PROJECTING ITALY'S LABOUR MARKET: ASSESSING THE SUSTAINABILITY OF THE WORKFORCE BY 2050[1]

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Abstract. Istat produces annual projections on population and households to describe future demographic trends, providing both overall values and detailed age and sex breakdowns. In a context of rapid population ageing, Italy stands out as one of the oldest countries in the world, with a mean age of the population close to 47 years. This demographic evolution draws attention to the sustainability of the future of the labour market, in terms of both size and age pattern of the active population. On 1 January 2025, the working-age population (15–64 years) represents 63.4% of the total, marking a slight decrease compared to 2024. In contrast, the share of those aged 65+ reaches 24.7%, up by 0.4 percentage points from the previous year. Ageing, longer education and low fertility are expected to reshape labour supply in the coming decades, with major implications for economic growth, welfare systems, and policy planning. In this work we present a secondary level projection model to evaluate labour market trends in Italy up to 2050. The analysis focuses on activity rates by sex and five-year age group. The model is based on a static approach where predicted activity rates are applied to population forecasts. Key factors influencing labour participation are explicitly considered, including increasing life expectancy, delayed entry into the labour market due to higher education attainment, and the progressive rise in retirement age. However, the aim of this work is not to estimate future employment or unemployment rates, given the many economic implications that would require consideration in a medium-long term perspective. The main goal is to assess the long-term sustainability of the labour market and to explore how demographic dynamics may affect the availability of the workforce in the future.

1. Introduction

The progressive aging of the population is one of the most significant demographic transformations currently affecting Italy and many other developed countries. This phenomenon is not limited to an increase in the average age but also entails a profound shift in the population structure, with older age groups making up an increasingly larger share compared to those of working age.

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[1] Although this paper is the outcome of the authors' joint reflections, paragraph 1 was drafted by Andrea Spizzichino, paragraphs 3,4 by Cristina Ocello, paragraphs 2,5,6 by Marco Rizzo, paragraph 7 by Martina Lo Conte and paragraph 8 by Marco Marsili.

This change has direct and substantial implications for the labour market. On one hand, the shrinking proportion of people between the ages of 15 and 64 - traditionally considered the population in active age - implies a potential decline in the labour supply. Fewer people of working age may result in fewer available workers, which could impact overall productivity, economic growth and sustainability of pension and welfare systems.

On the other hand, the fact that life expectancy has been rising, and retirement age has been gradually increasing, leads to a longer stay in the labour force. More and more individuals remain in an active status beyond the age of 65, whether by personal choice, financial necessity, or because of pension reforms.

Furthermore, population aging interacts with other demographic trends, such as declining birth rates and growing numbers of young people pursuing higher education, who tend to enter the labour market later than in the past. The result is a shrinking of the so-called "core" segment of the labour force - the age group that has traditionally borne the greatest economic and productive burden in the country.

This paper fits within this context by integrating official population projections and labour market statistics produced by Istat. Specifically, a derived projection model has been developed to estimate the evolution of the Italian labour market up to 2050. The model focuses on labour force participation rates, broken down by sex and five-year age group, using a static approach that applies the estimated participation rates to demographic projections.

2. Literature Review

Given the relevance of the issue, many national statistical offices and international organizations develop their own projection models. Among all, the U.S. Bureau of Labor Statistics stands out for producing forecasts that extend well beyond labour force participation, covering even employment, industry output, and final demand (Dubina, 2004). Projection horizons generally range from ten to fifty-five years (EPC, 2024).

The literature identifies four main approaches to projecting participation rates: (1) Judgmental (qualitative) methods: based on scenarios or targets established by experts. (2) Time extrapolation models or growth curves: describe the historical evolution of a variable as a function of time and extend the trend into the future, in particular, sigmoid curves (such as logistic curves), being well suited to processes tending toward stabilization, are widely used. (3) Regression models: estimate the relationship between participation rates and economic, demographic, or cultural factors. (4) Cohort-based approach: estimates participation rates based on the probability of entering or exiting the labour force for each cohort; these probabilities are kept constant or extrapolated over time to generate projections. See Houriet-Segard (2011) for a review of methodologies.

