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Gimme Shelter. Public Housing Programs and Industrialization

The INA-Casa plan, Italy

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Abstract

We model the impact of public housing supply on local development by using a spatial equilibrium model with a "share-altering" technological shift from agriculture to manufacturing. The model shows that a larger local availability of houses triggers greater population growth and, consequently, industrialization. It also suggests that these effects are stronger in places that exhibited, prior to the public housing plan, relatively higher population density. These implications are broadly confirmed by an empirical evaluation of the INA-Casa plan, a program implemented by the Italian government in the aftermath of WWII.

Keywords: Housing policy, urbanization, industrialization

JEL Classification: O14, R11.

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Soundtrack: https://www.youtube.com/watch?v=QeglgSWKSIY.

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1. Introduction

The Plan INA-Casa, possibly inspired by the British "Beveridge Plan", was implemented in Italy over the period 1949-1963, and aimed at providing good quality housing to working class people. A crucial feature of this plan was that its territorial distribution was uneven: see Di Biagi (2001). Some areas gained more than others, and this possibly twisted migration decisions and local labour market conditions. In this paper we ask whether the INA-Casa plan might have favoured urbanization and industrialization of certain areas by increasing local labour supply.

The distribution of workers across areas is crucial here. The notion of "directed technical change" (Acemoglu, 2002) suggests that the adoption of new technologies can be driven by the abundance of the production factors. In this perspective, the industrialization process of a certain area will require an adequate local supply of labour. Differently from the rural sector thus, manufacturing will go together with denser, urban, populations. Such ideas can be readily represented by considering alterations in the factor shares of a Cobb-Douglas production function, after Seater (2005) and Accetturo et al. (2014).[1]

Theories of urbanization generally build on rural-urban migration, driven by some wage or utility differential across areas. Such theories are based on two main mechanisms. The first one hinges on the "rural push", either induced by productivity gains in agriculture that make many farmers redundant, or, on the contrary, by increasing poverty in rural areas. The second mechanism works through the "urban pull". In the latter case, higher expected urban wages will attract migrants from the countryside, as in Harris and Todaro (1970). Also, migration to cities may allow for fast human capital acquisition, as in Lucas (2004) or provide, in general**,** economies of agglomeration: see Henderson (2010). Most of such models assume that cities just exist, and "urbanization" is a process in which existing cities exhibit growing population.[2] Differently, our approach can explain why - following a local shock driven by a public housing program – a rural area can turn into a urbanized area. Also, a public housing plan has advantages that go beyond the provision of mere dwelling space. In less developed areas, such development programs may also increase the quality of housing by providing sanitation and sewers, which are relevant factors for the health of the local labour force.[3]

In the model we propose there are, initially, two rural areas dedicated to the production of traditional, farming goods. Then, an asymmetric housing supply shock occurs, favouring one area over the other. Some individuals will migrate into the "luckier" area to enjoy better housing services. If the increase in local population is sufficiently large, local entrepreneurs will have an incentive to quit rural production and adopt technologies "directed" at exploiting local labour abundance. The area thus switches from agriculture into sectors that are

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[1] More recently, a similar approach has been followed by Comin et al. (2020).
[2] Urban growth may also be driven by politico-economy reasons, as in the case of megacities which enjoy "political favoritism": see Ades and Glaeser (1995) and Davis and Henderson (2003), among others.
[3] See, e.g., Galiani et al. (2017) on TECHO housing programs in Latin America. Castell-Quintana (2017) and Kesztenbaum and Rosental (2017) discuss, respectively, the benefit of sanitation in developing countries and in Paris at the turn of the 19th century. Beach (2021) analyzes the impact of water and sanitary infrastructure on US cities between the 19th and early 20th century.

more labour-intensive, as manufacturing (see Gollin, 2002, p.463). In equilibrium, one area remains rural, while the other will industrialize and urbanize even further.

There are a number of contributions that offer theoretical explanations of urbanization. For example, Murata (2008) builds on non-homothetic preferences to generate a shift from agricultural to manufactured goods, produced under increasing returns to scale. The fall in transportation costs will eventually favour labour reallocation towards the non-agricultural, urban, sector. Michaels et al. (2012) analyze the dynamics of the transformation of rural areas into urbanized ones, by postulating that local productivity has sector-specific components. Thus, certain areas have some specific comparative advantage in producing manufactured goods, which is reinforced by the presence of agglomeration externalities. Their model predicts increased dispersion in population density and, more important, a "U-shaped" relation between initial log-population density and local population growth. Their finding of an "increasing relationship between population growth and initial population density at intermediate densities" (p.559) is quite similar to the implications of our model, where the implementation of non-rural technologies requires a sufficient mass of workers.

Although our model is mainly focused on the process of the "rural-urban transition", rather than "sub-urbanization", it has also some affinities to Venables (2017), where the adoption of manufacturing requires a large labour supply, such to make urban wages sufficiently low. There, *unless* substantial agglomeration externalities are assumed, the development of manufacturing will eventually be associated with *lower* urban wages.[4] Urbanization would thus generate an "urban wage-*discount*", rather than the commonly observed "urban wage-premium": see Glaeser and Marè (2001). Empirically, however, there is a large gap between labour compensation in agriculture and non-agriculture, as emphasized in Gollin et al. (2014) and Storesletten et al. (2019). Differently from Michaels et al. (2012) and Venables (2017), we adopt the "share-altering hypothesis" presented in Accetturo et al. (2014). This approach has some advantages. For instance, the share altering hypothesis implies that the implementation of the labour "directed" technology will increase the marginal productivity of labour and, thus, raise urban wages. Thus, our model can generate the urban-rural nominal wage premium even *without* assuming agglomeration externalities which affect local Total Factor Productivity. Also, the "share-altering" hypothesis puts a particular emphasis on the conditions for the endogenous implementation of technologies, emphasizing the role of local supply shocks on industrialization. For instance, analyzing cross-county variation in migrations to the US over the period 1850-1920, Sequeira et al. (2020, p.404) find that "immigrants had an *immediate* positive effect on industrialization".[5]

To test the main implications of the model, we use the historical case of a publicly supported housing program, implemented in Italy between 1949 and 1963: the Piano INA-Casa, also known as "Piano Fanfani", after the Cristian-democrat politician, Amintore Fanfani, who proposed it in the aftermath of WWII. The housing plan had several purposes, such as reducing unemployment as well as providing new and functional dwellings for

[4] See Figures 1 and 2 in Venables (2017).

[5] On the relation between immigration, urbanization and industrialization, see also Atack et al. (2021).

the workers. The plan, indeed, had the purpose to "raise the standard of living of the working classes".[6] The general criteria required for the new buildings, and their distribution across the Italian territory, were decided by a national Committee with the support of INA (*Istituto Nazionale delle Assicurazioni*, the National Insurance Institute, a public institution founded in 1912).

The plan was implemented in two phases (1949-56 and 1956-63). We focus on the former both because it is the one that most closely reflects the dynamics of rural-urban migration, which is the focus of the theoretical model, and because there are no data for the latter, at least at a sufficient level of geographic disaggregation for the empirical analysis. During its first phase, the *INA casa* plan concerned 4,025 municipalities, out of a total number nearing 8,000. By exploiting a selection-on-observables identification strategy, we assess the impact of the plan on demographic and economic outcomes at the municipal level over the decade 1951-1961. The evidence is broadly consistent with the predictions of the model. We find that the housing plan stimulates the growth of the local population. By favoring larger population density, it also encourages the local development of the manufacturing sector. In other words, we show that the treatment had considerable impact on the rural-to-urban transition in the post-war period. Further, we find that the impact of public housing is not homogeneous across initial population densities: treated municipalities that start with a higher level of *initial* population exhibit a demographic and industrial growth that is relatively higher. Finally, we show that the transition to the industrial sector is relatively more capital-intensive in larger municipalities: this finding may suggest that credit constraints were more stringent in smaller towns, possibly due to poorer collateral.

The paper is composed as follows. Section 2 discusses the theoretical model and its implications. The historical background of post-war Italy and the plan INA-Casa is given in Section 3. Section 4 presents the data, the empirical strategy, and the empirical results. Section 5 concludes.

2. A Spatial Equilibrium Model

We explore the relation between housing development plans, which can be unevenly distributed across space, and their impact on local industrialization. In what follows, the economy is composed of two areas, $c = \{1,2\}$, individuals and firms are fully mobile, and landlords live elsewhere.

Starting from an economy based on production of traditional tradable goods, such as agriculture, the model shows which are the conditions that eventually lead local entrepreneurs to implement more labour-intensive technologies producing manufacturing (tradable) goods.

We first describe households' preferences and, then, the alternative technologies available to firms.

[6] See Bilancio della gestione INA-Casa per l'esercizio 1945-50, p.14.

2.1 Households

We suppose that households living in area $c = \{1,2\}$ derive utility from the quantity (h) and quality (q) of housing services they enjoy, from the consumption of traditional tradable goods, y, which sells at an international price normalized to one (numeraire), and from the consumption of tradable manufacturing goods, x, which sell at an international price equal to p. By assuming that preferences are Cobb-Douglas, utility is given by:

$$U_c = (\bar{q}_c \cdot h)^{1-\mu} \cdot y^{\mu-\delta} \cdot x^{\delta} \qquad (1)$$

where $\bar{q}_c$ denotes the local average quality of housing, and $\delta \in [0, \mu)$ defines the expenditure share on manufactured goods. The budget constraint is given by $r_c \cdot h + y + p \cdot x = w_c$. Thus, maximization of (1) will give the following indirect utility:

$$v_c = \eta \cdot (\bar{q}_c)^{1-\mu} \cdot \frac{w_c}{r_c^{1-\mu} \cdot p^{\delta}} \quad . \qquad (2)$$

where $\eta \equiv (1-\mu)^{1-\mu} \cdot (\mu-\delta)^{\mu-\delta} \cdot \delta^{\delta}$.

