The long journey to permanent employment

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Abstract

We propose the expected hitting time to permanent employment—i.e., the average time it takes for individuals in any labour market state to attain permanent employment—as a new indicator for assessing the effectiveness of labour market reforms. Since it captures changes in transition probabilities across all economic states, it provides a comprehensive measure of underlying labour market dynamics. Applying this metric to the Italian labour market for the period 2013–2020, we find that expected hitting times from temporary employment, unemployment, and inactivity fluctuated significantly in response to various policy interventions. Interestingly, we observe substantial differences across worker categories and notable asymmetries in responses to policy interventions based on gender, education, and geographical region.

Keywords: labour market flows, transition rates, Markov process in continuous time, expected hitting time

JEL Classification: C18, C53, E32, E24, J6.

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Contents

DA FARE:
1) estendere il numero delle categorie, specialmente per U e INACT. Ad esempio, dividere U in U più lungo di tot mesi e tutti gli altri U, e INACT tra INACT che non lavora da tot anni e tutti gli altri INACT. Questo ci permette di evitare di considerare il caso di Markov di ordine due, che forse in quanto quadrimestri forse non aggiungerebbe molto all'analisi. C'è in letteratura una qualche classificazione utile dei disoccupati di lungo periodo (ad esempio un anno), e degli INACT anche questi di lungo?
2) La mediana degli hitting times si potrebbe anche fare, ma con cinque stati le stime risulterebbero molto ballerine temo e non penso aggiunga molto all'analisi. La mediana si usa quando la variabile è continua o con un numero di classi elevato, altrimenti dice poco.
3) Che succede dopo che per la prima volta sei entrato in uno stato è per la ricerca futura. Ma intuitivamente, essendo un processo markoviano del primo ordine, nulla di diverso dato che conta solo lo stato di partenza. Se in particolare ci interessa lo stato permanente, allora si potrebbe sdoppiare in un PERM da poco e un PERM da lungo (un anno ad esempio). Ci interessa per il Job Act.
4) Possiamo calcolare il tempo di ritorno, ovvero se lascio lo stato impiego permanente, quando impiego a tornare allo stato impiego permanente.
5) Capire bene che è successo con la Poletti e gli incentivi fiscali. Questi ultimi sembrano addirittura avere un effetto o nullo o negativo (interrompono un trend decrescente).
6) Da verificare all'ISTAT se ci danno questi aggiornamenti ai dati panel (Si, si spera presto).

1 Introduction

In dual labour markets, where workers are segmented into stable and precarious employment, securing a permanent job is a priority for most working-age individuals. Even in the UK, which is often considered less segmented compared to other European countries, 65% of temporary and contract workers declared in 2022 that they would like to move to a permanent role.

The desire for a permanent job is linked to a large number of associated benefits,

the most straightforward being reduced job uncertainty, which translates into less anxiety regarding the recurrent need to find another job and a predictable income stream. Moreover, permanent jobs are typically associated with higher salaries and more comprehensive benefits, improving an individual's overall standard of living and financial security (Tealdi, 2019). Beyond financial advantages, permanent employment influences broader life decisions, such as family planning and home ownership. Studies suggest a correlation between permanent employment and improved life decisions; for example, recent research indicates higher fertility rates among individuals with permanent jobs (Prifti and Vuri, 2013; De Paola et al., 2021) as well as easier access to and more generous loanable funds for home buyers (Mistrulli et al., 2023). Conversely, job insecurity can lead to stress and anxiety, potentially impacting mental and physical health (Shahidi et al., 2016; Ritzen, 2019; Moscone et al., 2016). Finally, permanent jobs are often associated with safer working environments: temporary jobs, frequently characterized by time pressure and less stringent safety regulations, may expose workers to a higher risk of workplace accidents (Picchio and Van Ours, 2017; Koranyi et al., 2018). However, achieving the goal of permanent employment might take quite a long time, particularly for specific categories of workers.

This study estimates the expected time required to secure a permanent contract from different initial labor market states (e.g., unemployment, inactivity, temporary employment). Specifically, we compute the expected hitting times, which are built on transition probabilities across states and embed all possible different trajectories individuals may face before securing a permanent contract. While transition probabilities may be informative on their own, analyzing them in isolation provides only a segmented picture of the broader labor market dynamics. Furthermore, policy interventions may yield mixed signals: some changes in transition probabilities may indicate improvements, while others suggest deterioration, leading to ambiguity in policy assessment. An example we studied in a companion paper (Fiaschi and Tealdi, 2024) is the 2018 Italian labour market reform, which increased employment protection legislation for temporary contracts to reduce job uncertainty. While the reform successfully increased the transition probability from temporary to permanent employment, it also reduced the likelihood of inactive individuals entering the labour force. This dual effect complicates policy evaluation, underscoring the need for a comprehensive indicator capable of capturing complex labour market dynamics. We believe our proposed methodology

fills this gap and provides policymakers with a valuable tool for labour market analysis.