The main European reference in this field is the projection model developed by Carone in 2005 for the European Commission, within the Ageing Working Group. This model is based on a cohort-based approach projecting age- and sex-specific participation rates up to 2050. This methodology follows the OECD approach, with one relevant modification: the use of single years of age instead of five-year age groups. The method allows capturing generational differences in participation profiles, such as the increase in female participation. Projections are formulated under a "no policy change" scenario. Key results from this model highlight a projected decline in the active population and its ageing, because of the approaching retirement of the baby-boom generations and the lower birth rates in younger generations entering the working-age population (Carone, 2005).

A further international reference for active population projections is provided by the International Labour Organization (ILO). Their projections are developed using econometric methods, which, due to their flexibility, ensure international applicability and comparability. Specifically, the ILO develops three scenarios: (1) Constant scenario: participation rates are kept constant over the projection period, with only population changing. (2) Imputation scenario: participation rates are obtained using an imputation procedure for five-year age groups. (3) Logistic trend scenario: participation rates are extrapolated using various logistic trend variants for each time series (ILO, 2015).

3. Objectives

Considering the projected decline in the working-age population by 2050 (Istat, 2024), this project aims to estimate the evolution of labour force participation and assess its implications for labour market sustainability. The research question is: "*Will the active population be able to meet labour market demand over the next 25 years?*".

Population aging, declining birth rates, and migratory flows will significantly affect the availability and composition of the workforce. Analyzing these elements allows for the anticipation of potential imbalances between labour supply, demand and the definition of targeted strategies to support labour market resilience. The main objective is to project activity rates disaggregated by structural variables such as sex, age, and territory. According to the ILO, labour market indicators should be calculated not only in aggregate but also disaggregated by relevant characteristics (ILO, 2023), as aggregate stability may conceal significant underlying variations. This is the case in Italy, where differences by sex and region are particularly marked.

The analysis extends to 2050, with five-year age groups from 15 to 74. Extending the activity rate beyond the canonical 65 reflects projected pension eligibility requirements. The predicted number of potential workers will be derived from

projections accounting for trends in life expectancy, the pension system, and educational participation.

This projection is part of Istat's broader forecasting system, which since 1989 has been producing demographic projections at national and regional level. In 2021, the system was extended to municipalities and to households by type. Its main feature is an integrated approach, where demographic, household, and labour force components are analysed in mutual interaction.

4. Data

Building a model that can be capable of predicting the future evolution of the potential pool of workers requires putting together a considerable database. In particular, the data used in this study are as follows:

1) Base population: we use the Istat median-scenario probabilistic population projections by sex, age, and region (base 1.1.2024), covering the forecast period from 2025 to 2050 (Istat, 2024).
2) Labour market participation: data used to construct participation indicators come from the Labour Force Survey (LFS). We use the active population and the corresponding activity rate, disaggregated by sex, region, and five-year age groups from 15 to 74. The time series covers the period 2004–2024.
3) Education enrolment: to account for the postponement of labour market entry due to longer educational pathways, we use enrolment rates derived from the Istat Labour Force Survey.
4) Retirement age: to capture the evolution of the pension system, we include the projected minimum legal age for retirement, calculated annually by the State General Accounting Department in the report "Medium- and long-term trends of the pension and welfare system – 2024". These projections are based on previous Istat median-scenario population projections (base 1.1.2022) (MEF, 2024).

5. Model

The model is based on the static method known as the Propensity Model. This approach relies on *propensity rates*, which in this case of study are equivalent to activity rates. In fact, they are defined as the proportion of individuals in age group x who are in the labour force at time t:

$$Propensity\ Rate_{x,t} = \frac{P_{LF,x,t}}{P_{x,t}} \qquad (1)$$

The labour force is defined as the sum of employed individuals and those actively seeking employment (i.e., unemployed).

The proposed method offers several advantages: it aligns well with official population projections, produces widely used labour market indicators such as the number of active/inactive individuals and activity rates, is easily replicable and provides a good level of detail in the outputs.

The model consists of six main steps, each of which is discussed in detail below.

5.1 Estimating the Household Population

To ensure consistency with the definition of the population used in the LFS, we first estimate the population living in private households. Individuals residing in institutional households (e.g., hospitals, military barracks, prisons, care homes, religious communities) are then excluded from the projected population.

We calculated average incidence rates of the institutionalised population by sex, five-year age group, and region. Given the relative stability of this population over observed time, we assumed a constant trend in these incidence rates throughout the forecast horizon.