The assumption that individuals are perfectly mobile across the two areas will imply the following:

$$v_1 = v_2. \qquad (3)$$

2.2 Technologies

In what follows, we show how different technologies, and different productions, can be implemented across space. To this purpose, we start with an economy where only the traditional sector (say, agriculture) is initially operating in both areas. Then, we characterize the conditions under which firms in a certain area, say Area 1, will find it convenient to implement the manufacturing technology, which is relatively labour-intensive. All the available technologies are Cobb-Douglas with constant-returns-to-scale and require two inputs: land, as denoted by L_c, and labour, denoted by N_c.[7]

The traditional technology, which is more land-intensive, is given by:

$$Y_c = L_c^{1-\alpha} \cdot N_c^{\alpha}, \qquad (4)$$

where $\alpha \in (0,1)$. By denoting the unit price of local land as λ_c, profit-maximizing firms will demand a quantity of land equal to $L_c = \frac{(1-\alpha)\cdot Y_c}{\lambda_c}$ and a quantity of labour equal to $N_c = \frac{\alpha \cdot Y_c}{w_c}$.

Firms' full mobility also ensures that marginal costs are equalized across areas, which implies the following:

$$\frac{{\lambda_c}^{1-\alpha} \cdot {w_c}^{\alpha}}{(1-\alpha)^{1-\alpha} \cdot \alpha^{\alpha}} = 1 \text{ for } c = \{1,2\}. \qquad (5)$$

Suppose now that firms in an area, say Area 1, consider the adoption of a more labour-intensive technology to produce manufactured goods, X, at the international price p.

Similar to Michaels et al. (2012), the manufacturing, labour-intensive, technology is such that:

$$X = L_1^{1-\alpha-\Delta} \cdot N_1^{\alpha+\Delta}, \qquad (6)$$

where it holds that $\Delta \epsilon (0, 1-\alpha)$: for additional discussion on the "share-altering" hypothesis, see Accetturo et al. (2014).

When technology (6) is implemented in Area 1, the marginal cost is equal to the competitive price p, that is:

$$\frac{{\lambda_1}^{1-\alpha-\Delta} \cdot {w_1}^{\alpha+\Delta}}{(1-\alpha-\Delta)^{1-\alpha-\Delta} \cdot (\alpha+\Delta)^{\alpha+\Delta}} = p \ . \qquad (7)$$

[7] As in Eaton and Eckstein (1997), Lucas (2004), Michaels et al. (2012), we also assume that land and labor are the sole factors of production.

The issue of the implementation of manufacturing technologies raises a main question, that is, when will local entrepreneurs find it convenient to adopt the more labour-intensive technologies that allow to produce manufacturing goods? In other words, when will local entrepreneurs decide to abandon the rural sector to enter manufacturing? Consider Area 1, where local factor prices are given by (w_1, λ_1). By exploiting the marginal cost conditions (5) and (7) – calculated at the local factor prices - it will be profitable to implement the labour-intensive technology whenever it holds that $\frac{{\lambda_1}^{1-\alpha-\Delta} \cdot {w_1}^{\alpha+\Delta}}{(1-\alpha-\Delta)^{1-\alpha-\Delta} \cdot (\alpha+\Delta)^{\alpha+\Delta}} \cdot \frac{1}{p} \leq \frac{{\lambda_1}^{1-\alpha} \cdot {w_1}^{\alpha}}{(1-\alpha)^{1-\alpha} \cdot \alpha^{\alpha}}$. This inequality can be rearranged as $\left(\frac{w_1}{\lambda_1}\right)^{\Delta} \cdot \frac{1}{p} \leq \frac{(1-\alpha-\Delta)^{1-\alpha-\Delta} \cdot (\alpha+\Delta)^{\alpha+\Delta}}{(1-\alpha)^{1-\alpha} \cdot \alpha^{\alpha}}$, requiring that the local cost of labour be sufficiently cheap, relative to the price of land. By restating this condition in terms of $(n_1, \bar{L}_1)$, the input endowments in Area 1, one obtains:

$$p \cdot \left(\frac{n_1}{\bar{L}_1}\right)^{\Delta} \geq \frac{(1-\alpha)^{1-\alpha} \cdot \alpha^{\alpha}}{(1-\alpha-\Delta)^{1-\alpha} \cdot (\alpha+\Delta)^{\alpha}} \equiv \chi^*. \quad (8)$$

The implementation condition (8) requires some discussion. On the one hand, it illustrates the "directed technical change" nature of our approach, that is, technical change favouring abundant factors: see Acemoglu (2003), and the discussion in Accetturo et al. (2014). Since manufactured goods are more labour-intensive, they will only be produced if local labour is relatively abundant. On the other hand, the respect of condition (8) critically depends on the size of χ^*. For instance, Lucas (2004, p.S47) takes the share of land in agriculture (as denoted, here, by $1-\alpha$) to be equal to 0.35. However, this implies that the residual 0.65 should be identified with the share going to "a composite labor-plus-capital input". Gollin et al. (2014, p.984) suggest that the agricultural labour share ranges between 0.51 and 0.58. Thus, α =0.55 seems a reasonable value to consider.[8] By taking $\Delta = 0.15$, it turns out that the implementation threshold is $\chi^* = 1.05$.

In Appendix A1.1, we extend the technologies analyzed so far to include capital as a production factor. We argue that the presence of financial frictions at the local level due, e.g., to the scarcity of valuable assets to be collateralized (see, among others, Midrigan and Xu, 2014), may prevent the adoption of more capital-intensive technologies in the manufacturing sector. In this perspective, the severity of imperfections in local credit markets can shape the local industrial structure.

[8] By exploiting US data, Storesletten et al (2019) show that, over the period 1945-1960, the relative labour-income shares between farming and non-farming sectors was, on average, equal to 0.8: see Figure 1(c). Since we take α =0.55, it follows that $\alpha + \Delta \approx 0.7$. The OECD (2015, p.6) suggests a value of 69.8 for the labour share in the G20's private sector (excluding agriculture, mining and the real estate sector) over the 1990's.

In what follows, we will consider an initial stage of development in which both areas exhibit rural production. In other words, we will assume that –initially- it holds that $p \cdot \left(\frac{n_1}{\bar{L}_1}\right)^{\Delta} = p \cdot \left(\frac{n_2}{\bar{L}_2}\right)^{\Delta} < \chi^*$, so that neither area respects the implementation condition (8). Both areas start as land-intensive, agricultural, regions. However, as we will show, a housing plan which has an uneven impact across locations may promote local industrialization by twisting the geographical distribution of workers.

2.3 The Traditional economy: equilibrium in the land, labour and housing market

Suppose that, in the agricultural economy, it initially holds that $p \cdot \left(\frac{n_1}{\bar{L}_1}\right)^{\Delta} = p \cdot \left(\frac{n_2}{\bar{L}_2}\right)^{\Delta} < \chi^*$. Since condition (8) is violated, firms in both regions stick with the traditional technology (4).

The endowment of land in each area is given and equal to $\bar{L}_c$. Thus, the local land market equilibrium requires that $\bar{L}_c = L_c$, and implies that the local price of land is:

$$\lambda_c = (1-\alpha)\left(\frac{n_c}{\bar{L}_c}\right)^{\alpha} \qquad (9)$$

where n_c denotes labour supply in area $c = \{1,2\}$.

The local labour market equilibrium requires that $n_c = N_c$. Thus:

$$w_c = \alpha\left(\frac{n_c}{\bar{L}_c}\right)^{\alpha-1}. \qquad (10)$$

Further, by assuming that the stock of housing services in area $c = \{1,2\}$ is given and equal to $\bar{H}_c$, local housing market equilibrium requires that:

$$\bar{H}_c = (1-\mu) \cdot \frac{w_c \cdot n_c}{r_c}. \qquad (11)$$

We can now characterize the spatial equilibrium in this rural economy. Equilibrium requires that the local land markets, the labour markets, and the local housing markets all clear, that firms maximize profit, residents maximize utility and, finally, that individuals and firms are indifferent about locations.

Due to the Cobb-Douglas specification of preferences and production, the solution to the model can be calculated in terms cross-regional ratios, that is, $\frac{z_1}{z_2}$, for each variable z_c. Then, by taking logs, we can represent each cross-regional ratio in terms of $\hat{z}$, where:

$$\hat{z} \equiv ln\left(\frac{z_1}{z_2}\right). \qquad (12)$$

Leaving additional details about the derivation to the Appendix A1.1, we can solve for the values of the endogenous variables $\{\hat{n}, \widehat{w}, \hat{r}, \hat{\lambda}\}$ as functions of the exogenous variables $\{\hat{Q}, \widehat{H}, \hat{L}\}$. Here, $\{\hat{n}, \widehat{w}, \hat{r}, \hat{\lambda}\}$ represent, respectively, the (log of) the ratio between area 1's and area 2's population, wage, rent, and price of land. On the other hand, $\{\hat{Q}, \widehat{H}, \hat{L}\}$ represent, respectively, the (logs of) the ratios between area 1's and 2's average quality of housing, housing endowment, and land endowment.