While extensive research examines whether temporary contracts serve as stepping stones or dead ends to permanent employment, existing studies tend to analyze individual transition probabilities in isolation rather than capturing broader labor market flows (Gregory et al., 2021 is a partial exception).[1]

We use longitudinal quarterly labour force data for the period 2013-2020 to compute transition rates between five labour market states: inactivity (INACT), unemployment (U), temporary employment (TE), permanent employment (PE), and self-employment (SE). We then calculate the expected hitting times until permanent employment, starting from the three states we believe to be more interesting: inactivity, unemployment, and temporary employment, for the entire period of observation. We identify significant fluctuations in response to various labour market policies implemented during this period. Additionally, we conduct a heterogeneous analysis by age, gender, geographical location, and education level. We find significant disparities across individual categories, with women, low-educated individuals, and those living in the South taking the longest time to transition to a permanent contract. These differences are both large and statistically significant, highlighting the persistent segmentation of the labour market. Furthermore, we observe asymmetric responses to labour market interventions, suggesting potential unintended distortion effects.

The paper is structured as follows: Section 2 outlines our methodology, which adopts a labour market flow perspective, as in the search and matching framework. Section 3 provides institutional context, while Section 4 describes the dataset. Section 5 applies our approach using Italian labour market data, highlighting key findings, and Section 6 concludes. Technical details are provided in the appendices.

2 Expected transition lengths between labour market states

In this section, we explain our approach to the study of the transition to a permanent employment that should be sufficiently flexible to deal with 'realistic and empirically implementable' scenarios in the labour market (Pissarides, 2000, p.3). In particular,

[1] See Filomena and Picchio (2022) for a review of the literature.

we argue that the transition rates, estimated but tacking the movements of individuals across labour market states, can summarize the key dynamics of the labour market, where search and matching models (Mortensen et al., 1970; Phelps, 1968) supply a meaningful economic interpretation to the estimated transition rates. Section 2.1 introduces the notation of continuos-time Markov process with a finite number of states, which is the way we model labour market dynamics; Section 2.2 deals with hitting times and expected hitting time for a continuos-time Markov process. Finally, Section 2.3 discuss the empirical implementation of the proposed methodology.

2.1 Labour market dynamics

Assume that the labour market dynamics can be well described by the following equation:

$$\dot{\boldsymbol{\pi}} = \mathbf{Q}^T \boldsymbol{\pi}, \tag{1}$$

where $\boldsymbol{\pi}$ is a $1 \times K$ vector collecting the shares of individuals in the working age population in different K states, and $\mathbf{Q}$ is a $K \times K$ matrix, whose elements are the *instantaneous transition rates* between different states, with the constraint that:

$$\boldsymbol{\pi} \mathbf{1}^T = 1, \tag{2}$$

where $\mathbf{1}$ is a $1 \times K$ vector of ones; Equation (2) simply states that the shares of working age individuals in the K labour market states sum to one. The matrix of (instantaneous) transition rates $\mathbf{Q}$ is assumed to satisfy the following conditions:

$$\begin{cases} q_{ii} \leq 0 \; \forall i \in \{1, \cdots, K\}; \\ q_{ij} \geq 0 \; \forall i, j \in \{1, \cdots, K\}; \text{ and} \\ \sum_{j=1}^{K} q_{ij} = 0 \; \forall i \in \{1, \cdots, K\}, \end{cases} \tag{3}$$

which amounts to assume that the process governing the labour market dynamics is *conservative* (Cox and Miller, 1972, p. 180), i.e., there are no entries and exits from/to the working age population and, hence, the working age population is constant. Under general conditions (i.e., finite K), the matrix $\mathbf{Q}$ represents a continuous time *honest*

Markov process with discrete states (Cox and Miller, 1972, p. 182), i.e.:[2]

$$\mathbf{P}(t) = \exp(t\mathbf{Q}), \tag{4}$$

where $\mathbf{P}(t)$ is the matrix collecting the transition probabilities from period 0 to period t, with $\mathbf{Q}^0 = \mathbf{I}$. When $\mathbf{Q}$ is constant over time, the general solution to Equation (1) is (Hirsch et al., 2012, p. 129):

$$\boldsymbol{\pi}(t) = \boldsymbol{\pi}(0)\exp(t\mathbf{Q}), \tag{5}$$

where $\boldsymbol{\pi}(0)$ is the $1 \times K$ vector which collects the shares at time 0. A non-trivial equilibrium is characterized by $\dot{\boldsymbol{\pi}} = 0$, i.e., $\boldsymbol{\pi}\mathbf{Q} = 0$. Solving Equation (5), using Equation (2), we get that the equilibrium distribution of $\boldsymbol{\pi}$, $\boldsymbol{\pi}^{EQ}$, reads as:[3]

$$\boldsymbol{\pi}^{EQ} = \mathbf{1}\left(\mathbf{1}^T\mathbf{1} - \mathbf{Q}\right)^{-1}, \tag{6}$$

where $\boldsymbol{\pi}^{EQ}$ is a $1 \times K$ row-vector whose elements are non-negative and sum to 1. Finally, the convergence to equilibrium is exponential and the speed of convergence is measured by the eigenvalues of the $\mathbf{Q}$ matrix (Hirsch et al., 2012, p. 110).

2.1.1 Seasonality

So far, we have assumed the matrix $\mathbf{Q}$ to be constant over time, however it might not always be the case, especially with quarter/monthly data of labour market. With high frequency observations we could have seasonality in transition rates, for instance directly related to seasonal fluctuations of employment in specific sectors, such as tourism and agriculture (Shimer, 2012). In this scenario, chosen an appropriate τ for the seasonality present in the data (e.g., $\tau = 12$ for monthly data or $\tau = 4$ for quarterly data), from

[2]The definition of the exponential matrix is the following:

$$\exp(\mathbf{Q}t) = \sum_{r=0}^{\infty} Q^r \frac{t^r}{r!} = \mathbf{I} + \mathbf{Q}t + (\mathbf{Q}t)^2/2! + (\mathbf{Q}t)^3/3! + \cdots,$$

where $\mathbf{I}$ is the $K \times K$ identity matrix (see Chapter 2 in Norris, 1998).