By applying the complement to 100 of these percentages to the total projected population from 2025 to 2050, we obtain the population living in private households by region, sex, and age group.

5.2 Calculating the Total Activity Index (TAI)

The projection of the future evolution of the active population is based on a synthetic indicator that summarises activity behaviours over time. This indicator, referred to as the Total Activity Index (TAI), is calculated as the weighted sum of age-specific activity rates, with weights given by the person-years lived in each age group:

$$TAI_t = \sum_{x=15-19}^{70-74} Activity\ Rate_{x,t} \cdot L_{x,t} \tag{2}$$

Where x = five-year age group, t = year.[2]

The Lx values, which represent the person-years lived in each five-year age group x, by sex s, in year t, are derived from official Istat life tables. Under the assumption of independence between mortality and labour force participation, the TAI represents the average number of years a cohort of individuals would be expected to spend as part of the labour force (i.e., employed or actively seeking work) under the age-specific conditions observed in a given year.

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[2] For clarity, the subscripts for disaggregation by sex (*s*= male, female) and geographical area (*i*= North-West, North-East, Centre, and South) have been omitted from the formula.

For reference, in Italy in 2024, the TAI was 36.9 years for men and 28.1 years for women. This means that, on average, a man could expect to spend nearly 37 years as part of the labour force, a woman about 28 years. TAI values are calculated at the NUTS-1 level: North-West, North-East, Centre and South. This choice was made to allow for more stable extrapolations, as the results are less affected by small and volatile values such as those observed at the regional level.

5.3 Projecting the TAI

To produce projections of the Total Activity Index up to 2050, we applied forecasting techniques that ensure both statistical robustness and plausibility of the results over time. The projections are based on the historical time series data and make use of the most reliable models for temporal extrapolation, selected according to goodness-of-fit criteria coherence with observed trends.

The TAI was disaggregated by sex and geographical area to reflect heterogeneous labour market dynamics across population. Separate models were estimated for each subgroup, allowing the projections to capture differentiated trends by gender and territory. The final output consists of a set of harmonised projections that preserve internal consistency and ensure analytical detail at subnational level.

Figure 1 – *Observed and extrapolated TAI by sex. North-East and South Italy - 2004-2050.*
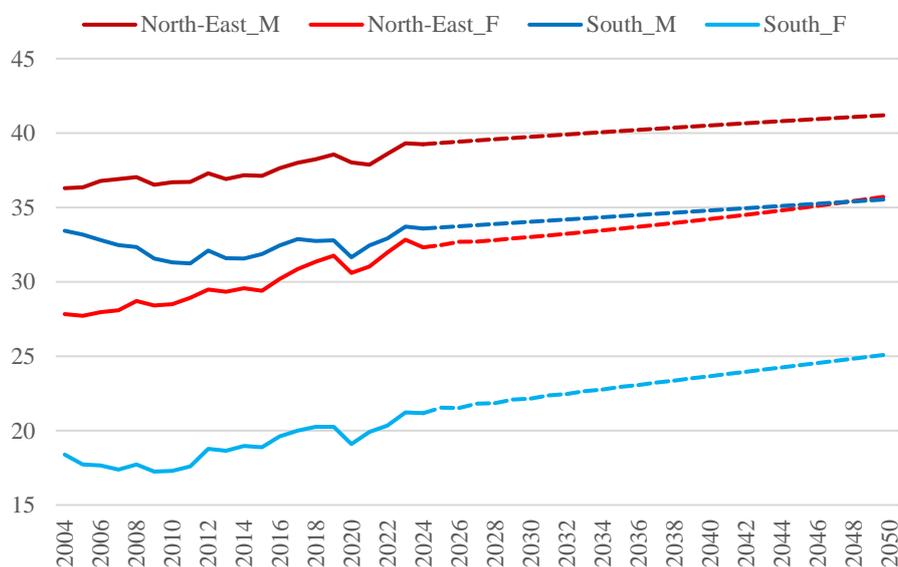
5.4 Adjusting the age distribution of Activity Rates

Once the TAI has been projected for each forecast year, age-specific activity rates (by sex and age group) for 2025–2050 are obtained by redistributing the TAI on the average distribution observed in 2022–2024.

