<sup>21</sup>, standard 4) is also matched.

Finally, it is worth a word on rents and on matching of standard 3). There is obviously a difference between economic rent and legal rent. If rents are considered as the economic return to land (rather than as actual payments made by tenants), they capture their marginal contribution to production, i.e. its marginal value. In this sense of the word “rent”, every plot yields a rent, irrespective of its tenure arrangement. Thus, the distribution of rent so understood is equivalent to the distribution of productive value-adjusted land. Fortunately, for the purposes of this paper, the rent that was registered for tax purposes and that the inquiry collected was the economic, not the legal rent. A few years before, those rents had been estimated simultaneously with uniform, rational and up-to-day accepted criteria for the first time. In 1939 the fascist regime managed a general and simultaneous revision of the Cadastre in order to increase the tax revenue to fund the coming war effort. At that time the New Cadastre had been implemented (or the old one was updated and of comparable quality) in something approaching 90% of Italy. New and uniform assessment criteria were introduced, which more rigorously reflected the economic rent (they were, indeed, the definitive criteria which have been in force ever since). The rent had to be valued as the actual

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<sup>19</sup> The Agrarian Zone was a very disaggregated statistical unit introduced in 1909 by the statistical service of the Ministry of Agriculture in order to carry the first Agrarian Cadastre (a national survey of agricultural production, which was only partially published). It was formed by municipalities of homogeneous agronomic and economic characteristics. Their number grew with time, and in 1945 Italy was divided in 775 Agrarian Zones. In this paper they are the basic unit of observation.

<sup>20</sup> For the Special Inquiry, the intervals were 8: below 50 hectares, from 50 to 100, 100 to 200, 200 to 300, 300 to 500, 500 to 1,000, 1,000 to 2,500 and over 2,500 (for size); below 10,000 lire, 10,000 to 20,000, 20,000 to 40,000, 40,000 to 60,000, 60,000 to 100,000, 100,000 to 200,000, 200,000 to 500,000 and over 500,000 (for rents).

<sup>21</sup> The agrarian zone is in any case a rather low level of aggregation: the average area of an agrarian zone was 143 square miles, slightly more than one tenth of an average US county.

contribution of land to production, thus discounting labour inputs (no matter if they were actually paid or if they were supplemented by the own-holder or its family), intermediate inputs and capital inputs (including the amortization of fixed capital investments such as irrigation works, ditches and land melioration investments). The contribution of capital and the operator managerial inputs had to be valued in a different taxable figure, which constituted the base for a tax on the returns to agricultural capital. Input had to be considered at the actual local input mixes, and output and input prices (including wages) had to be valued at local prices. Output and prices taken into account had to be the average ones for the period 1937-1939. The re-estimation was done relatively quickly, as the new tax-figures were put in force in 1943. For the first time in Italian history, land rents were valued as the land shadow-price of land with proper agronomic and economic criteria for almost the whole country (where the new Cadastre had been implemented) with a uniform method and valued at prices referred to a close period. As a consequence, the only period in the whole span of modern Italian history for which a national cross-section of land rents from the land tax figures is fully reliable and available are the years 1937 to 1939.

This period is not very distant from that for which land distributions are available. In view of the fact there is no evidence of significant changes in land distribution between 1939 and 1945 (the land market seems rather to have frozen during the war), I will consider the land distributions reflected in the government's inquiry as being fully representative of the 1937-1939 period.

Due to the published double distributions (of ownerships grouped by size and by rents), the inquiry facilitates the estimation of a value-adjusted land distribution, thereby matching standard 3) and overcoming the usual land quality heterogeneity problem as discussed in the inverse size-productivity literature. Summing up, such an impressive dataset enables the computation of inequality indexes that may be very close to the actual concentration of demand for agricultural labour.

The Gini index and the Theil index figures have been computed over several alternative distributions, specifically private and/or public land distributions and size and/or value distributions. Despite its popularity, the Gini index lacks certain properties which are regarded as desirable by scholars in the measure of inequality<sup>22</sup>. In particular, it is not always decomposable (inequality across an entire population cannot be expressed as a function of the inequalities of its component subgroups) and it does not satisfy the strong principle of transfers (a single resources transfer from one individual to a poorer individual may decrease the measured inequality). For the purpose of this paper inequality among the wealthy seems to be more related to market power (as the poor are not likely to demand much labour), and thus a measure yielding higher inequality levels for Lorenz

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<sup>22</sup> See Cowell (2009) for this point and for the following methodological issues regarding inequality measurement.

curves steeper at their end may be preferable. Decomposability can also be shown to be desirable when considering alternative definitions of “local labour market”. This makes the Theil index preferable to the Gini index for the purposes of this paper.

The data published are available grouped in intervals. I combined different versions of the distributions published to maximize the information available, obtaining 13-intervals datasets. Then the lower bound (assuming absolute within-interval equality) and the upper bound (computed over a maximum-inequality and original-distribution-compatible 26 intervals) of the inequality indexes were computed, and finally a compromise between the two was obtained. Formally, if  $S_i$  is the total area (or rent) of the properties included within the class delimited by the class limits  $a_i$  and  $a_{i+1}$ ,  $n_i$  is the number of properties within that class,  $\mu_i = S_i/n_i$  is the average area of each property within the class. The lower bound is computed assuming that  $n_i$  properties are of  $\mu_i$  size for all  $i$ . The upper bound is computed supposing, for each interval  $i$ , that a proportion  $\lambda_i = (a_{i+1} - \mu_i)/(a_{i+1} - a_i)$  of the properties are of an area equal to the lower bound of the class,  $a_i$ , and a proportion  $(1 - \lambda_i)$  of the  $n_i$  properties are each one of the size of the upper bound,  $a_{i+1}$ . The compromise is obtained as a weighted average of the lower and upper bounds, where the lower bound is assigned a weight of 1/3 in the case of the Gini index and 2/3 in the case of the Theil index, as suggested by Cowell (2009). Anyway, the results do not depend on a particular weighting criteria.

### *A.3. Other data on Italian agriculture at the end of the 1930s.*

Agricultural wages are available at a disaggregated territorial level in the “Bollettino Mensile di Statistica Agraria e Forestale”, published by the Italian Statistical Institute (ISTAT) starting in 1928. From January 1938 this Bulletin published monthly agricultural wages of more than 200 wage zones into which the country had been just divided. A wage was assigned to every single agrarian zone according to the boundaries of the wage zones published in the fascicles of the “Bollettino” of January and February of 1938. In order to test equation (9), wages and rents have to be comparable. Since unitary rents are measured as the returns to the land input on a yearly base, wages must be measured similarly. A weighted annual wage, taking into account differences in the number of hours worked across the year and across the country and the monthly changes in wages, was computed for men and women. First a standard hourly wage is obtained as a weighted average between the hourly wages of every month, where the weights are the (also monthly varying) legal lengths of the working day of every month, also published in the BMSAF for every agricultural wage zone. Doing so, it is assumed that the variation of the working day length (spanning from 6 to 10 hours) captures the variation of the labor input across the year. Second, this standardized wage is

multiplied by a standard average number of hours of work (computed as its simple average between months). The resulting yearly-standardized daily wage is then multiplied by 240 days of work a year. As a robustness check, other yearly wages were obtained assuming 180 and 300 days of work a year, without substantially changing the results. Then, a further weighted average between the two was obtained as the standard wage for labour. Two different sets of wages have been computed: one making a simple average of men and women's wages (referred to in the tables as "unweighted wages") and the other weighting each wage for the share of women within agricultural employment in the region (as appeared in the census) to which the agrarian zone belonged to (referred to in the tables as "weighted wages"). The first case is equal to supposing that both men and women entered in the workforce with equal weight; the second assumes the weight of women as being equal to the underestimate value of the Census. Both cases are the reasonable extremes, so, if the results hold for both, they would do so for any intermediate case, as they actually do.