[3]The proof uses $\boldsymbol{\pi}\mathbf{1}^T\mathbf{1} = \mathbf{1}$.

Equation (5) we have that

$$\boldsymbol{\pi}(t+\tau) = \boldsymbol{\pi}(t) \exp\left(\mathbf{Q}_a\left(t,\tau\right)\right), \tag{7}$$

where:[4]

$$\mathbf{Q}_a\left(t,\tau\right) \equiv \log\left(\exp\left(\mathbf{Q}(t+\tau-1)\right)\exp\left(\mathbf{Q}(t+\tau-2)\right)\ldots\exp\left(\mathbf{Q}(t)\right)\right) \tag{8}$$

is the matrix of *cumulative transition rates* in the period $[t, t+\tau]$. In the time-series of $\mathbf{Q}_a\left(t,\tau\right)$ seasonality has been removed.

2.2 Hitting times and expected hitting time

For introducing the hitting times and expected hitting time, let $(x_t)_{t\geq 0} = (x_t : 0 \geq t \leq \infty)$ the *right-continuos random process* whose aggregate dynamics is represented by Eq. 1. Therefore, such a process is a family of random variables $x_t : \Omega \to \{1, \cdots, K\}$.

The *hitting time* from state i to state j is a random variable representing the distribution of times for which a random process arrives for the first time at state j starting from state i. More generally, the hitting time of a subset A of states $\{1, \cdots, K\}$ is the random variable D^A defined by:

$$D^A(\omega) := \inf\{t \geq 0 : x_t(\omega) \in A\}, \tag{9}$$

where $\omega \in \Omega$. Therefore, starting from i, the probability that $(x_t)_{t\geq 0}$ ever hits A is $h_i^A := \mathbb{P}_i\left(D^A < \infty\right)$. Norris (1998, p. 112) states Theorem 1, which can be used for the calculation of hitting probabilities.

Theorem 1 (Hitting probabilities)**.** *The vector of hitting probabilities* $h^A = (h_i^A : i \in I)$ *is the minimal non-negative solution to the system of linear equations:*

$$\begin{cases} h_i^A = 1 & \text{for } i \in A, \\ \sum_{j\in\{1,\cdots,K\}} q_{ij} h_j^A = 0 & \text{for } i \notin A. \end{cases}$$

[4] In Equation 7, the logarithm of matrix is defined such as $\exp\left(\log(B)\right) = B$. If $||B - I|| < 1$, then $\log\left(B\right) = \sum_{k=1}^{\infty} (-1)^{k+1} (B-I)^k / k$ (see Theorem 2.7 in Hall, 2003).

Starting from i, the average time taken for $(x_t)_{t\geq 0}$ to reach A is given by

$$k_i^A := \mathbb{E}_i(D^A). \tag{10}$$

The expected hitting times can be calculated by Theorem 2 (Norris, 1998, p. 113).

Theorem 2 (Expected hitting times)**.** *Assume that $q_i > 0$ for all $i \in A$. The vector of expected hitting times $k^A = (k_i^A : i \in \{1, \cdots, K\})$ is the minimal non-negative solution to the system of linear equations*

$$\begin{cases} k_i^A = 0 & \text{for } i \in A \\ -\sum_{j\in\{1,\cdots,K\}} q_{ij} k_j^A = 1 & \text{for } i \notin A. \end{cases}$$

Theorem 2 is the base of our empirical investigations: chosen a state i (say unemployment) and a state j (say employment), it allows to calculate k_i^j, i.e. the average time taken from an unemployed individual to get a job.

2.3 Empirical implementation

Since observations on the labour market states of individuals are available at discrete time, a direct estimation of $\mathbf{Q}$ is not feasible. To circumvent this issue, we first estimate $\mathbf{P}$ in discrete time and then estimate $\mathbf{Q}$ using Equation (4). Anderson and Goodman (1957, p. 92) show that each element p_{ij} of the matrix $\mathbf{P}$ can be estimated by maximum likelihood as follows:

$$\hat{p}_{ij} = \frac{m_{ij}(t)}{m_i(t)}, \tag{11}$$

where $m_{ij}(t)$ is the number of individuals in period t in state i moving in period $t+1$ in state j and $m_i(t)$ is the total number of individuals in period t in state i. From the estimate of $\mathbf{P}$, we then get an estimate of $\mathbf{Q}$ using Equation (4), under the conditions discussed by Israel et al. (2001). In particular, they argue that under mild conditions, the matrix $\tilde{\mathbf{Q}}$, which is defined by the following geometric infinite series:

$$\tilde{\mathbf{Q}} = \sum_{r=1}^{\infty} -(-1)^r \frac{(\mathbf{P}-\mathbf{I})^r}{r} = (\mathbf{P}-\mathbf{I}) - \frac{(\mathbf{P}-\mathbf{I})^2}{2} + \frac{(\mathbf{P}-\mathbf{I})^3}{3} - \frac{(\mathbf{P}-\mathbf{I})^4}{4} + \cdots \tag{12}$$