Thus, in a traditional economy, one obtains the following:

$$\hat{n} = \frac{(1-\mu)\left(\hat{Q}+\widehat{H}\right)+\mu(1-\alpha)\hat{L}}{1-\alpha\mu} \qquad (13)$$

$$\widehat{w} = \frac{(1-\alpha)(1-\mu)\left[-\hat{Q}-\widehat{H}+\hat{L}\right]}{1-\alpha\mu} \qquad (14)$$

$$\hat{r} = \frac{\alpha(1-\mu)\hat{Q}+(1-\alpha)\left[-\widehat{H}+\hat{L}\right]}{1-\alpha\mu} \qquad (15)$$

$$\hat{\lambda} = \frac{\alpha(1-\mu)\left[\hat{Q}+\widehat{H}-\hat{L}\right]}{1-\alpha\mu} \qquad (16)$$

Notice that the relative *real* wage, given by $\widehat{w}-(1-\mu)\hat{r}$, is equal to $-(1-\mu)\hat{Q}$. With perfect labour mobility, real wages across areas may only differ to compensate for heterogeneity in local amenities (which, here, simply reduce to average housing quality): see, for example, Accetturo et al. (2019).

2.4 Impact of an (asymmetric) Housing Plan on the traditional economy

Consistently with observation on the INA housing plan that will be described in what follows (see Sect.3), we consider an increase in both the local quality and quantity of housing that favors Area 1 over Area 2, that is, the case when both $\hat{Q}$ and $\widehat{H}$ get larger. Considered alone, the impact of the plan tends to reduce wages in area

1, relative to area 2 (see expression 14), since residents enjoy better housing conditions, both in terms of quality and quantity.[9] On the other hand, by referring to expression (15), the larger availability of housing ($\widehat{H} > 0$) tends to reduce relative rents in area 1, although the increase in the local quality of housing ($\widehat{Q} > 0$) has an "amenity" effect working in the opposite direction. More important for the argument we develop here, the housing plan will increase population in Area 1, relative to Area 2: from expression (13), a rise in both $\widehat{Q}$ and $\widehat{H}$ will imply a higher $\hat{n}$.

As a consequence, two cases may arise. In particular, the increase in $\hat{n}$ is:

(i) such that $p \cdot \left(\frac{n_2}{\bar{L}_2}\right)^{\Delta} < p \cdot \left(\frac{n_1}{\bar{L}_1}\right)^{\Delta} < \chi^*$ holds, or

(ii) such that $p \cdot \left(\frac{n_1}{\bar{L}_1}\right)^{\Delta} \geq \chi^* > p \cdot \left(\frac{n_2}{\bar{L}_2}\right)^{\Delta}$ is true.

These cases imply deep differences for the development of Area 1, as we discuss in what follows.

Under case (i), the increase in local population in Area 1 - driven by the relative generosity of the housing plan in such a region - is not sufficient to reach the labour-land ratio that allows for the implementation of the labour-intensive technology. In other words, condition (8) is not respected and firms in Area 1 will have no incentive to switch to manufacturing. The same is obviously also true for Area 2, where the labour-land ratio gets smaller. Thus, the housing plan will redistribute the national population across areas without generating any shift in technology. Both areas are specialized in the traditional sector, and they remain so even after the housing shock.

By contrast, under case (ii), the housing plan attracts to Area 1 a number of workers that is sufficient to make the labour-intensive technology profitable. Thus, condition (8) is satisfied, and technology (6) is implemented. Under such circumstances, Area 1 will specialize into new products (manufacturing goods), while Area 2 remains stuck with rural productions. As we are going to show, in this case Area 1 will become "urbanized".

In what follows, we analyze the spatial general equilibrium implications of regional industrialization, triggered by the housing plan.

2.5 Asymmetric Industrialization

In the aftermath of the asymmetric housing plan, under case (ii), firms in Area 1 will find it convenient to adopt technology (6). In equilibrium, both firms and households must still be indifferent between the two locations, since they are perfectly mobile.

[9] Recall, from the discussion in Section 2.2, that the reduction in the local cost of labour is crucial for the implementation of labour-intensive technologies. This issue is discussed in detail in Accetturo et al. (2014).

The land market equilibrium now implies that the local price of land in Area 1 is:

$$\lambda_1 = (1-\alpha-\Delta)\cdot p\cdot\left(\frac{n_1}{\bar{L}_1}\right)^{\alpha+\Delta} \qquad (17)$$

while, in Area 2, the corresponding expression is given by (9). On the other hand, the local labour market equilibrium in Area 1 gives:

$$w_1 = (\alpha+\Delta)\cdot p\cdot\left(\frac{n_1}{\bar{L}_1}\right)^{\alpha+\Delta-1}, \qquad (18)$$

while expression (10) still holds for Area 2. Local housing market equilibrium in each area is still given by (11). Also, firms in Area 1 must respect the marginal cost condition (7), while firms in Area 2 must respect (5).

In what follows, we define $\hat{p} \equiv \ln(p)$, the logarithm of the price of (tradable) manufactured goods. By leaving additional details to Appendix A1.2, we can solve for the values of the endogenous variables $\{\hat{n}', \hat{w}', \hat{r}', \hat{\lambda}'\}$, as functions of the exogenous variables $\{\hat{Q}, \hat{H}, \hat{L}, \hat{p}, \Delta\}$, where $\Delta > 0$ denotes the labour-share change under the new technology. Here, the "primes" denote the values of the solutions which are obtained when Area 1 industrializes.

Under the respect of condition (8) in Area 1, the following expressions hold:

$$\hat{n}' = \frac{(1-\mu)(\hat{Q}+\hat{H}) + \mu(1-\alpha)\hat{L} + \mu\left[\hat{p} + \ln(\alpha+\Delta) + \Delta\cdot\ln\left(\frac{n_1}{\bar{L}_1}\right)\right] - \mu\ln(\alpha)}{1-\alpha\mu} \qquad (19)$$

$$\hat{w}' = \frac{(1-\mu)\cdot\left\{(1-\alpha)\left[\hat{L}-\hat{Q}-\hat{H}\right] + \hat{p} + \ln(\alpha+\Delta) + \Delta\cdot\ln\left(\frac{n_1}{\bar{L}_1}\right) - \ln(\alpha)\right\}}{1-\alpha\mu} \qquad (20)$$

$$\hat{r}' = \frac{\alpha(1-\mu)\hat{Q} + (1-\alpha)\left[\hat{L}-\hat{H}\right] + \hat{p} + \ln(\alpha+\Delta) + \Delta\cdot\ln\left(\frac{n_1}{\bar{L}_1}\right) - \ln(\alpha)}{1-\alpha\mu} \qquad (21)$$

$$\hat{\lambda}' = \frac{\alpha(1-\mu)\left[\hat{Q}+\hat{H}-\hat{L}\right] + \hat{p} + \ln(1-\alpha-\Delta) + \alpha\mu\ln\left(\frac{\alpha+\Delta}{1-\alpha-\Delta}\right) + \Delta\cdot\ln\left(\frac{n_1}{\bar{L}_1}\right) - A}{1-\alpha\mu} \qquad (22)$$

where $A = \ln(1-\alpha) + \alpha\mu\ln\left(\frac{\alpha}{1-\alpha}\right)$.

Expression (19) shows that industrialization ($\Delta > 0$) will further attract population to Area 1, on the top of the immigrants initially brought in by the housing plan.[10] Indeed, the adoption of labour-intensive technologies is associated with an upward jump[11] in the marginal productivity of labour, which attracts additional workers to Area 1. Similarly to Michaels et al. (2012), our simple models predicts that the structural transformation of the areas across the economy: (a) generates increased dispersion in population across areas and, more importantly, (b) implies that local population growth is a positive function of initial population density only when the initial level of population density is sufficiently large (formally, only when the condition $p \cdot \left(\frac{n_1}{\bar{L}_1}\right)^{\Delta} \geq \chi^*$ holds true). In fact, rural areas -characterized by low initial population density- will experiment residents' outflows favouring urbanizing areas. Taken together, these predictions imply increasing polarization across rural and urban areas.

As shown by (20), industrialization will also boost local wages. Overall, local nominal wages will grow in Area 1 whenever the negative impact exerted by the housing plan is dominated by the positive effect of the new technologies on the marginal productivity of labour. In this case, a "urban wage-premium" arises [12] (see, e.g., Glaeser and Maré, 2001). This is an important implication of the model, since it shows that a rural/urban gap in labour compensation can persist even when workers are perfectly mobile, a fact that -to some extent- is considered puzzling by Golling et al. (2014). Although mobility to Area 1 from Area 2 tends to raise wages in the latter, the technological switch to manufacturing has a direct, positive impact on the marginal productivity of labour in Area 1.

Effects similar to the ones on wages also hold for relative rents on housing: see equation (21). Local rents will have a net increase if the housing supply shock is more than compensated by the inflow of workers attracted by the new sector. As for the relative price of land in Area 1, the direct effect of the implementation of labour-intensive technologies is generally negative: see equation (22).