Agricultural labour workforce is taken from the Eighth Census of Population, which was carried out extraordinarily in 1936. It is therefore very close to the period to which the land inequality measure and the land rents refer. Additionally, as pointed out by Vitali (1968), this is to be considered the best Census of the pre-WWII era, both in the definition of its figures and in the development of the field work, and can hence be regarded as highly representative. Even if the 1936 Census is to be considered quite acceptable in its performance, Vitali considered that many women were probably excluded from the report. In his long run revision of Census data, he re-estimated the missing number of women active in agriculture for many pre-WWII Censuses. In order to control for some possible bias in regional under-reporting of women active in agriculture, I modified the Census data according to Vitali's procedure (though the results are similar with the original Census figure). Contractual figures are also taken from this source.

The amount of land, measured in hectares, is taken from the figure "total agricultural (arable) and forest land" of the Agrarian Cadastre of 1929 -a huge agricultural survey carried out at municipality level by the regime - after adjusting for some changes in the boundaries of agrarian zones between 1929 and 1945<sup>23</sup>.

Data on population in 1931 is taken from the Seventh Population Census (1931), which was reported in the provincial volumes of the Agrarian Cadastre, whose data has been also used to correct for changes in the boundaries of agrarian zones between 1931, 1936, 1938 and 1945.

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<sup>23</sup> This, instead of taking land from the 1945 Inquiry itself, is done because some municipalities had not yet finished the process of formation of the Geometric Cadastre in 1945. In such cases, the inquiry includes information only for the remaining municipalities of the agrarian zone which had complete data. It does not seem reasonable to drop some observations simply because a single municipality is lacking, so I kept the non-complete data and assumed that the non included municipality had characteristics (rents per hectare, land distribution and the share of public lands) similar to those of its neighbouring municipalities. As agrarian zones were designed according to their inner agricultural homogeneity, this seems a reasonable procedure.

Very detailed rainfall data is available from a series of publications (*Annali idrologici*) published by several semi-regional authorities working under the Ministry of Public Works (Ministero dei Lavori Pubblici, 1936-1939). From that source, data has been collected for the years 1936, 1937, 1938 and 1939 (it should be recalled that rents were computed at the agricultural conditions in the 1937-1939 period). For each year, data on the monthly total amount of rainfall and the number of rainy days have been collected for every single climatic observation station available (there were 4632 in total, spread across Italy). The majority of these stations (4,178) were attributed to a municipality existing in 1929, 1936 or 1945. The stations that it has not been possible to attribute to a single municipality have been dropped from the sample. Several hundreds of them belonged to Switzerland and the region Venezia Giulia (mostly lost after WWII). Neither was included in the land inequality database, so the loss of information is smaller than it may seem at first glance. When more than one station was attributed to a single municipality, a simple average of their values was computed. At the end of the process, 3,020 municipalities had rainfall data. Each municipality was then assigned to an agrarian zone (the basic unit of analysis of the paper), and a simple average of rainfall data (mm fallen and days of rain) was again computed for every agrarian zone. For 32 agrarian zones, mainly small ones, there was no available dataset, so their data has been interpolated from that of the closest zones. With such data, the rainfall regime for the late 30s has been included in the analysis. The variables included are the average monthly rainfall across the whole period and its coefficient of variation, the four-years average amount of rainfall in every season and its square (in order to allow for u-shaped relationships), the coefficient of variation of the same variables (in order to account for deviations from the mean), the average rain intensity (defined as the average amount of rain fallen by rainy day) in every season and its coefficient of variation.

The gravity centre of an agrarian zone is defined as its latitude-longitude coordinates, obtained as a municipality population-weighted mean. Municipality center coordinates in 1929, estimated by the Geographic Military Institute, were published in the provincial volumes of the Agrarian Cadastre. When computing distances, the system of coordinates has been corrected in order to account for the curvature of the Earth.

APPENDIX B. STATISTICAL APPENDIX

**Table A1. Summary statistics for variables at agrarian zone level.**

Variable:	Mean	Std. Dev.	Min.	Max.
Wages (unweighted)	2140.5060	344.4145	1472.5000	3648.0000
Wages (weighted)	2408.7660	374.6771	1612.6510	4047.6700
Rent per hectare (private)	330.8143	254.9394	17.7587	1846.5860
Rent per hectare (all)	310.5572	256.6462	8.1415	1711.3600
Public land share	0.2012	0.1877	0.0013	0.9420
Av. rent per priv. ownership	1176.6740	1643.9960	24.4048	12398.4300
Gini private (rents)	0.7637	0.0677	0.5626	0.9671
Gini all (rents)	0.7830	0.0649	0.5670	0.9650
Theil private (rents)	1.5214	0.5048	0.5653	5.6314
Theil all (rents)	1.7424	0.5874	0.5782	5.5074
Theil private (size)	1.6774	0.6065	0.5003	4.5212
Theil all (size)	2.2764	1.0133	0.6045	6.2748
Sharecropper	0.1927	0.2175	0.0000	0.8237
Tenant	0.0782	0.0970	0.0000	0.6114
Industrial employment share	24.1539	13.3419	4.6000	75.2000
Non agr. employment share	37.1216	17.5858	8.3000	95.7000
Wheat share	0.1909	0.1225	0.0000	0.5640
Wheat yield	13.9436	6.2792	0.0000	35.8425
Average altitude	507.1878	471.4285	1.5363	2819.0000
Average difference in altitude	240.0054	196.9641	1.6955	992.8655
Slope	0.0010	0.0015	0.0000	0.0105
Latitude (km from Equator)	4749.0740	277.4847	3940.5000	5195.6060
Av. monthly rainfall	87.8774	29.9991	23.7344	208.8956
C.V. av. monthly rainfall	0.6831	0.1071	0.4342	1.2980
Winter rainfall	234.5707	95.0816	70.0422	611.5300
Spring rainfall	299.5470	114.4149	38.1750	848.2500
Summer rainfall	176.2428	125.3721	2.6250	734.4375
Autumn rainfall	313.9785	107.4418	103.3875	737.6375
C.V. winter rainfall	0.3356	0.1405	0.0348	0.7691
C.V. spring rainfall	0.3100	0.1072	0.0559	0.8248
C.V. summer rainfall	0.3381	0.2203	0.0282	1.7321
C.V. autumn rainfall	0.2883	0.0998	0.0266	0.6511
Rain intensity winter	10.4331	2.5413	5.2804	24.5235
Rain intensity spring	9.0990	2.2776	5.0829	24.7547
Rain intensity summer	10.1020	3.2125	0.8917	25.1181
Rain intensity autumn	13.0114	3.4997	6.2166	27.1100
C.V. rain intensity winter	0.3791	0.1276	0.1150	0.9766
C.V. rain intensity spring	0.4172	0.1204	0.1639	0.9486
C.V. rain intensity summer	0.5522	0.3468	0.1304	2.5890
C.V. rain intensity autumn	0.3655	0.1056	0.1031	0.9199
Ln (labor (unadjusted)/land)	-1.2021	0.6766	-3.3168	1.5309
Ln (labor (adjusted)/land)	-1.0362	0.6944	-3.1130	1.6788