Instead of assuming a static age distribution, the model incorporates changes driven by two key demographic and institutional dynamics: the evolution of the pension system and the increasing educational attainment among youth.

The rise in the minimum legal retirement age - driven by Law no. 122/2010 - is expected to delay exit from the labour market for older individuals. This results in a wider area under the right tail of the age-activity curve.

At the same time, prolonged education among young people delays entry into the labour market (Carone, 2005), thus reducing the area under the left tail of the curve - although with a lesser effect than that driven by the pension system.

The impact of later retirement is handled by incorporating the projected retirement age as estimated by the State General Accounting Office (MEF, 2024) in its annual report "Medium- and Long-Term Trends of the Pension and Healthcare System". First, we calculate the elasticity of activity rates (*AR*) for older age groups with respect to changes in the retirement age over 2004–2024, separately by sex and geographical area:

$$e = \frac{\Delta AR / AR}{\Delta age\_r / age\_r} \tag{3}$$

Using the average elasticity values by sex, age group, and region, and the projected retirement age from MEF, we adjust the 2022–2024 age distribution of activity rates accordingly:

$$AR_{t,x,s} = \left(AR_{22-24,x,s} \cdot e \cdot \frac{age\_r_t - age\_r_{24}}{age\_r_{24}} \right) + AR_{22-24,x,s} \tag{4}$$

To model delayed entry into the labour force, we use enrolment rates from Istat Labour Force Survey. For each sex and age group, we estimate the probability of exiting the education system over the 2012–2022 period:

$$P_{x,s,t} = \frac{School\_Rate_{x,s,t} - School\_Rate_{x+1,s,t+1}}{School\_Rate_{x,s,t}} \tag{5}$$

We then compute the average trend in these probabilities for younger cohorts and adjust the 2022–2024 activity rate distributions to account for the share of

individuals likely to remain in education each year, assuming future trends follow the pattern observed over 2012–2022.

5.5 From TAI to age-specific activity rates

Once the age distribution of activity rates - corrected for retirement and education effects - is calculated for each forecast year, sex, and geographical area, final activity rates are obtained through:

$$AR_{x,s,t} = AR_{x,s,22-24} \cdot \frac{TAI_{s,t}}{TAI_{s,22-24}} \cdot \frac{L_{x,s,22-24}}{L_{x,s,t}} \tag{6}$$

Where the second and the third factors adjust the distribution to match the projected TAI and the changes in mortality (person-years lived) over time:

5.6 Deriving the projected active and inactive population

Finally, applying these projected activity rates to the projected household population (from step 1), we obtain the active population by sex, age group, and geographical area up to 2050. The inactive population is derived by subtracting the active population from the household population. National-level estimates are produced in bottom-up approach by aggregating single geographical areas.

6. Results

The activity rate for the age group 15-74 in Italy is expected to increase over the entire period, rising from 57.9% in 2024 to 61.9% in 2050 (+4 percentage points). Significant gender differences persist. The male activity rate will grow from 66.5% in 2024 to 68.3% in 2050, while the female rate, starting from a considerably lower level of 49.4%, is expected to reach 55.0% by 2050. This trend reflects a gradual but meaningful convergence in labour force participation between men and women. One underlying reason for this trend is the higher rate of female education. It is already evident that labour force participation is higher among female graduates. Given the expected further growth in the number of women with tertiary education.

Nevertheless, the distribution of activity rates shows a lower labour market participation for females than males at all ages. Moreover, territorial differences are evident. Figure 2 shows the projected activity rates by age group and sex in the North-West and South Italy - the geographical areas with the highest and lowest levels. In the North-West the activity rate for men in the 30-49 age group will reach over 96% in 2050, while in the South it will just exceed 87%, almost 10 percentage points less. Females' rates are much lower but in North-West they will overcome 80%. An increase for the female rate in the South is expected by 2050. In the core

working age groups (30-54) the activity rate in 2050 is expected to reach almost 64%, up from just over 50% in 2024.