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[10] The impact of $\Delta > 0$ in equation (19) is given by $\left[\frac{1}{\alpha+\Delta} + \ln\left(\frac{n_1}{\bar{L}_1}\right)\right]$, which is unambiguously positive when $\frac{n_1}{\bar{L}_1} \geq 1$ (sufficient condition) or, at least, when $\frac{n_1}{\bar{L}_1}$ is not much smaller than one, as we assume. The same argument holds for equations (20)-(21).

[11] The direct impact of $\Delta > 0$ on the marginal productivity of labour in industry, relative to the one in agriculture, can be simply assessed by comparing expression (18) with expression (10), both calculated for the *same* labour-land ratio.

[12] This is a crucial difference between our model, which builds on the idea share-altering technical change in Accetturo et al. (2014), and the model presented by Venables (2017). In Venables (2017), urban equilibrium wages must be sufficiently low to make the manufacturing sector viable, *unless* sizable agglomeration externalities are assumed. Thus, in Venables' basic model, we should observe a urban wage-*discount*.

Once again, full workers' mobility implies that the new technology will have no net impact on the relative real wage: that is, is still holds that $\hat{w}' - (1-\mu)\hat{r}' = -(1-\mu)\hat{Q}$. Eventually, differences in nominal wage across areas are offset by differences in local amenities and local cost-of-living. However, this is not the case when workers' mobility is imperfect.[13] With mobility costs which limit migration into Area 1, the technological switch has a larger impact on nominal wages and, more remarkably, it also raises local *real* wages (for a formal discussion, see Accetturo et al., 2019). Finally, in Appendix A1.3, we characterize the impact of the housing plan on local output levels.

To wrap-up the intuition about what happens in this (static) model, we may summarize our argument by starting from a first stage when the asymmetric housing plan develops. Such a plan attracts more workers to Area 1 and reduces, at the same time, nominal local wages. In a second stage, the low wages of Area 1 make labour-intensive technologies profitable. However, industrialization will *raise* the marginal productivity of labour. New firms and additional workers will flow into Area 1 as long as extra-profits or net utility gains can be made.

2.6 Sum-up of the main theoretical predictions for the empirical analysis

The model developed above, together with the discussion in Appendix 1 about the role of capital, offers some main predictions for the empirical analysis about the impact of the case at stake, the *Piano INA-Casa* (1949-1963). In the absence of data on wages and rents at the municipality level, Census data offer the possibility to test the following implications:

(1) The municipalities that benefitted from the housing plan exhibit an increase in their population, relative to the municipalities that were not treated.

(2) In the treated municipalities, the switch from agriculture to manufacturing occurs to a larger extent. In other words, the treatment favours manufacturing, which is more labor intensive, at the expenses of local agriculture. One should also observe higher activity in the construction sector, while the model does not offer precise predictions for the local service sector which, at the time of the *Piano INA-Casa*, was largely based on family businesses.

(3) The transformations highlighted above should be relatively stronger in municipalities that exhibited, since the beginning of the plan, larger population density. Thus, in municipalities that were relatively denser, the growth in the employment share of manufacturing should be stronger. On the other hand, we should observe a stronger fall in the employment share of agriculture in municipalities that start with relatively denser populations.

[13] Gollin et al. (2014) argue that in developing countries there can be various reasons, such as geographical barriers, poor property rights, or formal restrictions to movements, besides psychological cost or liquidity constraints, why rural/urban labour mobility is imperfect.

(4) Finally, since the value of collateralizable assets (such as real estate) is higher in more populated areas, manufacturing goods that require larger capital-labour ratios will tend to locate in more densely populated municipalities.

As we are going to show in what follows, such theoretical predictions are largely supported by the evidence we obtain at the municipal level from the INA-Casa plan.

3. The INA-Casa Plan: Historical Background

In the aftermath of WWII, both for war damage and for its dominating agricultural heritage, Italy was still half-way to industrialization. The 1951 Census reported that agriculture was the main activity of the 47,5 million residents, corresponding to 42,2% of labour market participants. Urbanization was still very limited, in comparison with the decades that followed. A quarter of the Italian population lived scattered in the outskirts of the 7,995 municipalities of the national territory. The demographic composition was biased towards the youth: 26% of the Italians were below 15, while the 66% of the population was between 15 and 64. Partly due to wartime devastation, the quality of housing was generally quite poor, especially outside urban centers. In 1951, only 7.4% of total dwellings were endowed both with running water and bathroom: see, e.g., Di Biagi (2001).

In an economy struggling with the dire problems of post-war reconstruction and high unemployment, Amintore Fanfani, the Labour & Welfare Secretary in the fifth De Gasperi's cabinet, proposed a massive plan for popular housing, the so-called *Piano INA-Casa*. The plan was approved by the Parliament on the 28th of February 1949 with the law n. 43, called *Provvedimenti per incrementare l'occupazione operaia, agevolando la costruzione di case per lavoratori* (i.e., "Measures to increase employment by favouring the construction of houses for the workers"). The plan, which was to be financed partly by the government and partly by new taxation on employers and employees, had initially a duration of seven years, starting on the 1st of April 1949. On the 1st of April 1956, though, the plan was extended for seven more years, until February 1963. The criteria for the distribution of resources over the Italian territory were mainly driven by the levels of crowding of the existing dwellings and war damage at the municipality level (Beretta Anguissola, 1963, p.400, 457). The South of Italy was to receive one third of the funds.

The plan served several purposes. On the one hand, it aimed at providing new and healthy housing for the lower and middle classes. The newly built apartments were assigned to households following criteria that were based on the needs of the recipients. Families who were homeless, or shared the flat with other households, or lived in over-crowded or unhealthy dwellings were at top of the list of candidates. The recipient of a flat had the option to buy it on installments, or to rent it at very advantageous conditions.[14] Indeed, 40% of the households benefitting from new housing had lived in basements, caves or shacks, while another 17% was previously sharing home with other families. On the other hand, the program aimed at stimulating employment in the emerging industrial sectors. Overall, the plan reached remarkable achievements. Over the 14 years of activity, it delivered 355,000 new accommodations distributed across 5,036 municipalities out of a total of 7,995 (Istituto Sturzo, 2002). The total amount of funds allocated to the plan was equal to 936bn lire, approximately corresponding, in 1963 dollars, to 1.5bn. In the decade 1951-61, the program provided the 9.1% of all new lodgings built over the period (Beretta Anguissola, 1963). The plan also stimulated internal mobility. In 1954, 63% of beneficiary households came from other municipalities. This figure rises to 79.3% for Piedmont and Lombardy, the fastest-growing regions of the time. Also, 62.2% of beneficiaries were blue collars.

As explained above, the plan was implemented in two phases. Over the first phase (1949-1956), new buildings were widely spread around the national territory. Purposely, within each province, the administrative center received less resources than the remaining municipalities. The opposite holds true for the second plan (1956-1963), when administrative centers received more (Beretta Anguissola, 1963, p.22, p.144; and Table 27, p.159). Thus, while the first plan was characterized by a nationwide "rural-urban transformation" that concerned a multitude of small centers, the second plan concentrated on a smaller number of municipalities (Beretta Anguissola, 1963, p.160, Table 28), with funds assigned proportionally to the number of workers and to measures of crowding. Crowding had indeed become a major issue with industrial growth, and the impact of the price of land on total construction costs was increasing fast, rising from 5% during the first phase to 20% over the second phase (see Beretta Anguissola, 1963, p.77,89). Consequently, the second phase was more biased towards "sub-urbanization", that is, the construction of large peripheral quarters in the outskirts of towns.

4. Some Evidence

There is relatively scant information on the implementation of the INA-Casa plan. Data on the number of houses built and local budgetary allocations are available only at the provincial level (Nuts 3). However, provincial data are of little use for our purposes: within the same province there are both treated and untreated municipalities. Thus, the impact of the plan on this broad area also reflects migration movements from the latter to the former and, thus, it provides a biased measure of the effect of public housing on economic transformation in the area. The only information available at the *municipal* level is contained in a document released in 1956 by the Italian Minister of Labour and Social Security: *Piano INA-CASA Primo Settenio: Gli*

[14] A flat worth 2,500,000 lire was located for 3,125 lire per month. The purchase of the same flat, instead, implied a monthly payment of 7,345 lire over 25 years: see Beretta Anguissola (1963, p.116).

Artefici. This document concerns the first phase of the INA-Casa plan (1949-1956), and provides a list of municipalities involved in the construction of new buildings under the plan. No further information (such as the number of houses, and/or their type) is provided. Unfortunately, information about treated municipalities is not even available for the second phase (1956-1963) of the INA-Casa plan which, however, involved mainly middle-size cities and administrative centers (see Section 3).