Ln (population in 1931/land)	0.1764	0.8155	-2.4117	3.8968
Ln (rent per hectare/ un. wage)	-2.3251	0.9817	-5.6785	-0.1946
Ln (rent per hectare/ ad. wage)	-2.4438	0.9809	-5.7916	-0.3263
Productivity-Wage Gap (un.)	0.5789	0.4646	-1.8459	2.5438
Productivity-Wage Gap (adj.)	0.2942	0.4717	-2.0704	2.3462

*Notes:* “Rent per hectare” is the unitary rent at 1937-1939 prices; “private” refers only to private ownerships, “all” to all kinds of ownership in the agrarian zone. In the following tables the dependent variable is computed considering all kinds of ownerships. “Wage” is an annual wage (1938 lire) computed assuming 240 days of work per year, weighting monthly wages by monthly work intensity (varying across agrarian zones). “Unweighted wages” is a simple male-female wage average; “weighted wages” is an average weighted by sex participation in agricultural labor force in 1936, according to Vitali’s (1968) regional figures. “Labor” is the number of males and females actives in agriculture in 1936; “unadjusted” is labor as reported by the Population Census, “adjusted” is labor adjusted to include underreporting of females’s activity rate in agriculture following Vitali (1968). “Public land share” is the percentage of land belonging to public entities (municipalities, provinces, State) as well as to cooperatives, public agencies, charitable organizations and similar organizations. “Theil index, private properties (area)” and “Theil index, all properties (area)” are computed, respectively, on the distribution of private and all (private and public) ownerships by size (i.e. without adjusting by value). “Theil index (rents)” are computed on the distribution of ownerships by rent (i.e. adjusting size by its value). Rainfall variables measured in millimeters, computed on the 1936-1939 data. “Sharecropper” and “tenant” are the shares in the agricultural labor force of each category (as reported by the 1936 Population Census). “Industrial” and “non agricultural” employment are the shares of each category in total employment. “Wheat share” computed as the wheat area on total agricultural land. “Wheat yield” is computed for 1936, measured in quintals per hectare. Rainfall measures are measured in mm. “Average monthly rainfall” is the average rain (in mm) fallen in a single month between January 1936 and December 1939. “C.V. av. monthly rain” is the coefficient of variation of the monthly rain across the same period. “Seasonal rainfall” is the total amount of rain fallen in a given season (computed as 1936-1939 averages), of which the CV is also computed. “Rainfall intensity” is the total amount of rain (in mm) divided by the number of rainy days in a given season. “Average altitude” is computed in meters below the sea level; “average difference in altitude” is a weighted measure of altitude dispersion within the agrarian zone; “slope” is a rough estimate of the slope of the terrain. Latitude is computed in Km from the Equator for the agrarian zone level, and in degrees of latitude for the relevant market level of analysis. “Productivity-Wage Gap (un.)” is the difference between the logarithm of (unadjusted) labour productivity and the logarithm of (unweighted) wages. “Productivity-Wage Gap (adj.)” is the difference between the logarithm of (adjusted) labour productivity and the logarithm of (weighted) wages.

**Table A2. Summary statistics for variables at relevant market level.**

Variable:	Mean	Std. Dev.	Min.	Max.
Wages (unweighted)	2143.1720	279.3211	1584.0000	3036.8630
Wages (weighted)	2408.3160	299.2013	1746.5750	3284.4580
Rent per hectare (private)	336.1742	182.6385	27.8022	1097.2290
Rent per hectare (all)	304.5498	185.7461	26.2969	1034.3820
Public land share	0.2125	0.1320	0.0181	0.7719
Av. rent per priv. ownership	935.4282	856.4606	88.5802	5543.9660
Theil private (rents)	1.8935	0.3879	0.5653	3.3878
Sharecropper	0.2056	0.1874	0.0037	0.7247
Tenant	0.0872	0.0732	0.0062	0.3356
Industrial employment share	0.2870	0.1132	0.1216	0.6475
Non agr. employment share	0.4492	0.1540	0.2039	0.8582
Wheat share	0.1914	0.0870	0.0019	0.4354
Wheat yield	14.6677	5.8583	3.7500	27.7446
Average altitude	536.3631	353.1997	4.8815	2282.4380
Average difference in altitude	252.9008	147.3742	4.1107	875.7779
Slope	0.0010	0.0010	0.0000	0.0063
Latitude (km from Equator)	42.7844	2.4914	35.5000	46.7143
Av. monthly rainfall	88.8467	22.9959	23.7344	164.0270
C.V. av. monthly rainfall	0.6818	0.0830	0.5621	1.2312
Winter rainfall	236.2795	75.5811	85.4140	528.1139
Spring rainfall	303.9222	87.0334	38.1750	591.0701
Summer rainfall	178.0895	114.5065	2.6250	554.5025
Autumn rainfall	317.4072	82.2982	103.3875	565.0059
C.V. winter rainfall	0.3359	0.1201	0.1259	0.5769
C.V. spring rainfall	0.3099	0.0870	0.1346	0.8248
C.V. summer rainfall	0.3365	0.1832	0.1315	1.4214
C.V. autumn rainfall	0.2886	0.0709	0.1059	0.6511
Rain intensity winter	10.4794	1.7652	5.6841	15.6826
Rain intensity spring	9.1665	1.6198	5.0974	16.4866
Rain intensity summer	10.1524	2.6436	1.0000	19.6889
Rain intensity autumn	13.1124	2.6427	6.9697	21.1526
C.V. rain intensity winter	0.3782	0.0791	0.2359	0.7165
C.V. rain intensity spring	0.4174	0.0821	0.2557	0.9233
C.V. rain intensity summer	0.5476	0.2924	0.2098	2.5495
C.V. rain intensity autumn	0.3637	0.0602	0.2368	0.8507
Ln (rent per hectare/ ad. wage)	-2.2755	0.6880	-4.4853	-0.7014
Ln (labor (adjusted)/land)	-1.0034	0.5009	-2.9106	0.1447
Ln (population in 1931/land)	0.3115	0.6063	-1.5731	2.3800
Productivity-Wage Gap (un.)	0.6484	0.3082	-0.2970	1.4978
Productivity-Wage Gap (adj.)	0.3648	0.3168	-0.5103	1.2382

*Notes:* Variables description as in Table 1, unless otherwise stated. Variables are computed for the relevant factor market relative to every single agrarian zone in Italy. The relevant market for a given agrarian zone is defined as the set of all agrarian zones whose gravity center lies no farther than 50 km from the agrarian zone's own center.