is such that $\exp\left(\tilde{\mathbf{Q}}\right) = \mathbf{P}$ and its rows sum to zero (Theorem 2 in Israel et al., 2001). A potential drawback of using Equation (12) is that it does not ensure that $\tilde{\mathbf{Q}}$ is a "valid" $\mathbf{Q}$, i.e., $\tilde{\mathbf{Q}}$ satisfies all Conditions (3). Specifically, there is no guarantee that all off-diagonal entries of matrix $\tilde{\mathbf{Q}}$ are non-negative.[5] Finally, Zahl (1955, p. 97) shows that the properties of the maximum likelihood estimate of $\mathbf{P}$ are inherited by $\mathbf{Q}$. We will use bootstrap as an alternative robust approach to inference (see Appendix A). Given $\tilde{\mathbf{Q}}$, we use Theorem 2 for estimating the expected hitting times, i.e. $\hat{k}_i^A$. Inference on the estimated expected hitting times will be by a bootstrap procedure.

[5]In Section 3, Israel et al. (2001) propose two methods to circumvent this issue. The first is to set $q_{ij} = \max(\tilde{q}_{ij}, 0)$ for $i \neq j$ and $q_{ii} = (\tilde{q}_{ii} + \sum_{j \neq i} \min(\tilde{q}_{ij}, 0)$, i.e. to set to zero all negative off-diagonal elements and change the diagonal elements to make sure the sum of each row is equal to zero. The second method sets the negative off-diagonal values to zero and spans the difference on all positive entries to assure that the sum of each row is equal to zero.

In our approach based on transition probabilities, the impact of the pandemic on the time needed to achieve (permanent or temporary) employment is measured by the first passage time (FPT), i.e., the probability distribution of quarters which an individual takes to arrive for the first time at state j, i.e., permanent or temporary employment, starting from state i, i.e., education.15 We also compute the expected first passage time (EFPT), i.e., the expected 15The FPT calculations are based on the assumption that the process represented by the transition matrices is ergodic. The share of 20-24 years old in self-employment is rather small, i.e. approximately 3.5%, hence we do not focus on the transition from school to self-employment for this age category. Moreover, in Italy 16 number of years it takes to move from the education state to the employment state (permanent or temporary) for the first time (Lieberman and Hillier, 2001, p. 818; see Appendix F for technical details). This approach differs from the one commonly used in the literature (Manacorda et al., 2017; Pastore et al., 2021). When individual longitudinal data are available (administrative records, cross-section sample survey with retrospective questions, panel and cohort surveys) and the exact dates of termination of education and starting of the first job are known, a measure of the duration of the school-to-work transition (STWT) is computed as the time elapsed until individuals who have terminated schooling exit to a job. The main drawback of this approach regards individuals that at the time of data termination or collection have finished education, but haven't had their first job and are either unemployed or inactive (incomplete transitions). The share of young individuals with incomplete transitions might be large among specific categories; this could have an non-negligible impact on the estimated STWT duration. For example, Table 1 in Pastore et al. (2020) shows large differences in the estimated Italian STWT duration when based on complete versus incomplete transitions, where in the latter the exit time to a job is set equal to the time of data termination or collection. This issue should impose a general downward bias in the estimated STWT duration and poses a potential problem for cross-country comparisons, caused by the heterogeneity in youth inactivity and unemployment rates across countries. Moreover, time series comparisons could also be problematic, as this downward bias could depend on the business cycle, i.e., on the fluctuating share of young individuals who are inactive or unemployed at the time of data termination or collection. The estimation of the EFPT is suitable whenever exact dates of termination of education and starting of the first job are not observed. Moreover, in comparison with the STWT duration estimation, the EFPT offers a sophisticated method to deal with individuals with incomplete transitions, i.e., individuals who are in education in the previous quarter and either unemployed or inactive in the current quarter, by providing an estimation of the time needed

3 Institutional background

In this section, we describe the institutional background, providing a short overview of the key labour market policies implemented during the period of observation.

Poletti Decree The Decree was approved on 21 March 2014. It removed the obligation for employers hiring temporary employees to justify their choice of hiring a worker with a temporary contract rather than a permanent contract (Di Porto and Tealdi, 2024). This represented a significant change, as an incorrectly reported justification previously entitled the employee to sue the employer and potentially have their contract converted into a permanent contract. The reform also increased the number of possible extensions from one to five, within a maximum duration of three years within the same company.

Budget Law The 2015 Budget Law (effective in January 2015) introduced a substantial hiring subsidy for new hires on permanent contracts. The subsidy applied to all newly hired permanent workers between January and December 2015, provided they had not held a permanent contract in the previous six months or with the same firm in the past three months. The subsidy consisted of a three-year exemption from social security contributions, up to a threshold of €8,060 per year. Given the average contributions typically paid by firms, this amount was considered generous (Sestito and Viviano, 2018). The subsidy also applied to conversions from temporary to permanent contracts within the same firm. In 2016, the subsidies were extended, but the exemption was reduced to 40% of social security contributions, capped at €3,250 per year for a maximum of two years. The 2017 Budget Law introduced a new provision allowing employers who hired individuals below the age of 35 on a permanent contract in 2018 to receive a 50% reduction in social security contributions for up to 36 months, with a cap of €3,000 annually. To be eligible, employees should not have previously been hired on a permanent contract. These incentives were also confirmed for 2019 and 2020.