To provide evidence on the impact of the INA-Casa plan on local development, we adopt a selection-on-observable strategy and compare treated municipalities with their untreated counterparts. We use data from various sources. We take year 1951 as pre-program date since, at that time, the INA-Casa plan was just starting. Our matching procedure takes into account time-invariant features of municipalities, such as the macro-area (North, Centre, South of Italy), the elevation and steepness of the territory, and the surface: these data are taken from the *Atlas of Italian Municipalities* (Italian National Institute of Statistics, ISTAT). We also make sure that treated and controls are similar with regard to a long list of 1951 features: the share of active population over residents, the share of people with at least a bachelor's degree, the ageing index, the homeownership rate, the non-urbanized fraction of the municipality surface (data from the *8000 Census* database, ISTAT). To consider the pre-plan economic structure of the municipalities, we exploit the 1951 *Industry and Services Census* (ISTAT) to insert the sectoral employment share (manufacture and mining, construction, private sector services) in the matching algorithm. Information about the share of workers in agriculture over total workers is obtained from the Census of Population in 1951 (*8000 Census* database). We also consider the concurrent development of the highway network by inserting a dummy for those municipality in the provinces in which a freeway exit was opened during the 1951-61 decade.[15] Lastly, we add an index for the local minimum wage level in effect at that time (de Blasio and Poy, 2017). The decision of which municipalities to select for the construction of the new houses was a decision made at the central level. Obviously, it was not a random choice and electoral motivations may have influenced the choice. In principle, a municipality that was the electoral fiefdom of a national politician might have received additional benefits, beyond those related to the INA-Casa plan. This could result in a positive bias in our estimates. On the other hand, a municipality connected to a national politician but excluded from the plan might have received some offsets. In this case, our estimates could be biased downward. In order to control for political connections, we included the distance of each Italian municipality in our sample to the nearest birthplace of a member of the Parliament in the 1950-1958 period.Finally, we control for population (ln) in 1951 and, importantly, for its pre-trend (1936-1951). Thus, we make sure that treated and controls share common pre-intervention trends. Unfortunately, population is the only variable available for the period prior to the implementation of the plan. Table A1 and A2 in Appendix 2 provide description of the variables and the summary statistics for all the covariates.

[15] Please note that in the 1950s only a few highways were operational, since the vast majority of them were built in the decades that followed (see Pozzi et al, 2006 and Percoco, 2016). Only 25% of the municipalities in our sample are localized in a province served by a highway.

The sample under scrutiny is the full list of Italian municipalities, apart from the exclusion of few municipalities that experienced consolidations during the 1951-61 decade, for which data on covariates are not available. Thus, the total number of municipalities considered is 7,469, with 4,025 treated and 3,444 controls. In the *Raw Sample* of Table 1, we provide pre-program (1951) information on a list of covariates in the treatment and control group. Many covariates are highly unbalanced: the INA-Casa plan was implemented in municipalities that were larger than the untreated ones in terms of population (and surface), and that exhibited faster demographic growth in the previous decade. Also, the economic structure of treated municipalities was different from the one of the untreated, showing a higher share of workers in manufacturing. Treated municipalities had, on average, a more educated and younger population, whereas the homeownership rate for the treated was relatively lower. Importantly, treated units were nearer to a city where an incumbent member of Parliament was born. This finding suggests that political influence probably played a role in selecting the treated units.

To limit such differences, we use an Inverse Probability Treatment Weighting (IPTW) procedure. We first run a logit where the treatment is regressed on the entire list of covariates in Table 1. The distribution of the probability of being treated – Propensity Score (PS) – is shown in Figure 1: it is very skewed, with a high probability of being treated for the treated units and shows a limited overlap among the PS value in the treated and control group. Following Crump et al. (2009), we limit the sample to a portion of the list of municipalities by only keeping observations lying in the [0.1-0.9] interval of the estimated PS. Then, observations are weighted by the inverse of estimated PS (in the case of controls the weight is $1/(1 - PS)$). In situations with a limited overlap, this approach has been proved to provide a good approximation of the optimal subsample in observational studies, i.e. a subsample where the average treatment effect can be estimated most precisely; see also Austin (2017). As shown in the *IPTW Sample* of Table 1, we are able to identify 2,058 treated and 2,099 control units, for which all the previous documented differences have been smoothed out.

[Figure 1 here]

[Table 1 here]

The outcome variables we consider are the decadal (1961-51) growth rates (in log differences) of population and employment, distinguishing by manufacture and mining, construction and the private service sector. We also consider the share of people working in the agricultural sector (over total resident workers).[16] In Table 2

[16] Note that, for the manufacturing and services sectors, Census data report the number of individuals employed by firms localized in the municipality. We do not have same information for agricultural employment: the only available information is the share of people employed in agriculture over resident workers.

below, the first column illustrates the difference between treated and controls, while the second column displays the results from specifications where we control also for all the predetermined characteristics.

Our results suggest that the treated municipalities experienced a cumulative 1961-51 population growth that is 1.3 percentage points higher than the one in non-treated municipalities, when controlling for covariates. Further, we find that the plan had a positive effect on employment growth in the manufacturing sector: we estimate a growth differential of 4.4 percentage points. We also find that the program increased employment in the construction sector but the coefficient is not statistically significant. This is probably due to the fact that we focus on a subsample of relatively smaller places (about 2,500 residents, on average) and the firms involved in the construction of houses were not necessarily registered in treated areas. We also do not detect evidence of an increase of employment in private sector services. Finally, we find a reduction in the share of people working in agriculture. Overall, our findings are broadly in line with the implications of the theoretical model in Sect. 2.6.

[Table 2 here]

Next, we explore the relationship between our outcome variables and initial population density. Figure 2, which is derived by fitting a non-linear specification in which treatment is interacted with density and density squared, suggests that initial density matters. Our treatment effect increases (decreases) with initial population for both residents and manufacturing (agriculture) growth. Finally, we split manufacturing employment between sectors that are relatively more capital-intensive and the others. Guided by Bank of Italy (1998), we classify as labour intensive the following industries: leather, textile, clothing, footwear, furniture, wood, paper, mechanic repairing shops. Capital intensive industries are food and drinks, tobacco, metallurgy, mechanical engineering, printing, transportation, minerals, chemistry, oil, plastic, rubber). As illustrated in the extension to our basic model (see the Appendix A1.4), the presence of credit constraint implies that manufacturing firms exhibiting large capital-labour ratios will be disproportionally located in denser municipalities, since the value of collateralizable assets, such as real estate, is higher in more populated areas. Our evidence suggests that this is indeed the case.

[Figure 2 here]

5. Concluding Remarks

The experience of public housing plans in post-WWII Italy can shed light on the mechanics of industrialization in developing countries. The INA-Casa plan (1949-1963), also known as "Piano Fanfani" after the Christian Democrat politician who promoted it, was a publicly supported plan for the construction of decent housing for the working class. As illustrated by the theoretical model we develop, new housing can provide a considerable comparative advantage for a municipality, by attracting additional workforce. In turn, the presence of an abundant local workforce can make it convenient to implement labour-intensive productions, such as manufacturing. The transition from a rural economy to an urbanized one, then, will attract additional workers. The approach we follow to model the technological switch has the following central feature. "Share-altering technical change" explicitly relies on the abundance of the relevant input (labour, here), as in directed technical change models. Moreover, as we showed, the implementation of manufacturing productions can lead to higher local wages, generating the typically observed urban-rural wage gap. As an advantage of our set-up, the theoretical results are obtained without appealing to the black-box of "agglomeration externalities", often embedded in the Total Factor Productivity term of the local production function.

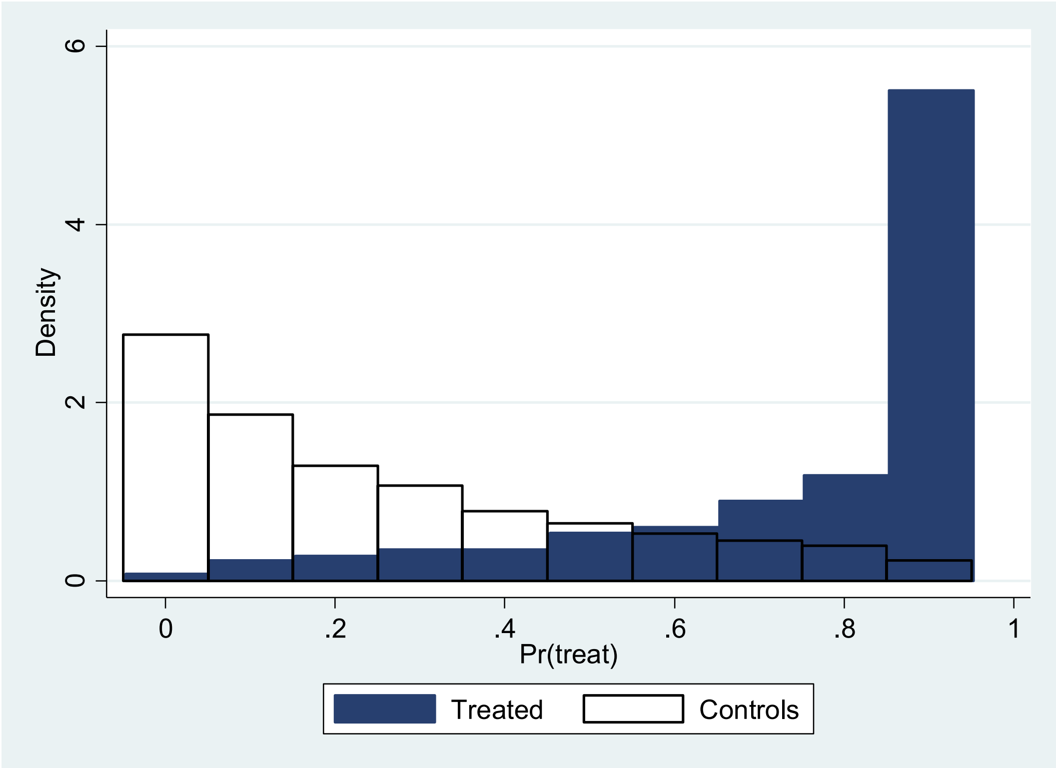
In short, the rural-urban transition mechanism proposed here has a driving force (provision of new housing) and a propagation mechanism (profitable industrialization) at the local level. Some of the empirical implications we derive have similarities to Michaels et al. (2012), even though their model is based on idiosyncratic sector-specific local components. In particular, the impact of housing on subsequent industrialization is not homogeneous across the distribution of population densities. Our findings from the INA program show that municipalities that exhibited higher initial density have benefited relatively more from the plan. Indeed, denser places were relatively more likely to meet the conditions for industrialization. At the same time, urbanization went together with a drastic fall in agricultural employment.