**Table A3. Factor prices and land inequality (Italy, 1930-1940). Unadjusted land-size inequality.**

Dependent Variable: Logarithm of the rent per hectare-agricultural wage ratio (unweighted wages)				
	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Ln labor (unadj.)- land ratio	1.133*** (0.036)	1.194*** (0.035)	1.014*** (0.042)	0.984*** (0.038)
<i>Land Inequality:</i>				
Theil index, private properties (size)		0.290*** (0.044)		
Theil index, all properties (size)			-0.144*** (0.028)	0.246*** (0.039)
Public land share				-2.580*** (0.197)
Constant	-0.963*** (0.445)	-1.376*** (0.080)	-0.779*** (0.053)	-1.182*** (0.059)
N. of Obs.	727	727	727	727
R <sup>2</sup>	0.610	0.640	0.625	0.697
F-statistic	981.96	582.49	615.25	565.33

*Notes:* Robust standard errors in parenthesis. \*\*\* significance at 1%, \*\* significance at 5%, \*significance at 10%.

**Table A4. Factor prices and land inequality (Italy, 1930-1940). Value-adjusted land inequality.**

Dependent Variable: Logarithm of the rent per hectare-agricultural wage ratio (unweighted wages)						
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
Ln labor (unadj.) - land ratio	1.164*** (0.032)	1.216*** (0.039)	1.003*** (0.034)	0.986*** (0.034)	1.158*** (0.031)	0.990*** (0.033)
<i>Land Inequality:</i>						
Theil index, private properties (value)	0.517*** (0.055)			0.410*** (0.046)		
Theil index, all properties (value)		0.240*** (0.043)	0.429*** (0.040)			
Gini index, private properties (value)					3.570*** (0.329)	
Gini index, all properties (value)						3.136*** (0.322)
Public land share			-2.028*** (0.121)	-1.260*** (0.124)		-1.672*** (0.118)
Constant	-1.713*** (0.089)	-1.282*** (0.074)	-1.459*** (0.063)	-1.511*** (0.078)	-3.659*** (0.257)	-3.253*** (0.247)
N. of Obs.	727	727	727	727	727	727
R <sup>2</sup>	0.680	0.627	0.730	0.721	0.670	0.719
F-statistic	702.14	504.60	693.53	643.84	766.91	707.58

Notes: Robust standard errors in parenthesis. \*\*\* significance at 1%, \*\* significance at 5%, \*significance at 10%.

**Table A5. Factor prices and land inequality (Italy, 1930-1940). OLS vs. IV estimation.**

**Robustness checks: a) unweighted vs. weighted wages; b) unadjusted vs. adjusted labor force.**

	Dependent Variable: Logarithm of the ratio between rent per hectare and					
	Unweighted wages			Weighted wages		
	(1) OLS	(2) IV 1 <sup>st</sup> Stage	(3) IV 2 <sup>nd</sup> Stage	(4) OLS	(5) IV 1 <sup>st</sup> Stage	(6) IV 2 <sup>nd</sup> Stage
Ln labor (unadj.)- land ratio	0.986*** (0.034)		1.160*** (0.043)			
Ln labor (adj.)-land ratio				0.950*** (0.032)		1.122*** (0.042)
Ln population 1931- land ratio		0.627*** (0.018)			0.652*** (0.019)	
Land inequality	0.410*** (0.046)	-0.158*** (0.026)	0.452*** (0.051)	0.397*** (0.044)	-0.167*** (0.028)	0.440*** (0.049)
Public land share	-1.260*** (0.124)	-0.671*** (0.079)	-0.930*** (0.143)	-1.368*** (0.120)	-0.551*** (0.083)	-1.054*** (0.139)
Constant	-1.511*** (0.078)	-0.937*** (0.049)	-1.432*** (0.085)	-1.788*** (0.076)	-0.786*** (0.051)	-1.740*** (0.082)
N. of Obs.	727	727	727	727	727	727
R <sup>2</sup>	0.721	0.733	0.711	0.719	0.716	0.708
F-statistic	643.84	662.55	610.80	650.78	607.65	603.49

*Notes:* Robust standard errors in parenthesis. \*\*\* significance at 1%, \*\* significance at 5%, \*significance at 10%. Land inequality measured by a Theil index of value-adjusted land ownership concentration.

**Table A6. The effect of land inequality on factor prices: controls.**

Dependent Variable: Logarithm of the rent per hectare-wages ratio						
	(1)	(2)	(3)	(4)	(5)	(6)
	IV	IV	IV	IV	IV	IV
	1 <sup>st</sup> Stage	2 <sup>nd</sup> Stage	1 <sup>st</sup> Stage	2 <sup>nd</sup> Stage	1 <sup>st</sup> Stage	2 <sup>nd</sup> Stage
Ln labor-land ratio		1.194*** (0.057)		0.937*** (0.044)		0.886*** (0.046)
Ln population 1931-land ratio	0.549*** (0.060)		0.875*** (0.017)		0.860*** (0.017)	
Land inequality	-0.112*** (0.025)	0.460*** (0.058)	-0.057*** (0.017)	0.265*** (0.038)	-0.071*** (0.018)	0.222*** (0.039)
Public land share	-0.925*** (0.075)	-0.786*** (0.174)	-0.220*** (0.055)	-0.933*** (0.125)	-0.232*** (0.057)	-0.865*** (0.130)
<i>Regional Dummies:</i>						
Piedmont	-0.123** (0.056)	0.408*** (0.087)	0.173*** (0.047)	0.212** (0.089)	0.168*** (0.060)	0.318*** (0.120)
Liguria	-0.224** (0.088)	-0.696*** (0.133)	0.125** (0.063)	-0.607*** (0.139)	0.220*** (0.071)	-0.713*** (0.166)
Lombardy	-0.201*** (0.054)	0.214*** (0.078)	0.104** (0.048)	-0.140* (0.085)	0.055 (0.062)	0.060 (0.118)
Ven. Trid.	-0.170* (0.091)	0.398*** (0.122)	0.265*** (0.065)	0.127 (0.119)	0.156* (0.085)	0.413** (0.161)
Veneto	-0.102* (0.058)	0.283*** (0.078)	0.025 (0.045)	0.124 (0.075)	-0.003 (0.061)	0.300*** (0.109)
Emilia	0.020 (0.057)	0.152* (0.092)	-0.031 (0.040)	-0.269*** (0.065)	-0.035 (0.046)	-0.151* (0.078)
Tuscany	-0.196*** (0.061)	-0.213** (0.092)	0.033 (0.040)	-0.271*** (0.064)	0.041 (0.043)	-0.205*** (0.072)
Latium	-0.003 (0.062)	0.171* (0.092)	0.048 (0.045)	0.304*** (0.084)	0.061 (0.050)	0.316*** (0.093)
Abruzzi	-0.087 (0.058)	0.261*** (0.093)	-0.120*** (0.045)	0.292*** (0.084)	-0.172*** (0.050)	0.452*** (0.092)
Campania	0.046 (0.062)	0.230** (0.112)	0.023 (0.050)	0.389*** (0.107)	0.007 (0.059)	0.524*** (0.136)
Apulia	-0.491*** (0.059)	0.880*** (0.095)	-0.185*** (0.050)	0.727*** (0.089)	-0.244*** (0.063)	0.843*** (0.128)
Lucania	-0.328*** (0.078)	0.207 (0.137)	-0.090 (0.059)	0.210* (0.114)	-0.098 (0.071)	0.217 (0.144)
Calabria	-0.159** (0.073)	0.087 (0.107)	-0.094* (0.053)	0.260** (0.103)	-0.287*** (0.074)	0.283** (0.143)
Sicily	-0.580*** (0.059)	0.519*** (0.116)	-0.312*** (0.048)	0.459*** (0.106)	-0.471*** (0.073)	0.226 (0.185)
Sardinia	-0.922*** (0.066)	0.483*** (0.116)	-0.375*** (0.050)	0.304*** (0.090)	-0.436*** (0.071)	0.102 (0.140)