Jobs Act The Jobs Act was approved in March 2015 and significantly reformed permanent contracts in firms with more than 15 employees (Boeri and Garibaldi, 2019). The new contract introduced graded security, with severance payments increasing progressively with tenure. The payments were set at four months' wages for the first two

years, increasing with tenure up to a maximum of 24 monthly wages at 12 years of tenure. The reform also introduced a new out-of-court settlement procedure, allowing employers to pay an indemnity equal to two monthly wages for the first two years of tenure, followed by an additional monthly wage per year of service, capped at 18 monthly wages after 18 years of work. Agreeing to this settlement prevented further legal disputes, such as appeals for unfair dismissal. This created strong incentives for both parties to settle disputes through this procedure, given that the amount paid was not subject to social contributions or taxation. Lastly, the reform replaced worker reinstatement with monetary compensation for economic unfair dismissals. The new dismissal rules applied only to new hires on permanent contracts and were not retroactive.

Decreto Dignità The Decreto Dignità was approved in July 2018 (Fiaschi and Tealdi, 2024). It reduced the maximum duration of temporary contracts from 36 to 24 months. It also introduced a restriction whereby temporary contracts exceeding 12 months could only be used under three specific circumstances: (i) to replace a worker, (ii) for temporary reasons outside the regular business, and (iii) in case of a temporary and unforeseeable increase in business activity. If none of these conditions were met, the contract would be automatically converted into a permanent one. Additionally, the number of contract extensions within the 24-month period was reduced from five to four, and any contract renewal beyond 12 months required justification under one of the three specified conditions. The reform also increased the social security contributions payable by employers for each temporary contract.

COVID-19 Policies The first cases of COVID-19 in Italy were reported in January 2020, but a full nationwide lockdown was implemented on March 10. All commercial activities, except for supermarkets and pharmacies, were shut down, movement was restricted, and all non-essential businesses and industries were closed. The Italian government introduced two key labour market policies in response: (i) a COVID-19 furlough scheme and (ii) a ban on layoffs. The furlough scheme was initially implemented for nine weeks, allowing firms to renew temporary contracts while bypassing standard regulatory norms. Upon the completion of the furlough period, firms were allowed to dismiss employees due to redundancy. The ban on layoffs prevented firms from dismiss-

ing workers for 60 days starting from March 17, and it could be applied retroactively to pending layoffs that had already been validated as of February 23. Subsequent decrees extended the validity of these measures, keeping them in place until the end of 2021.

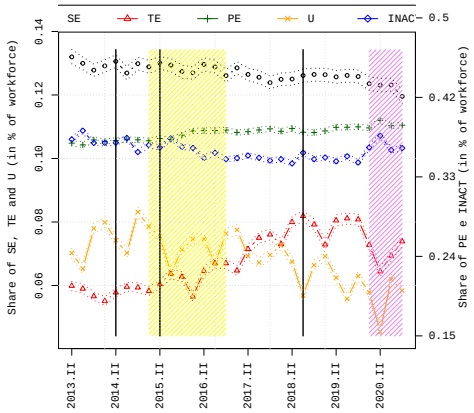
4 Data

We use Italian quarterly longitudinal labour force data provided by the Italian Institute of Statistics (ISTAT) for the period 2013 (Quarter I) to 2020 (Quarter IV).[6] The Italian Labour Force Survey (LFS) follows a simple rotating sample design, where households participate for two consecutive quarters, exit for the following two quarters, and return for two additional consecutive quarters. As a result, 50% of households interviewed in a quarter are re-interviewed after three months, 50% after twelve months, and 25% after nine and fifteen months. This rotation scheme enables the construction of three-month longitudinal data, capturing almost 50% of the original sample. The longitudinal nature of these data is essential for understanding labour market mobility. Each surveyed individual provides information on a wide range of personal and labour market characteristics at the time of the interview and three months earlier. Given this structure, we compute labour market flows by tracking quarter-on-quarter transitions between different labour market states. Specifically, we estimate gross flows using a five-state model: permanent employment, temporary employment, self-employment, unemployment, and inactivity.

A limitation of these data is their point-in-time measurement, which does not capture within-quarter transitions. For example, if a worker becomes unemployed and finds a new job within the same quarter, these transitions remain unobserved. However, as detailed in Section 2.3, assuming constant transition rates within a quarter, we estimate the instantaneous transition rates ($\mathbf{Q}$) from observed quarterly transitions ($\mathbf{P}$). On average, approximately 70,000 individuals are interviewed per quarter, of whom 45,000 belong to the working-age population. The average quarterly inflow of younger individuals into the working-age population is 0.3%, while the outflow of older individuals is 0.4%, supporting the assumption of an approximately constant working-age population within quarters. We focus on individuals aged 16 to 64.

[6]Data for the period 2013 (Quarter I) to 2020 (Quarter IV) are available upon request at: https://www.istat.it/it/archivio/185540.

Figure 1. Shares of individuals in different states from 2013-Q1 to 2020-Q4.



Note: The graph shows the shares of SE, TE, PE, U, and INACT in the workforce (age 16-64). Yellow shading represents hiring subsidies, pink shading denotes the COVID period, and vertical lines indicate major policy interventions.

In Figure 1, we report the shares of individuals in the five different states for the time period considered (2013-2020). The share of unemployed fluctuates between 8% and 5%, while the share of inactive remains relatively stable at around 34%. Among employed individuals, approximately 40% are hired on a permanent contract, around 13% are self-employed, and the share of temporary workers fluctuates between 6% and 8%.