Table 1. Balancing in covariates between treated and controls in the Raw Sample and in the IPTW Sample.

	Raw sample			*IPTW sample*		
	Treated	Controls	Difference	Treated	Controls	Difference
Pop. 1951 (ln)	8.539	7.261	1.278*** (.018)	7.824	7.833	-.009 (.020)
Population growth 1951-1936	.095	.000	.095*** (.002)	.058	.051	.007* (.003)
Macro-area						
North	.489	.623	-.134*** (.011)	.497	.511	-.014 (.015)
Centre	.156	.090	.066*** (.007)	.132	.119	.013 (.010)
South and Islands	.354	.285	.069*** (.010)	.369	.369	.000 (.015)
Elevation (ln)	5.026	5.699	-.673*** (.028)	5.433	5.418	.015 (.046)
Steepness (ln)	5.481	5.763	-.282*** (.039)	5.675	5.658	.017 (.063)
Surface (ln)	3.398	2.827	.571*** (.021)	3.126	3.129	-.003 (.034)
Non-urbanized fraction of the municipality surface, 1951	.309	.326	-.017*** (.006)	.328	.326	.002 (.010)
Share of Empl. in manufactures and mining, 1951	.491	.393	.098*** (.003)	.442	.442	-.000 (.006)
Share of Empl. in construction, 1951	.077	.078	-.001 (.002)	.079	.078	.001 (.004)
Share of Empl. in private services, 1951	.431	.527	-.096*** (.003)	.478	.479	-.001 (.005)
Share of Empl. in agriculture, 1951	.508	.655	-.147*** (.005)	.608	.608	.000 (.007)
Share of active population, 1951	.549	.562	-.013*** (.002)	.554	.555	-.001 (.003)
Share of people with at least a bachelor's degree, 1951	.022	.017	.005*** (.000)	.017	.017	-.000 (.000)
Ageing index, 1951	.354	.501	-.147*** (.005)	.373	.376	-.003 (.006)
Homeownership rate, 1951	.486	.647	-.161*** (.004)	.586	.582	.004 (.006)
Distance from the nearest city of birth of a MP in 1950-1958	12.939	15.403	-2.464*** (.649)	14.826	14.458	.368 (.793)
Local minimum wage index	86.121	86.892	-.770*** (.179)	85.413	85.697	-.284 (.243)
Highway	.261	.216	.045*** (.009)	.216	.209	.007 (.012)
N	4025	3444		2068	2031	

Note: the IPTW sample is obtained using a logit regression where the treatment indicator (being a municipality where the INA plan is realized) is regressed on the entire list of covariates described in Table 1. The sample is trimmed at the 1th and 99th percentiles of population. In the IPTW Sample we keep observations lying within the [0.1–0.9] interval of the estimated Propensity Score (PS); weights are given by the inverse of the PS (in the case of untreated municipalities, the weight is 1/(1 − PS)). Standard errors are robust and clustered at the local labour system level.

Figure 1. The distribution of the estimated Propensity Score.



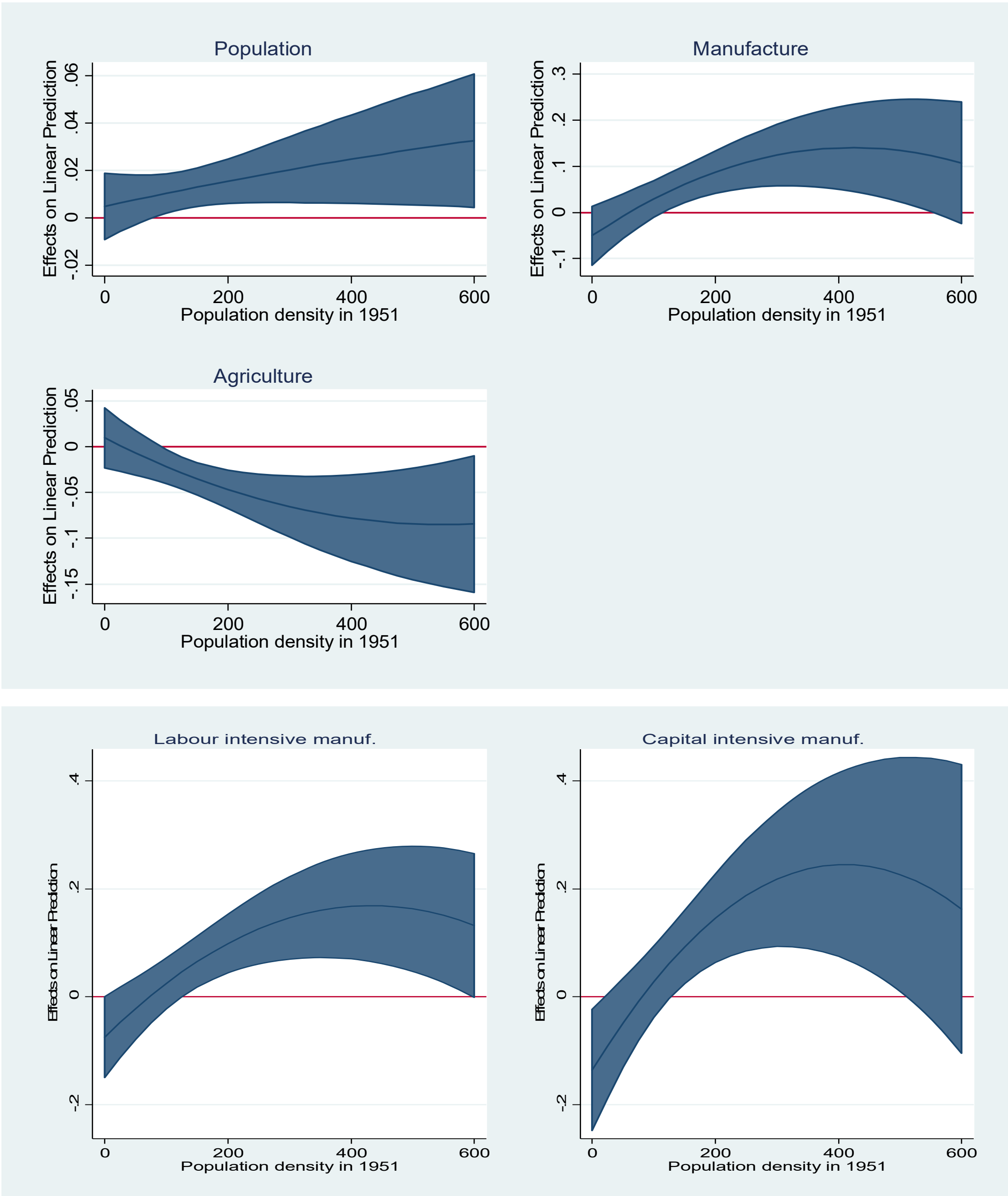
Note: Estimated Propensity Score from a (logistic) regression where the treatment variable (having the INA program in the municipality) is regressed on the entire list of covariates in Table 1.

Table 2. Baseline results, IPTW Sample. Growth rate 1961-1951.

	Population		Manufactures		Construction		Private sect. services		Agriculture	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treat	0.0154**	0.0126***	0.0435*	0.0442*	0.0190	0.0219	-0.0051	-0.0072	-0.0300**	-0.0292***
	(0.0060)	(0.0048)	(0.0260)	(0.0231)	(0.0690)	(0.0552)	(0.0116)	(0.0106)	(0.0120)	(0.0106)
Controls	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
N	4099	4099	4099	4099	4099	4099	4099	4099	4099	4099

Note: for each outcome in the first column no covariates are controlled for; in the second column we control for: population in 1951 (ln), population growth rate 1961-1951, dummies for territorial area (North, Centre, South of Italy), elevation (ln), steepness (ln), surface (ln), non-urbanized fraction of the municipality surface in 1951, the share in different sectors in 1951 (manufacture and mining, construction, private services), the share of employment in agriculture, the share of workers out of population in 1951, the share of people with at least college education in 1951, the ageing index in 1951, the homeownership rate in 1951, the distance (km) from the nearest city of birth of a Member of Parliament in 1950-1958, local minimum wage index, highway (details in Table A1, Appendix 2). Standard errors are robust and clustered at the local labour system level.

Figure 2. Interaction between the treatment and initial population density



Note: the graphs display how the estimated difference between treated and controls vary with respect to population density in 1951 (pre-program). It is derived from a non-linear specification in which treatment is interacted with density and density squared. Confidence interval at the 90% level.