(Tab. 6 continues below)

**Table A6 (cont.)**

	(1) IV 1 <sup>st</sup> Stage	(2) IV 2 <sup>nd</sup> Stage	(3) IV 1 <sup>st</sup> Stage	(4) IV 2 <sup>nd</sup> Stage	(5) IV 1 <sup>st</sup> Stage	(6) IV 2 <sup>nd</sup> Stage
Average rent per ownership			0.000** (000)	0.000*** (000)	0.000 (0.000)	0.000*** (0.000)
Sharecropper			0.124** (0.060)	-0.387*** (0.120)	0.104 (0.063)	-0.333** (0.131)
Tenant			-0.047 (0.102)	-0.143 (0.202)	0.045 (0.104)	-0.270 (0.201)
Non agricultural employment			-0.019*** (0.001)	0.005*** (0.001)	-0.019*** (0.001)	0.006*** (0.001)
Wheat share			0.236*** (0.087)	0.642*** (0.188)	0.285*** (0.093)	0.679*** (0.202)
Wheat yield			0.005** (0.002)	0.019*** (0.004)	0.009*** (0.002)	0.017*** (0.005)
<i>Environmental controls:</i>						
Av. monthly rainfall					-0.010 (0.016)	0.078** (0.032)
C.V. av. monthly rainfall					0.127 (0.144)	-0.013 (0.296)
Winter rainfall					0.001 (0.002)	-0.007** (0.003)
Winter rainfall^2					0.000 (0.000)	0.000 (0.000)
Spring rainfall					-0.001 (0.002)	-0.005 (0.003)
Spring rainfall^2					0.000** (0.000)	-0.000 (0.000)
Summer rainfall					0.001 (0.001)	-0.009*** (0.003)
Summer rainfall^2					0.000 (0.000)	0.000 (0.000)
Autumn rainfall					0.003* (0.001)	-0.006* (0.003)
Autumn rainfall^2					-0.000*** (0.000)	-0.000 (0.000)
C.V. winter rainfall					-0.104 (0.090)	0.859*** (0.184)
C.V. spring rainfall					-0.100 (0.100)	-0.151 (0.198)
C.V. summer rainfall					0.075 (0.066)	-0.033 (0.137)
C.V. autumn rainfall					0.006 (0.112)	-0.005 (0.223)
Rain intensity winter					-0.005 (0.009)	-0.050** (0.020)
Rain intensity spring					0.025** (0.010)	0.027 (0.020)

(Tab. 6 continues below)

**Table A6 (cont.)**

	(1) IV 1 <sup>st</sup> Stage	(2) IV 2 <sup>nd</sup> Stage	(3) IV 1 <sup>st</sup> Stage	(4) IV 2 <sup>nd</sup> Stage	(5) IV 1 <sup>st</sup> Stage	(6) IV 2 <sup>nd</sup> Stage
Rain intensity summer					-0.011* (0.006)	0.006 (0.013)
Rain intensity autumn					-0.002 (0.008)	0.015 (0.017)
C.V. rain intensity winter					0.107 (0.076)	-0.323* (0.176)
C.V. rain intensity spring					-0.117 (0.080)	0.240 (0.158)
C.V. rain intensity summer					-0.011 (0.046)	0.215** (0.096)
C.V. rain intensity autumn					-0.038 (0.091)	0.040 (0.189)
Constant	-0.572*** (0.060)	-2.003*** (0.116)	-0.463*** (0.061)	-2.502*** (0.131)	-0.538*** (0.149)	-2.924*** (0.300)
N. of Obs.	727	727	727	727	727	727
R <sup>2</sup>	0.822	0.777	0.930	0.858	0.935	0.877
F-statistic	181.08	185.04	386.18	220.37	212.00	138.23

*Notes:* Robust standard errors in parenthesis. \*\*\* significance at 1%, \*\* significance at 5%, \*significance at 10%.  
Weighted wages, adjusted labor force. Land inequality measured by a Theil index of value-adjusted land ownership concentration. Regions at 1945 borders.

**Table A7. The effect of land inequality on factor prices: widening the definition of local labor market. Relevant factor market analysis.**

Dependent Variable: Logarithm of the rent per hectare-wages ratio				
	(1)	(2)	(3)	(4)
	OLS	OLS	IV	IV
			1 <sup>st</sup> Stage	2 <sup>nd</sup> Stage
Ln labor-land ratio	1.103*** (0.027)	1.116*** (0.025)		1.301*** (0.031)
Ln population 1931-land ratio			0.694*** (0.017)	
Land inequality		0.339*** (0.041)	-0.120*** (0.026)	0.351*** (0.042)
Constant	-1.169*** (0.027)	-1.798*** (0.081)	-0.993*** (0.050)	-1.636*** (0.085)
N. of Obs.	727	727	727	727
R <sup>2</sup>	0.645	0.681	0.706	0.663
F-statistic	1678.19	1002.30	870.05	903.06

*Notes:* Robust standard errors in parenthesis. \*\*\* significance at 1%, \*\* significance at 5%, \*significance at 10%. Weighted wages, adjusted labor force. Their index of private value-adjusted land ownership concentration.

**Table A8. The effect of land inequality on factor prices: widening the definition of local labor market. Agrarian zone observations vs. relevant market observations. Controls and robustness checks.**