5 Results

We report in Figure 2 the expected hitting times to get a permanent contract starting from temporary employment (Figure 2a), unemployment (Figure 2b) and inactivity (Figure 2c) calculated following Norris (1998).

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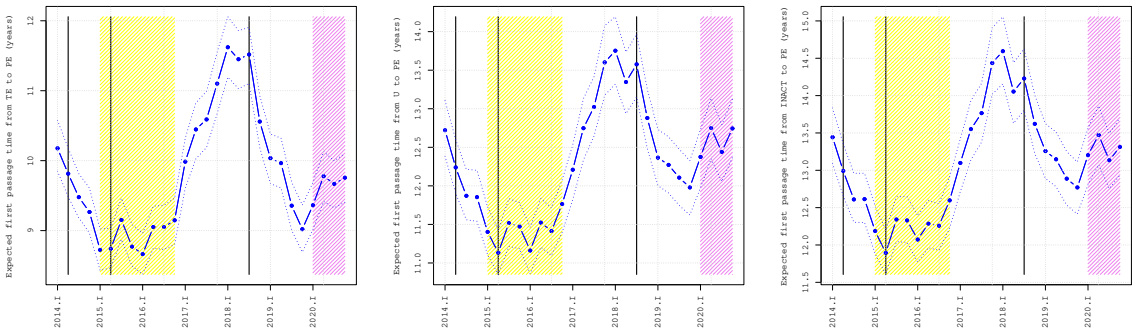
We observe large fluctuations in hitting times during the observation period, ranging between 9 and 11.5 years from temporary employment, mainly in response to policy interventions. Specifically, expected times decreased from 10 to 8 years in 2013 and 2014, followed by a period of stability in 2015 and 2016 during the time of firm subsidies. However, there was a sharp increase (up to 12 years) immediately after the removal of subsidies in 2017. Following the implementation of the Decreto Dignità in 2018, the average hitting time decreased again to 9 years, with a slight increase during the

Figure 2. Expected hitting times from temporary employment, unemployment and inactivity.



(a) TE (b) U (c) INACT

Note: The yellow shaded area identifies the period of subsidies for the hiring of permanent employees, while the pink shaded area represents the Covid period. The vertical lines indicate the timing of the Poletti Decree, Jobs Act, Decreto Dignitá, respectively.

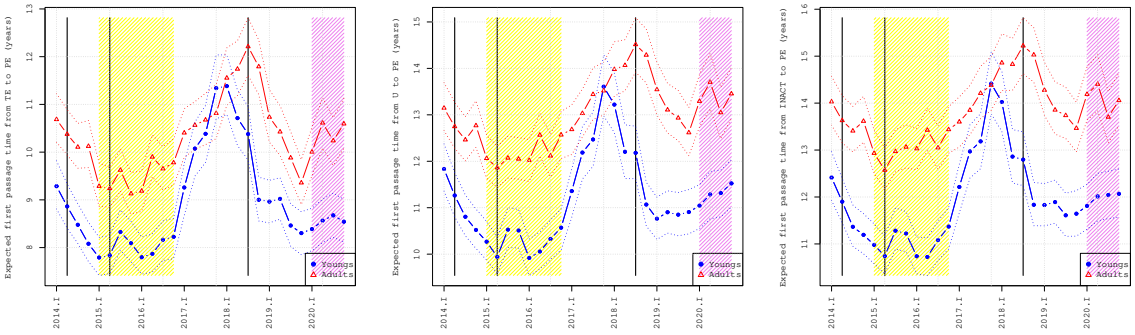
COVID period. A similar pattern emerges when examining expected hitting times from unemployment and inactivity to permanent employment. The range of fluctuations is wider, oscillating between a minimum of 11 years and a maximum of 13.5 years from unemployment, and between 12 and 14.5 years from inactivity. Overall, while the Jobs Act and firm subsidies did not effectively reduce expected hitting times to permanent employment, the removal of subsidies had a significant backlash. Conversely, the Decreto Dignità played a substantial role in reducing expected hitting times from temporary employment, unemployment, and inactivity.

5.1 Heterogeneity across categories of individuals

In this section we calculate the expected hitting times for different categories of individuals based on age, gender, geographical area of residency, and education. In Figure 3 we split the sample in two categories: young individuals aged 15-34 and adults, aged 35-64.

We observe some differences in the expected hitting times between the two categories, with young individuals taking less time on average to achieve permanent employment. The gap of approximately 1.5 years when starting from temporary employment is evident in 2014, 2015, and 2016, but it seems to disappear following the expiration of firm subsidies. However, it reopens at the beginning of 2018, with the expected hitting times from temporary employment decreasing from 11.5 years to 8 years among young individuals and from 12 to 9 years among adults. The expected hitting times

Figure 3. Expected hitting times for individuals aged 15-34 and 35-64.