Figure 2 – *Activity rates by gender and age class. North-West and South Italy – Years 2024 and 2050. Percentage values.*
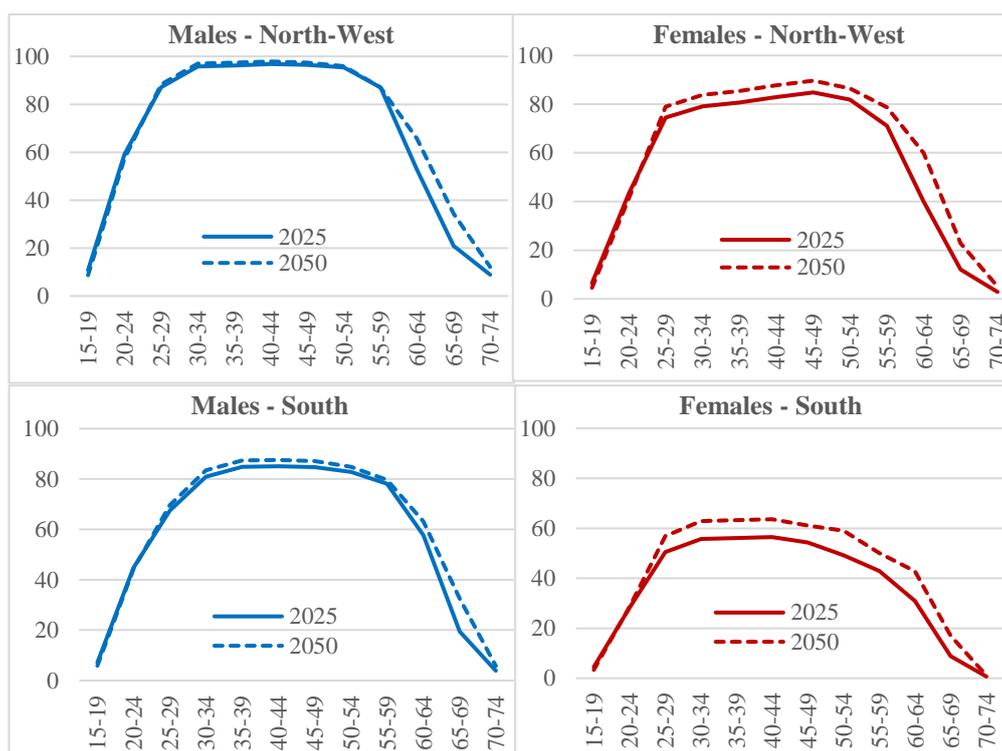
Despite the increase in activity rates, the size of the active population is expected to decrease for both sexes. Figure 3 shows a gradual but marked change in the labour market, driven mainly by an ageing and decreasing population. The overall working-age population is expected to decline steadily: from around 22.2 million in 2024 to 19.1 million in 2050 for men, from 21.9 to 17.8 million for women. Within this shrinking population, the number of active individuals also declines: active males fall from 14.6 to 13.0 million, while active females decrease from 11.0 to 9.8 million. In this scenario, the non-active population declines notably, particularly among women, from 11.2 to 8.0 million. Although female participation remains significantly lower than male participation throughout the period, it is interesting to note that among women the chance of an active population overtaking the inactive one is expected around 2038, equalling what has always been observed among men.

Our labour force projections underscore the dual challenge Italy has to face in the coming decades: a declining working-age population and persistent but narrowing gender disparities in labour market participation.

Figure 3 – *Population by activity status and gender. Italy – Years 2024 - 2050. Millions.*
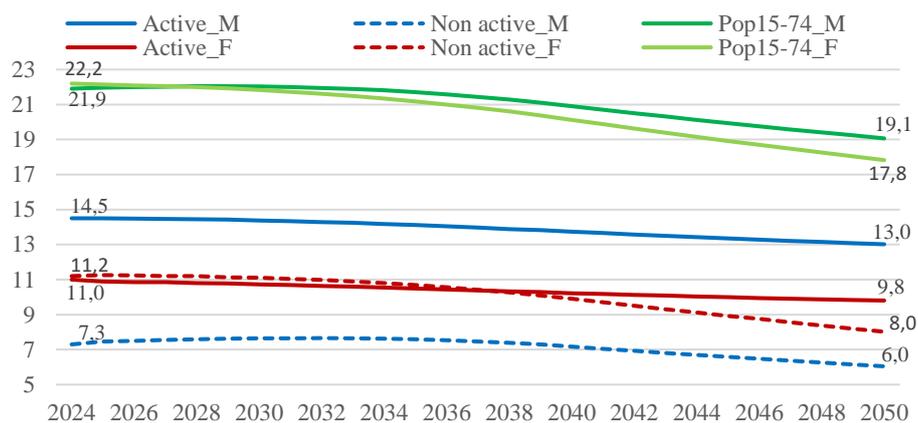
To evaluate how future labour market dynamics are shaped by changes in participation behaviour rather than by demographic trends, a forecasting exercise of the active and inactive population was carried out assuming constant rates. Activity rates observed in 2024 were applied to the median scenario of the population projection throughout the projection horizon.