Dependent Variable: Logarithm of the rent per hectare-wages ratio						
	Agrarian Zone			Relevant labor market		
	(1) OLS	(2) IV 1 <sup>st</sup> Stage	(3) IV 2 <sup>nd</sup> Stage	(4) OLS	(5) IV 1 <sup>st</sup> Stage	(6) IV 2 <sup>nd</sup> Stage
Ln labor-land ratio	0.608*** (0.047)		0.730*** (0.050)	0.751*** (0.059)		1.003*** (0.084)
Ln population 1931-land ratio		0.822*** (0.020)			0.819*** (0.022)	
Land inequality	0.116*** (0.030)	-0.075*** (0.018)	0.151*** (0.033)	0.219*** (0.030)	-0.084*** (0.013)	0.284*** (0.044)
Public land share	-0.653*** (0.151)	-0.204*** (0.060)	-0.566*** (0.152)	-0.968*** (0.167)	0.169*** (0.059)	-1.096*** (0.196)
<i>Regional Dummies:</i>						
Piedmont	0.415*** (0.128)	0.169*** (0.065)	0.388*** (0.126)	0.684*** (0.122)	0.297*** (0.056)	0.489*** (0.126)
Liguria	-0.702*** (0.182)	0.166** (0.075)	-0.723*** (0.177)	-0.380** (0.160)	0.100 (0.066)	-0.399*** (0.153)
Lombardy	0.101 (0.131)	0.051 (0.069)	0.080 (0.130)	0.049 (0.159)	0.327*** (0.070)	-0.133 (0.177)
Ven. Trid.	0.450** (0.199)	0.139 (0.096)	0.446** (0.198)	0.712*** (0.192)	0.334*** (0.078)	0.527*** (0.189)
Veneto	0.217* (0.131)	-0.020 (0.070)	0.200 (0.130)	0.264** (0.124)	0.133** (0.057)	0.124 (0.124)
Emilia	-0.140 (0.085)	-0.030 (0.050)	-0.155* (0.084)	-0.128 (0.079)	0.223*** (0.037)	-0.281*** (0.098)
Tuscany	-0.232*** (0.076)	0.027 (0.044)	-0.226*** (0.076)	-0.037 (0.070)	-0.077** (0.033)	-0.007 (0.077)
Latium	0.231*** (0.087)	0.040 (0.052)	0.218** (0.087)	0.155 (0.096)	-0.129*** (0.042)	0.138 (0.096)
Abruzzi	0.426*** (0.087)	-0.185*** (0.052)	0.426*** (0.087)	0.314*** (0.089)	-0.308*** (0.041)	0.297*** (0.088)
Campania	0.546*** (0.135)	-0.008 (0.069)	0.505*** (0.139)	0.407** (0.160)	-0.078 (0.058)	0.317** (0.151)
Apulia	0.702*** (0.134)	-0.256*** (0.071)	0.734*** (0.136)	0.547*** (0.132)	-0.399*** (0.057)	0.576*** (0.136)
Lucania	0.142 (0.165)	-0.103 (0.084)	0.179 (0.169)	-0.366** (0.165)	-0.171** (0.067)	-0.267 (0.166)
Calabria	0.254 (0.198)	-0.270*** (0.101)	0.287 (0.200)	-0.735*** (0.222)	-0.413*** (0.078)	-0.591*** (0.207)
Sicily	0.363 (0.321)	-0.430*** (0.127)	0.414 (0.324)	-0.707*** (0.262)	-0.506*** (0.090)	-0.631*** (0.242)
Sardinia	-0.277 (0.177)	-0.465*** (0.086)	-0.124 (0.178)	-0.757*** (0.210)	-0.668*** (0.069)	-0.413* (0.245)

(Tab. 8 continues below)



**Table A8 (cont.)**

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	IV	OLS	IV	IV
		1 <sup>st</sup> Stage	2 <sup>nd</sup> Stage		1 <sup>st</sup> Stage	2 <sup>nd</sup> Stage
<i>Socio-economic controls:</i>						
Average rent per ownership	0.0001*** (0.000)	0.000 (0.000)	0.0001*** (0.0000)	0.0002*** (0.0000)	-0.0001*** (0.0000)	0.0002*** (0.0000)
Sharecropper	-0.244** (0.120)	0.122* (0.063)	-0.300** (0.121)	-0.581*** (0.131)	0.291*** (0.063)	-0.893*** (0.154)
Tenant	0.038 (0.188)	0.107 (0.105)	-0.088 (0.189)	0.344* (0.198)	-0.142 (0.100)	-0.165 (0.259)
Non agricultural employment	0.005*** (0.001)	-0.019*** (0.001)	0.004*** (0.001)	-0.014 (0.073)	-1.655*** (0.060)	-0.044 (0.074)
Wheat share	0.284 (0.203)	0.261*** (0.098)	0.272 (0.206)	0.653*** (0.198)	0.236** (0.108)	0.641*** (0.210)
Wheat yield	0.016*** (0.005)	0.008*** (0.003)	0.014*** (0.005)	0.055*** (0.007)	-0.007** (0.003)	0.050*** (0.007)
<i>Environmental controls:</i>						
Av. monthly rainfall	0.093*** (0.031)	-0.008 (0.016)	0.092*** (0.031)	0.264*** (0.039)	-0.070*** (0.016)	0.275*** (0.040)
C.V. av. monthly rainfall	0.208 (0.278)	0.081 (0.145)	0.157 (0.289)	1.097*** (0.254)	-0.010 (0.130)	1.044*** (0.259)
Winter rainfall	-0.008*** (0.003)	0.001 (0.002)	-0.009*** (0.003)	-0.022*** (0.004)	0.008*** (0.002)	-0.024*** (0.004)
Winter rainfall^2	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000* (0.000)	0.000 (0.000)
Spring rainfall	-0.007** (0.003)	-0.002 (0.001)	-0.007** (0.003)	-0.017*** (0.004)	0.002 (0.002)	-0.018*** (0.004)
Spr. rainfall^2	-0.000 (0.000)	0.000** (0.000)	-0.000 (0.000)	-0.000*** (0.000)	0.000*** (0.000)	-0.000*** (0.000)
Summer rainfall	-0.008*** (0.003)	0.002 (0.001)	-0.008*** (0.003)	-0.024*** (0.004)	0.006*** (0.001)	-0.025*** (0.004)
Sum. rainfall^2	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000*** (0.000)	-0.000 (0.000)	0.000*** (0.000)
Autumn rainfall	-0.006** (0.003)	0.002 (0.001)	-0.006** (0.003)	-0.017*** (0.003)	0.009*** (0.001)	-0.019*** (0.003)
Aut. rainfall^2	-0.000 (0.000)	-0.000*** (0.000)	-0.000 (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
C.V. winter rainfall	0.439** (0.176)	-0.134 (0.094)	0.486*** (0.180)	0.690*** (0.194)	-0.186** (0.087)	0.671*** (0.208)
C.V. spring rainfall	-0.247 (0.212)	-0.092 (0.102)	-0.215 (0.216)	-0.729*** (0.219)	-0.316*** (0.085)	-0.568** (0.259)
C.V. summer rainfall	-0.048 (0.135)	0.062 (0.065)	-0.093 (0.133)	-0.309* (0.184)	0.293*** (0.064)	-0.427** (0.178)
C.V. autumn rainfall	-0.181 (0.215)	-0.023 (0.111)	-0.136 (0.215)	0.058 (0.264)	-0.123 (0.133)	0.176 (0.266)

(Tab. 8 continues below)

**Table A8 (cont.)**

	(1) OLS	(2) IV 1 <sup>st</sup> Stage	(3) IV 2 <sup>nd</sup> Stage	(4) OLS	(5) IV 1 <sup>st</sup> Stage	(6) IV 2 <sup>nd</sup> Stage
Rain intensity winter	-0.036* (0.020)	-0.004 (0.009)	-0.040** (0.020)	-0.098*** (0.030)	-0.008 (0.010)	-0.114*** (0.029)
Rain intensity spring	0.023 (0.019)	0.025** (0.010)	0.020 (0.019)	0.173*** (0.026)	0.015 (0.013)	0.152*** (0.026)
Rain intensity summer	-0.004 (0.013)	-0.016*** (0.006)	-0.001 (0.013)	-0.088*** (0.014)	-0.038*** (0.007)	-0.065*** (0.017)
Rain intensity autumn	-0.004 (0.017)	-0.003 (0.008)	0.003 (0.016)	0.004 (0.023)	-0.011 (0.009)	0.040* (0.021)
C.V. rain intensity winter	-0.222 (0.168)	0.114 (0.076)	-0.221 (0.172)	-0.889*** (0.338)	0.757*** (0.088)	-0.966** (0.377)
C.V. rain intensity spring	0.139 (0.146)	-0.134* (0.079)	0.172 (0.148)	-0.028 (0.176)	-0.526*** (0.080)	0.104 (0.183)
C.V. rain intensity summer	0.088 (0.096)	-0.017 (0.046)	0.109 (0.096)	0.571*** (0.148)	-0.148*** (0.051)	0.688*** (0.148)
C.V. rain intensity autumn	-0.086 (0.173)	-0.048 (0.090)	-0.073 (0.176)	-0.231 (0.209)	0.039 (0.106)	-0.250 (0.211)
Average altitude	-0.001*** (0.000)	-0.000* (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.000*** (0.000)	-0.000** (0.000)
Average difference in altitude	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.001*** (0.000)	-0.001*** (0.000)	0.002*** (0.000)
Slope	11.574 18.939	36.607*** (10.124)	-4.833 (18.357)	-124.41*** (30.22)	114.873*** (11.524)	-181.09*** (36.07)
Latitude	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.111** (0.052)	0.022 (0.016)	-0.087* (0.046)
Constant	-2.693 (2.065)	-0.504 (0.931)	-2.683 (2.088)	-0.012 (2.136)	-0.633 (0.697)	-0.754 (1.903)
N. of Obs.	727	727	727	727	727	727
R <sup>2</sup>	0.895	0.937	0.894	0.973	0.986	0.972
F-statistic	135.26	199.96	140.06	682.94	935.95	647.76