(a) TE (b) U (c) INACT

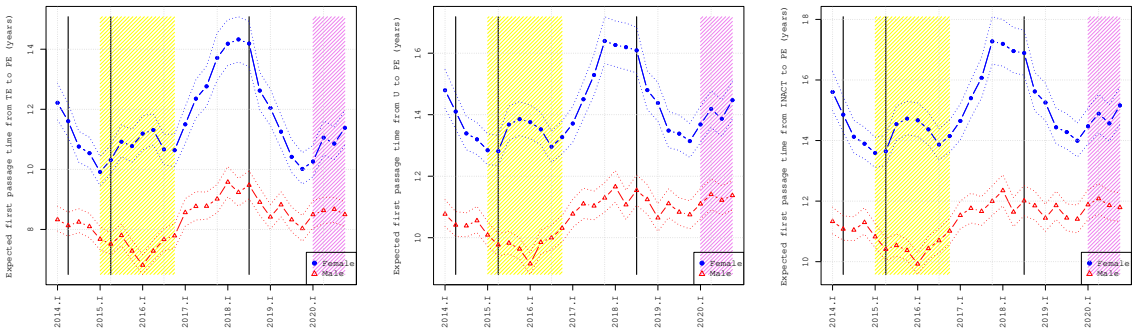
Note: The blue line refers to young individuals (age 15-34), while the red line refers to adults (age 35-64). The yellow shaded area identifies the period of subsidies for the hiring of permanent employees, while the pink shaded area represents the Covid period. The vertical lines indicate the timing of the Poletti Decree, Jobs Act, Decreto Dignitá, respectively.

among young workers decreased at the beginning of 2018, likely due to the fiscal incentives for younger workers introduced by the Budget Law, whereas for adults, the decrease occurred after the implementation of the Decreto Dignità. The gap is larger when starting from unemployment and inactivity (2 years), with expected hitting times ranging between 10 and 13 years for young individuals and between 12 and 14.5 years for adults when starting from unemployment. Similar patterns emerge when starting from inactivity, with expected hitting times fluctuating between 11 and 14 years for young individuals and between 13 and 15 years for adults.

In Figure 4, we consider females and males separately. The difference in expected hitting times is striking: females take, on average, an additional 4 years to reach permanent employment when starting from temporary employment. Over time, we also observe that the expected hitting time remained relatively stable among men (between 7 and 9 years), whereas it was highly volatile among women (between 10 and 14 years). Although expected hitting times increased for both males and females after the expiration of firm subsidies, the gap widened to 5 years at the beginning of 2018. Only after the implementation of the Decreto Dignità did the expected times decrease for both groups, but the reduction was much more pronounced among women, narrowing the gap to 2 years. Specifically, in 2019, it took approximately 8 years for men and 10 years for women to transition from temporary to permanent employment.

We report similar patterns when starting from unemployment and inactivity, with men taking between 10 and 11 years in both cases. For women, the range varies

Figure 4. Expected hitting times for females and males.



(a) TE (b) U (c) INACT

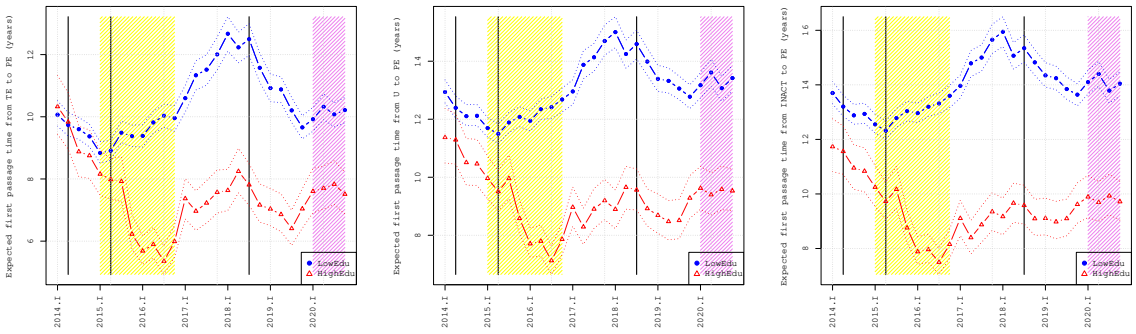
Note: The blue line refers to females, while the red line refers to males. The yellow shaded area identifies the period of subsidies for the hiring of permanent employees, while the pink shaded area represents the Covid period. The vertical lines indicate the timing of the Poletti Decree, Jobs Act, Decreto Dignitá, respectively.

between 13 and 16 years when starting from unemployment and between 14 and 17 years when starting from inactivity. In Figure 5, we separately consider low-educated (primary and secondary level) and high-educated (tertiary level) individuals. As expected, low-educated individuals take longer to achieve permanent employment. While the gap was not statistically significant when starting from a temporary position in 2014, it suddenly increased to approximately 4 years during the period of firm subsidies (2015/2016). During this time, the transition period decreased significantly for high-educated individuals across all three states but increased for low-educated individuals. Although the subsidies were available to all employees, firms seemingly offered disproportionately more permanent contracts to high-educated workers. The expected hitting times decreased for both categories after the implementation of the Decreto Dignità, with the gap narrowing to 3 years.

In 2019, it would take 6.5 years for high-educated individuals to get a permanent job starting from a temporary one, while it would take 9.5 years for low-educated individuals. Similarly, it would take 9 years for high-educated individuals to get a permanent job starting from unemployment or inactivity, while it would take 13 years and 14 years for low-educated individuals starting from unemployment and inactivity, respectively.

In Figure 6, we report the expected hitting times for individuals living in the North-Center and the South of the country. Once again, the differences between these two groups are striking. While the gap in 2014 was approximately 3.5 years for individuals

Figure 5. Expected hitting times for low-educated and high-educated.