Figure 4 – *Population by activity status projected with constant and variable rates. Italy – Years 2024 - 2050. Millions.*
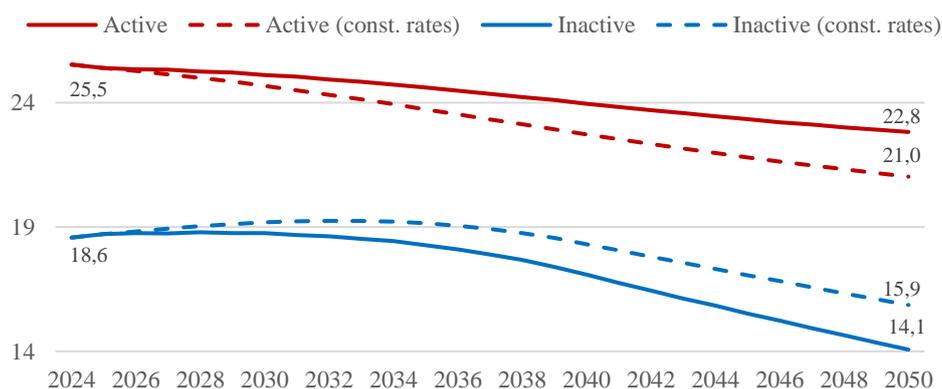
The results show that assuming unchanging participation rates has significant effects: if labour market participation remained fixed at the most recent observed levels, by 2050 the number of active individuals would be almost two million lower (22.8 million in the variable-rate scenario versus 21 million in the constant-rate scenario). Conversely, the inactive population would increase, expanding the share of people who are neither employed nor actively seeking work to 15.9 million individuals.

7. Conclusions

The experiment appears to yield robust results and could strengthen the set of projections carried out by Istat, by adding to core demographic indicators and family structure valuable insights into the potential labour force.

The resulting information may hold significant socio-demographic value, helping policymakers gain a clearer understanding of potential changes in the share of the labour force and of the broader social dimensions connected to this issue.

The preliminary results highlight that, in a context of a projected population decline (–16.4% of residents aged 15-74 between 2024 and 2050 according to the medium scenario), the working-age population may experience a less pronounced decrease (–10%), particularly if progress continues to be encouraged among women. This also involves a continued increase in participation at older adult ages under current legislation.

Regarding women and South Italy, there is significant potential for growth in the active segment of the population. Currently, these groups show much lower values compared to men and other geographical areas. Investing in these areas could help slow down the decline of the Italian working-age population, thereby supporting the labour market. However, much like other well-known future demographic trends (especially births and deaths), the structural effects of population dynamics have a significant - and in some respects irreversible - impact on the overall levels of the future labour force, even under assumptions of rising activity rates.

The future evolution of the job offer in Italy will be influenced by various structural factors, not only demographic, especially technological. The main trends that will probably characterize the next decades consist of a progressive digital transformation and automation of society, with growing sectors such as ICT and artificial intelligence. The effect on the job offer will involve the growth of roles linked to technology, but also the need to retrain workers in traditional sectors, which many companies already struggle to find today. On a purely demographic level, this requires proactive policies towards international migratory processes, considering the overall modest contribution that could come from future births, in the search for

the human capital that the country will need to face the future socio-economic challenges.

The decline in the working-age population is therefore one of the most critical challenges for Italy in the next decades. Unless structural interventions are made, the real risk is to have not an adequate number of workers to support all the growing sectors. An increase in female participation alone should be seen as an opportunity, as it would mean millions more female potential workers. Likewise, targeted interventions in disadvantaged areas, particularly in the South, lead to the conclusion that success is possible, with clear economic and demographic benefits for the country.

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