*Notes:* Robust standard errors in parenthesis. \*\*\* significance at 1%, \*\* significance at 5%, \*significance at 10%. Weighted wages, adjusted labor force. Theil index of private value-adjusted landownership concentration.

**Table A9. The effect of land inequality on the productivity-wage gap. Agrarian zone observations vs. relevant market observations. Unadjusted labour force, unweighted wages.**

Dependent Variable: Productivity-Wage Gap (Logarithm of output per worker - Logarithm of wages)								
	Agrarian Zone				Relevant Labour Market			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Land inequality	0.411*** (0.044)	0.310*** (0.036)	0.284*** (0.038)	0.251*** (0.042)	0.236*** (0.028)	0.205*** (0.025)	0.284*** (0.026)	0.203*** (0.022)
<i>Socio-economic controls:</i>								
Public land share		-0.493*** (0.082)	-0.281*** (0.081)	-0.137 (0.113)		-0.871*** (0.092)	-0.531*** (0.097)	-0.318*** (0.113)
Average rent per ownership		0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)		0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Sharecropper		-0.537*** (0.063)	-0.297*** (0.104)	-0.291** (0.112)		-0.749*** (0.044)	-0.689*** (0.088)	-0.845*** (0.098)
Tenant		-0.338** (0.157)	-0.114 (0.140)	-0.103 (0.155)		-0.861*** (0.113)	-0.707*** (0.145)	-0.630*** (0.124)
Non agricultural employment		0.004*** (0.001)	0.002** (0.001)	0.002* (0.001)		0.434*** (0.077)	0.102* (0.061)	0.295*** (0.053)
Wheat share		0.828*** (0.149)	0.652*** (0.142)	0.430** (0.170)		0.488** (0.205)	0.326 (0.227)	0.519*** (0.173)
Wheat yield		-0.005* (0.003)	0.008** (0.003)	0.004 (0.004)		-0.008*** (0.002)	0.020*** (0.005)	0.033*** (0.005)
<i>Regional Dummies:</i>								
Piedmont			0.077 (0.073)	-0.027 (0.097)			-0.095 (0.064)	0.081 (0.092)
Liguria			-0.148 (0.117)	-0.283** (0.117)			-0.129 (0.104)	-0.378*** (0.112)
Lombardy			-0.044 (0.075)	-0.014 (0.101)			-0.298*** (0.078)	-0.241** (0.116)
Ven. Trid.			-0.120 (0.088)	-0.046 (0.141)			-0.235*** (0.081)	0.071 (0.140)
Veneto			-0.112 (0.068)	-0.061 (0.107)			-0.232*** (0.055)	0.037 (0.091)
Emilia			-0.165*** (0.054)	-0.143** (0.070)			-0.469*** (0.050)	-0.296*** (0.061)
Tuscany			-0.111** (0.054)	-0.040 (0.060)			-0.120*** (0.041)	0.133*** (0.050)
Latium			-0.049 (0.082)	-0.060 (0.088)			-0.005 (0.052)	-0.273*** (0.075)
Abruzzi			-0.070 (0.076)	0.015 (0.085)			-0.223*** (0.051)	-0.092 (0.067)

(Table 9 continues below)

**Table A9 (cont.)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Campania			0.004	0.010			-0.025	0.030
			(0.010)	(0.271)			(0.117)	(0.075)
Apulia			0.191**	0.271**			0.074	0.119
			(0.087)	(0.125)			(0.065)	(0.108)
Lucania			0.085	0.110			0.002	-0.337**
			(0.104)	(0.154)			(0.059)	(0.131)
Calabria			-0.272***	-0.040			-0.374***	-0.483***
			(0.102)	(0.183)			(0.050)	(0.171)
Sicily			0.383***	0.744***			0.336***	0.027
			(0.083)	(0.238)			(0.055)	(0.184)
Sardinia			0.696***	0.731***			0.651***	0.511***
			(0.070)	(0.145)			(0.054)	(0.165)
<i>Environmental controls:</i>								
Av. monthly rainfall				0.067***				0.226***
				(0.024)				(0.033)
C.V. av. monthly rainfall				0.201				0.498**
				(0.246)				(0.216)
Winter rainfall				-0.009***				-0.022***
				(0.002)				(0.003)
Winter rainfall <sup>2</sup>				0.000**				0.000***
				(0.000)				(0.000)
Spring rainfall				-0.003				-0.015***
				(0.002)				(0.003)
Spr. rainfall <sup>2</sup>				0.000				0.000*
				(0.000)				(0.000)
Summer rainfall				-0.008***				-0.023***
				(0.002)				(0.003)
Sum. rainfall <sup>2</sup>				0.000				0.000***
				(0.000)				(0.000)
Autumn rainfall				-0.004**				-0.020***
				(0.002)				(0.003)
Aut. rainfall <sup>2</sup>				0.000**				0.000***
				(0.000)				(0.000)
C.V. winter rainfall				0.148				0.028
				(0.149)				(0.151)
C.V. spring rainfall				-0.139				-0.448***
				(0.185)				(0.162)
C.V. summer rainfall				-0.293**				-0.741***
				(0.116)				(0.141)
C.V. autumn rainfall				-0.010				-0.112
				(0.191)				(0.216)

(Table 9 continues below)

<b>Table A9 (cont.)</b>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Rain intensity winter				-0.000 (0.014)				-0.050** (0.021)
Rain intensity spring				-0.015 (0.015)				-0.017 (0.019)
Rain intensity summer				0.016 (0.010)				0.075*** (0.011)
Rain intensity autumn				0.001 (0.012)				0.059*** (0.015)
C.V. rain intensity winter				-0.017 (0.152)				0.107 (0.237)
C.V. rain intensity spring				0.153 (0.143)				0.318** (0.138)
C.V. rain intensity summer				0.026 (0.087)				0.577*** (0.108)
C.V. rain intensity autumn				-0.089 (0.145)				0.095 (0.170)
Average altitude				0.000 (0.000)				0.000 (0.000)
Average difference in altitude				0.000 (0.000)				0.001*** (0.000)
Slope				-41.69*** (14.122)				-177.5*** (16.898)
Latitude				0.000 (0.000)				-0.004 (0.035)
Constant	-0.047 (0.066)	0.001 (0.082)	-0.179* (0.106)	-1.894 (1.756)	0.202*** (0.056)	0.377*** (0.096)	-0.056 (0.094)	-1.348 (1.394)
Number of obs.	727	727	727	727	727	727	727	727
F-statistic	87.46	65.5	45.64	30.95	68.58	142.71	319.75	305.2
R-squared	0.200	0.424	0.586	0.630	0.088	0.513	0.841	0.927

*Notes:* Robust standard errors in parenthesis. \*\*\* significance at 1%, \*\* significance at 5%, \*significance at 10%. Weighted wages, adjusted labor force. Theil index of private value-adjusted landownership concentration.