Appendix 1 – Theoretical Model

A1.1 The Traditional economy: Derivation of the main results

In what follows, we sketch the main steps leading to the spatial equilibrium solutions in expressions (13)-(14)-(15)-(16) in the main text.

From indirect utility (2) and perfect mobility of individuals (equation 3), we obtain:

$$(\bar{q}_1)^{1-\mu} \cdot \frac{w_1}{r_1^{1-\mu}} = (\bar{q}_2)^{1-\mu} \cdot \frac{w_2}{r_2^{1-\mu}} . \qquad \text{(A1.1)}$$

The local housing market equilibrium condition, given by expression (11), implies that:

$$\frac{\bar{H}_1}{\bar{H}_2} = \frac{w_1 \cdot n_1}{r_1} \cdot \frac{r_2}{w_2 \cdot n_2} . \qquad \text{(A1.2)}$$

The marginal cost equalization condition (5) gives:

$$\lambda_1{}^{1-\alpha} \cdot w_1{}^{\alpha} = \lambda_2{}^{1-\alpha} \cdot w_2{}^{\alpha} \qquad \text{(A1.3)}$$

Local land market equilibrium condition (9) delivers the following:

$$\frac{\lambda_1}{\lambda_2} = \left(\frac{n_1}{n_2}\right)^{\alpha} \cdot \left(\frac{\bar{L}_1}{\cdot \bar{L}_2}\right)^{-\alpha} . \qquad \text{(A1.4)}$$

Equations (A1.1)-(A1.2)-(A1.3)-(A1.4) constitute a system of four equations in $\left(\frac{n_1}{n_2}, \frac{w_1}{w_2}, \frac{r_1}{r_2}, \frac{\lambda_1}{\lambda_2}\right)$, given $\left(\frac{\bar{H}_1}{\bar{H}_2}, \frac{\bar{q}_1}{\bar{q}_2}, \frac{\bar{L}_1}{\bar{L}_2}\right)$. By taking logs and using definition (12), we obtain the solutions (13)-(14)-(15)-(16) reported in the text.

A1.2 Asymmetric Industrialization: Derivation of the main results

From indirect utility (2) and perfect mobility of individuals (equation 3), we obtain, again, equation (A1.1). The local housing market equilibrium still gives expression (A1.2).

Industrializing Area 1 coexists with rural Area 2. Since firms are perfectly mobile across areas, the marginal cost conditions (5) and (7) give:

$$\frac{\lambda_1{}^{1-\alpha-\Delta} \cdot w_1{}^{\alpha+\Delta}}{(1-\alpha-\Delta)^{1-\alpha-\Delta} \cdot (\alpha+\Delta)^{\alpha+\Delta}} \cdot \frac{1}{p} = \frac{\lambda_2{}^{1-\alpha} \cdot w_2{}^{\alpha}}{(1-\alpha)^{1-\alpha} \cdot \alpha^{\alpha}} \qquad \text{(A2.1)}$$

Local land market equilibrium conditions (9) and (17) deliver the following:

$$\frac{\lambda_1}{\lambda_2} = p \cdot \left[\frac{1-\alpha-\Delta}{1-\alpha}\right] \cdot \left(\frac{n_1}{n_2}\right)^{\alpha} \cdot \left(\frac{\bar{L}_1}{\cdot \bar{L}_2}\right)^{-\alpha} \cdot \left(\frac{n_1}{\bar{L}_1}\right)^{\Delta}. \qquad \text{(A2.2)}$$

Equations (A1.1)-(A1.2)-(A2.1)-(A2.2) constitute a system of four equations in $\left(\frac{n_1}{n_2}, \frac{w_1}{w_2}, \frac{r_1}{r_2}, \frac{\lambda_1}{\lambda_2}\right)$, given $\left(\frac{\bar{H}_1}{\bar{H}_2}, \frac{\bar{q}_1}{\bar{q}_2}, \frac{\bar{L}_1}{\bar{L}_2}, p, \Delta\right)$. By taking logs and using definition (12), we obtain the solutions (19)-(20)-(21)-(22) reported in the text.

A1.3 Impact of the housing plan on regional outputs

By exploiting the production functions (4) and (6) calculated for the levels of land and labour that clear the local input markets, we can also obtain the (log of the) ratio between local output levels as a function of the local relative labour supply, $\hat{n}$. Such an output gap, denoted as $\hat{y}$, is equal to ln $\left(\frac{Y_1}{Y_2}\right)$ in case (i), and equal to ln $\left(\frac{pX_1}{Y_2}\right)$ in case (ii). Thus, we can write the following:

$$\begin{cases} \hat{y} = \alpha \cdot \hat{n}, & if \;\; p \cdot \left(\frac{n_1}{\bar{L}_1}\right)^{\Delta} \leq \chi^* \\ \hat{y} = \alpha \cdot \hat{n} + \ln\left[p\left(\frac{n_1}{\bar{L}_1}\right)^{\Delta}\right], & if \;\; p \cdot \left(\frac{n_1}{\bar{L}_1}\right)^{\Delta} > \chi^* \end{cases} \qquad \text{(A3.1)}$$

Equation (A3.1) is a discountinuous and increasing function in $\hat{n}$. The discontinuity occurs at a critical level of $\hat{n}^*$, such that $p\left(\frac{n_1}{\bar{L}_1}\right)^{\Delta} = \chi^*$, as shown in Figure A1.1 below.

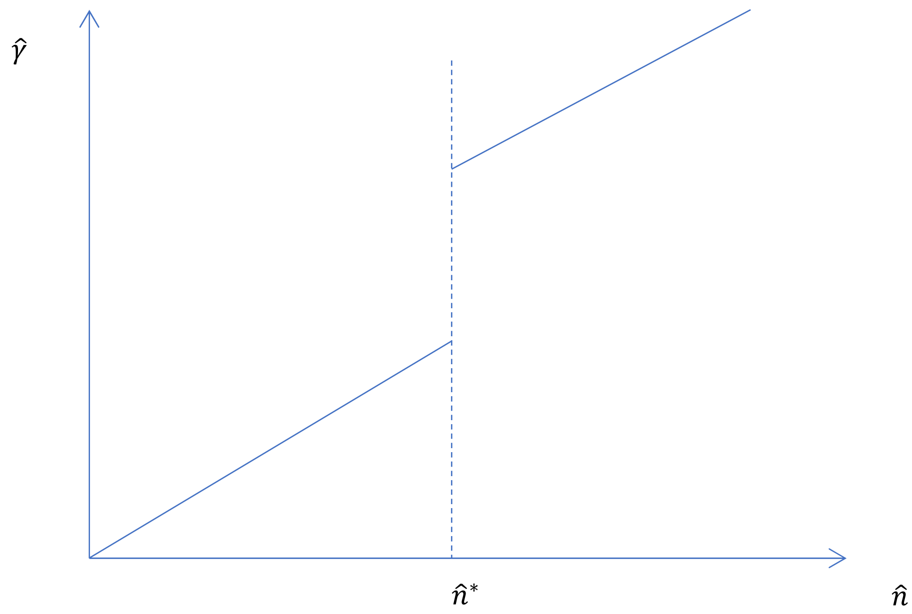


Figure A1.1. Output level differential across areas

Figure A1.1 emphasizes some of the main featuers of the model. First, an asymmetric housing plan biases the distribution of the economy-wide population in favour of an area (here, Area 1), increasing local production. But, if the population shift is sufficiently large, it will also lead to the adoption of more labour-intensive production methods. In this case, firms switch to manufacturing, and Area 1 industrializes.

A1.4 The role of Capital.

When we considered technology in the traditional sector (equation 4) and technology in the manufacturing sector (equation 6) in the main text, we postulated that production required only land and labour. To gain some additional implication, especially about local industrial specialization *within* manufacturing, we will also consider the role of capital input, denoted by K_c. The *local* price of capital is indicated as ρ_c. Notice that, by assuming that the local price of capital ρ_c can differ across areas, we are postulating that the capital factor is not perfectly mobile economywide.[17] To justify this view, we can appeal to financial frictions at the local level: see Midrigan and Xu (2014) and the literature quoted therein. For instance, the scarcity of valuable and collateralizable assets may limit the local availability of credit, preventing the access to capital-intensive technologies. Thus, the extent of imperfections in local credit markets can strongly contribute to shape the industrial structure of an area.

When capital is a factor of production, the traditional technology can be written as:

$$Y_c = L_c^{1-\alpha-\beta} \cdot N_c^{\alpha} \cdot K_c^{\beta}, \qquad \text{(A4.1)}$$

where $\{\alpha, \beta\} \in (0,1)$, and $\alpha + \beta < 1$. Profit-maximizing firms will demand a quantity of land equal to $L_c = \frac{(1-\alpha-\beta)\cdot Y_c}{\rho_c}$, a quantity of labour equal to $N_c = \frac{\alpha \cdot Y_c}{w_c}$, and a quantity of capital equal to $K_c = \frac{\beta \cdot Y_c}{\rho_c}$.

Again, firms' full mobility ensures that marginal costs are equalized across areas, yielding the following:

$$\frac{\lambda_c{}^{1-\alpha-\beta} \cdot w_c{}^{\alpha} \cdot \rho_c^{\beta}}{(1-\alpha-\beta)^{1-\alpha-\beta} \cdot \alpha^{\alpha} \cdot \beta^{\beta}} = 1 \;\; \text{for } c = \{1,2\}. \qquad \text{(A4.2)}$$

Suppose that firms in Area 1 consider producing manufactured goods, X, which sell at the international price p. With capital input, the manufacturing technology now becomes:

$$X = L_1^{1-\alpha-\beta-\Delta} \cdot N_1^{\alpha+\delta\Delta} \cdot K_1^{\beta+(1-\delta)\Delta}, \qquad \text{(A4.3)}$$

[17] If capital were perfectly mobile, it would have a unique nationwide (or international) price ρ.

with $\delta \epsilon (0, 1]$. If technology (A4.3) is implemented in Area 1, the marginal cost will be equal to the competitive price p:

$$\frac{{\lambda_1}^{1-\alpha-\beta-\Delta} \cdot {w_1}^{\alpha+\delta\Delta} \cdot \rho_1^{\beta+(1-\delta)\Delta}}{(1-\alpha-\beta-\Delta)^{1-\alpha-\beta-\Delta} \cdot (\alpha+\delta\Delta)^{\alpha+\delta\Delta} \cdot \beta^{\beta+(1-\delta)\Delta}} = p \quad . \qquad \text{(A4.4)}$$

In Area 1, where local factor prices are given by (w_1, λ_1, ρ_1), local entrepreneurs will find it convenient to abandon the rural sector to enter manufacturing when it holds that:

$$\frac{{\lambda_1}^{1-\alpha-\beta-\Delta} \cdot {w_1}^{\alpha+\delta\Delta} \cdot \rho_1^{\beta+(1-\delta)\Delta}}{(1-\alpha-\beta-\Delta)^{1-\alpha-\beta-\Delta} \cdot (\alpha+\delta\Delta)^{\alpha+\delta\Delta} \cdot \beta^{\beta+(1-\delta)\Delta}} \cdot \frac{1}{p} \leq \frac{{\lambda_c}^{1-\alpha-\beta} \cdot {w_c}^{\alpha} \cdot \rho_c^{\beta}}{(1-\alpha-\beta)^{1-\alpha-\beta} \cdot \alpha^{\alpha} \cdot \beta^{\beta}} \quad . \qquad \text{(A4.5)}$$

Condition (A4.5) can be rearranged into:

$$\left(\frac{w_1}{\lambda_1}\right)^{\delta\Delta} \cdot \left(\frac{\rho_1}{\lambda_1}\right)^{(1-\delta)\Delta} \cdot \frac{1}{p} \leq \frac{(1-\alpha-\beta-\Delta)^{1-\alpha-\beta-\Delta} \cdot (\alpha+\delta\Delta)^{\alpha+\delta\Delta} \cdot \beta^{\beta+(1-\delta)\Delta}}{(1-\alpha-\beta)^{1-\alpha-\beta} \cdot \alpha^{\alpha} \cdot \beta^{\beta}} \quad , \qquad \text{(A4.6)}$$

requiring that the local costs of labour and capital must be sufficiently low, relative to the price of land. As for condition (7) in the text, also (A4.6) can be restated in terms of $(\bar{L}_1, n_1, K_1)$, the input endowments available in Area 1, so to yield:

$$p \cdot \left(\frac{n_1}{\bar{L}_1}\right)^{\delta\Delta} \cdot \left(\frac{K_1}{\bar{L}_1}\right)^{(1-\delta)\Delta} \geq \left[\frac{1-\alpha-\beta}{1-\alpha-\beta-\Delta}\right]^{1-\alpha-\beta-\Delta} \cdot \left[\frac{\alpha}{\alpha+\delta\Delta}\right]^{\alpha+\delta\Delta} \cdot \left[\frac{\beta}{\beta+(1-\delta)\Delta}\right]^{\beta+(1-\delta)\Delta} \equiv \chi^{**}, \qquad \text{(A4.7)}$$

which is the analog of the implementation condition (8) in the main text. Condition (A4.7) has several implications.

- First, manufactured products will be produced in Area 1 only if local labour *and* capital are sufficiently abundant, given the endowment of land $\bar{L}_1$.

- Second, since the left-hand-side of (A4.7) can be rewritten as $p \cdot \left(\frac{n_1}{\bar{L}_1}\right)^{\Delta} \cdot \left(\frac{K_1}{n_1}\right)^{(1-\delta)\Delta}$, with $\delta < 1$, the likelihood of implementing the manufacturing technology gets higher when the local capital-labour ratio $\left(\frac{K_1}{n_1}\right)$ is larger.
- Third, and most important, the existence of frictions limits the access of producers to credit markets and, thus, puts a cap on the availability of local capital. When such financial frictions are strong, manufacturing is viable - at best - only to industrial sectors that require low capital-labour ratios. As emphasized by Midrigan and Xu (2014), the presence of constraints on the amount of debt producers can issue can prevent "traditional-sector producers from joining the modern sector" (p.423).

In our context, such conclusions carry interesting implications. Suppose that - as, in Kiyotaki and Moore (1997) – the debt capacity of a producer is limited by the value of collateral that can be pledged. Much of the value of collateral will depend on the value of local real estate, as shown by evidence in Gieseke et al. (2014). Since the value of real estate is generally higher in more densely populated areas, access to debt will be easier in larger urban centres. As a consequence, manufacturing firms located in larger towns are more likely to specialize in capital intensive industrial sectors, while -due to restricted availability of credit- firms located in smaller towns will tend to specialize in sectors that exhibit low capital-labour ratios.

Appendix 2 - Variable description and Summary Statistics

Table A1. Variable description

Variable	Description	Source
Pop. 1951 (ln)	Total population	Census of Population and Housing, ISTAT
Population growth 1951-1936	Growth rate of population in 1951-36	Census of Population and Housing, ISTAT
North, Centre, South and Islands	Dummy for territorial macro area	Atlas of Italian municipalities, ISTAT
Elevation (ln)	Elevation of the municipality measured at the town hall level	Atlas of Italian municipalities, ISTAT
Steepness (ln)	Difference between maximum and minimum elevation level within municipality	Atlas of Italian municipalities, ISTAT
Surface (ln)	Total surface of municipality	Atlas of Italian municipalities, ISTAT
Non-urbanized fraction of the municipality surface, 1951	Fraction of residents living in scattered houses over total population	8000 Census database (data taken from Census of Population and Housing), ISTAT
Share of Empl. in manufactures and mining, construction, and private services, 1951	People employed in different sectors over total number of workers employed in the municipality	Census of Industry and Services, ISTAT
Share of Empl. in agriculture, 1951	Resident population employed in agriculture over total resident workers	8000 Census database (data taken from Census of Population and Housing), ISTAT
Share of active population, 1951	Active population over resident population (15-64 years old)	8000 Census database (data taken from Census of Population and Housing), ISTAT
Share of people with at least a bachelor's degree, 1951	People with at least a bachelor's degree over population (6+)	8000 Census database (data taken from Census of Population and Housing), ISTAT
Ageing index, 1951	Population aged 65+ over population aged 0-14	8000 Census database (data taken from Census of Population and Housing), ISTAT
Homeownership rate, 1951	Number of homes that are owner-occupied over total number of occupied households	8000 Census database (data taken from Census of Population and Housing), ISTAT
Distance from the nearest city of birth of a MP	Air distance (in km) between the municipality and the nearest city of birth of a MP in charge in 1950-1958	Author's elaboration based on archives of the Italian Parliament and ISTAT data
Local minimum wage index	Local wage index (in the 1950s) at the provincial (Nuts-3) level	Data are taken from de Blasio and Poy (2017)
Highway	A dummy indicating if the municipality is in a province (Nuts-3) where an highway is open in the 1950s.	Data are taken from Pozzi et al. (2006)

Table A2. Summary statistics

Variable	Mean	sd	p50	min	max	N
Pop. 1951 (ln)	7.949	1.031	7.902	4.304	14.317	7,469
Population growth 1951-1936	.051	.134	.051	-1.296	2.402	7,469
North	.551	.497	1.000	.000	1.000	7,469
Centre	.125	.331	.000	.000	1.000	7,469
South and Islands	.322	.467	.000	.000	1.000	7,469
Elevation (ln)	5.336	1.303	5.669	.000	7.618	7,469
Steepness (ln)	5.611	1.701	6.122	.000	8.220	7,469
Surface (ln)	3.134	.997	3.114	-2.302	7.312	7,469
Non-urbanized fraction of the municipality surface, 1951	.317	.257	.263	.000	.971	7,469
Share of Empl. in manufactures and mining, 1951	.446	.177	.432	.009	.966	7,469
Share of Empl. in construction, 1951	.078	.104	.044	.000	.936	7,469
Share of Empl. in private services, 1951	.475	.167	.485	.022	.965	7,469
Share of Empl. in agriculture, 1951	.576	.240	.637	.001	1.000	7,469
Share of active population, 1951	.555	.086	.549	.309	.888	7,469
Share of people with at least a bachelor's degree, 1951	.020	.012	.017	.000	.131	7,469
Ageing index, 1951	.422	.248	.345	.051	2.747	7,469
Homeownership rate, 1951	.560	.208	.583	.000	1.000	7,469
Distance from the nearest city of birth of a MP in 1950-1958	14.075	27.287	11.232	.000	856.550	7,469
Local minimum wage index	86.477	7.767	87.000	70.000	100.000	7,469
Highway	.240	.427	.000	.000	1.000	7,469

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