**Table A10. The effect of land inequality on the productivity-wage gap. Agrarian zone observations vs. relevant market observations. Adjusted labour force, weighted wages.**

Dependent Variable: Productivity-Wage Gap (Logarithm of output per worker - Logarithm of wages)								
	Agrarian Zone				Relevant Labour Market			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Land inequality	0.410*** (0.043)	0.301*** (0.035)	0.274*** (0.037)	0.246*** (0.041)	0.207*** (0.029)	0.180*** (0.024)	0.270*** (0.026)	0.186*** (0.023)
<i>Socio-economic controls:</i>								
Public land share		-0.515*** (0.084)	-0.274*** (0.081)	-0.138 (0.114)		-0.970*** (0.095)	-0.498*** (0.098)	-0.296** (0.118)
Average rent per ownership		0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)		0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Sharecropper		-0.547*** (0.064)	-0.285*** (0.103)	-0.265** (0.111)		-0.775*** (0.047)	-0.662*** (0.090)	-0.789*** (0.095)
Tenant		-0.309* (0.158)	-0.107 (0.138)	-0.083 (0.155)		-0.779*** (0.113)	-0.657*** (0.144)	-0.573*** (0.126)
Non agricultural employment		0.003*** (0.001)	0.002** (0.001)	0.002* (0.001)		0.279*** (0.078)	0.096 (0.063)	0.274*** (0.053)
Wheat share		0.968*** (0.152)	0.674*** (0.143)	0.445** (0.171)		0.569*** (0.211)	0.342 (0.237)	0.494*** (0.175)
Wheat yield		-0.010*** (0.003)	0.009*** (0.003)	0.005 (0.004)		-0.013*** (0.002)	0.024*** (0.005)	0.036*** (0.005)
<i>Regional Dummies:</i>								
Piedmont			0.026 (0.070)	-0.101 (0.095)			-0.169*** (0.064)	-0.042 (0.093)
Liguria			-0.206* (0.116)	-0.354*** (0.117)			-0.189* (0.105)	-0.493*** (0.112)
Lombardy			-0.204*** (0.072)	-0.187* (0.099)			-0.511*** (0.078)	-0.448*** (0.118)
Ven. Trid.			-0.252*** (0.086)	-0.193 (0.140)			-0.395*** (0.081)	-0.079 (0.141)
Veneto			-0.158** (0.065)	-0.118 (0.107)			-0.298*** (0.054)	-0.031 (0.092)
Emilia			-0.196*** (0.052)	-0.181*** (0.069)			-0.521*** (0.050)	-0.354*** (0.062)
Tuscany			-0.229*** (0.052)	-0.152*** (0.058)			-0.239*** (0.040)	0.067 (0.049)
Latium			-0.106 (0.080)	-0.091 (0.087)			-0.069 (0.051)	-0.260*** (0.073)
Abruzzi			-0.063 (0.073)	0.036 (0.083)			-0.221*** (0.051)	-0.037 (0.066)

(Table 10 continues below)

**(Table A10 cont.)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Campania			0.025 (0.098)	0.143 (0.134)			0.050 (0.075)	0.071 (0.115)
Apulia			0.204** (0.085)	0.293** (0.123)			0.102 (0.066)	0.209* (0.106)
Lucania			0.133 (0.101)	0.155 (0.152)			0.060 (0.058)	-0.259** (0.129)
Calabria			-0.201** (0.099)	0.062 (0.181)			-0.297*** (0.048)	-0.323* (0.169)
Sicily			0.378*** (0.082)	0.767*** (0.239)			0.350*** (0.055)	0.139 (0.186)
Sardinia			0.722*** (0.067)	0.776*** (0.143)			0.685*** (0.052)	0.615*** (0.164)
<i>Environmental controls:</i>								
Av. monthly rainfall				0.065*** (0.024)				0.231*** (0.033)
C.V. av. monthly rainfall				0.198 (0.246)				0.549** (0.214)
Winter rainfall				-0.009*** (0.002)				-0.023*** (0.003)
Winter rainfall^2				0.000** (0.000)				0.000*** (0.000)
Spring rainfall				-0.003 (0.002)				-0.014*** (0.003)
Spr. rainfall^2				0.000* (0.000)				0.000** (0.000)
Summer rainfall				-0.008*** (0.002)				-0.024*** (0.003)
Sum. rainfall^2				0.000 (0.000)				0.000*** (0.000)
Autumn rainfall				-0.004** (0.002)				-0.021*** (0.003)
Aut. rainfall^2				0.000** (0.000)				0.000** (0.000)
C.V. winter rainfall				0.195 (0.149)				0.184 (0.153)
C.V. spring rainfall				-0.130 (0.186)				-0.383** (0.166)
C.V. summer rainfall				-0.299** (0.117)				-0.792*** (0.140)
C.V. autumn rainfall				-0.022 (0.191)				-0.267 (0.217)

(Table 10 continues below)

(Table A10 cont.)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Rain intensity winter				0.002 (0.014)				-0.040* (0.022)
Rain intensity spring				-0.014 (0.015)				-0.011 (0.019)
Rain intensity summer				0.016* (0.010)				0.079*** (0.011)
Rain intensity autumn				-0.004 (0.012)				0.049*** (0.015)
C.V. rain intensity winter				-0.019 (0.154)				0.075 (0.250)
C.V. rain intensity spring				0.180 (0.140)				0.375*** (0.141)
C.V. rain intensity summer				0.017 (0.088)				0.542*** (0.108)
C.V. rain intensity autumn				-0.060 (0.145)				0.239 (0.168)
Average altitude				0.000 (0.000)				0.000 (0.000)
Average difference in altitude				0.000 (0.000)				0.001*** (0.000)
Slope				-38.839*** (14.011)				-176.200*** (17.220)
Latitude				0.000 (0.000)				-0.006 (0.035)
Constant	-0.330*** (0.066)	-0.198** (0.082)	-0.426*** (0.103)	-2.145 (1.760)	-0.027 (0.059)	0.279*** (0.098)	-0.336*** (0.092)	-1.623 (1.395)
Number of obs	727	727	727	727	727	727	727	727
F-statistic	89.66	67.41	50.41	33.23	50.51	142.97	328.66	299.98
R-squared	0.193	0.423	0.600	0.642	0.064	0.523	0.847	0.931

Notes: Robust standard errors in parenthesis. \*\*\* significance at 1%, \*\* significance at 5%, \*significance at 10%. Weighted wages, adjusted labor force. Theil index of private value-adjusted landownership concentration.



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