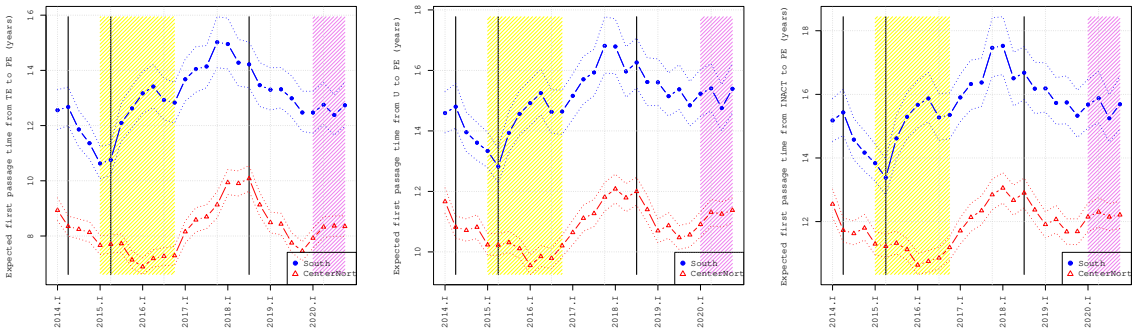
(a) TE (b) U (c) INACT

Note: The blue line refers to low-educated, while the red line refers to high-educated. The yellow shaded area identifies the period of subsidies for the hiring of permanent employees, while the pink shaded area represents the Covid period. The vertical lines indicate the timing of the Poletti Decree, Jobs Act, Decreto Dignitá, respectively.

starting from temporary employment, it widened to 6 years during the period of firm subsidies. This increase was driven by a rise in expected hitting times for workers in the South and a decline for those in the Center-North. The subsidies disproportionately benefited workers in the Center-North, where the average time to permanent employment decreased from 8 to 7 years. In contrast, in the South, the average time increased from 11 to 13 years. After the expiration of the subsidies, the average hitting times increased for both groups until the implementation of the Decreto Dignità. Following this reform, the average time to permanent employment decreased faster among workers in the Center-North, further widening the gap to 5 years. By 2019, it would take 6 to 7 years for workers in the Center-North to secure a permanent job starting from a temporary one, whereas for individuals in the South, the expected time was approximately 10 years.

Despite fluctuations over the observation period, the gap between residents in the Center-North and the South has remained persistently around 5 years for transitions from unemployment and inactivity. In 2019, individuals in the Center-North would take 10 years to secure a permanent job starting from unemployment and 12 years starting from inactivity. In contrast, for individuals in the South, the expected times were 13 years and 14 years, respectively.

Figure 6. Expected hitting times in the Center-North and South.



(a) TE (b) U (c) INACT

Note: The blue line refers to the South, while the red line refers to the Center-North. The yellow shaded area identifies the period of subsidies for the hiring of permanent employees, while the pink shaded area represents the Covid period. The vertical lines indicate the timing of the Poletti Decree, Jobs Act, Decreto Dignitá, respectively.

6 Discussion and concluding remarks

We propose the expected hitting time as a novel indicator that comprehensively captures changes in transition probabilities across all labour market states influenced by policy reforms. By providing a single value, this measure allows policymakers to gain an immediate understanding of the effectiveness of interventions.

When applied to the Italian labour market, we find that the multiple reforms implemented between 2013 and 2020 had substantial effects on the expected hitting times to permanent employment from temporary employment, unemployment, and inactivity. Moreover, we observe large disparities in expected hitting times across different categories of workers. In particular, women, low-educated individuals, and residents in the South face significantly longer transition periods before securing permanent employment. Interestingly, the effects of the reforms were highly heterogeneous across worker categories. Firm subsidies primarily benefited highly educated individuals and men, while the Decreto Dignità had a more significant impact on women and low-educated individuals. Overall, these substantial differences in expected hitting times across various demographic groups highlight a highly segmented labour market, where the most vulnerable individuals—namely, low-educated workers, women, and those living in the South—face the greatest challenges in achieving the goal of a permanent job.

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Appendix

A Bootstrap procedure

Given a sample of transitions X of cardinality N, the bootstrap procedure is composed of three steps (Efron and Tibshirani, 1994, Chapter 6):

1. Draw B samples of cardinality N by sampling with replacement from X;
2. For every bootstrapped sample b estimate matrix $\mathbf{P}_b$ and the corresponding $\tilde{\mathbf{Q}}_b$;
3. Compute the standard errors of the transition rates $\tilde{q}_{ij}$, $\sigma_{q_{ij}}$ as:

$$\sigma_{q_{ij}} = \sqrt{\sum_{b=1}^{B} \frac{\left(\tilde{q}_{ij,b} - \bar{\tilde{q}}_{ij}\right)^2}{B}},$$

   where $\tilde{q}_{ij,b}$ is the (i,j) element of $\tilde{\mathbf{Q}}_b$ and $\bar{\tilde{q}}_{ij}$ is the average (i,j) element of all the B bootstraps.

The test of zero difference between two transition rates and/or between two equilibrium labour market shares is based on the bootstrap procedure suggested in Efron and Tibshirani (1994, Chapter 16).

B The Italian labour market

Following major labour market reforms in the 1990s and early 2000s, labour market outcomes in Italy improved substantially. Employment and labour force participation rates increased, while the unemployment rate declined. However, despite these improvements, the Italian labour market continues to underperform compared to most other European countries (OECD, 2019). Specifically, the participation rate remains significantly lower than in most European countries, the unemployment rate is higher, and the shares of temporary employment and self-employment are well above the EU average (Table 1). The rapid growth in temporary employment prompted the implementation of several reforms aimed at facilitating transitions from temporary to permanent employment, reducing unemployment and inactivity, and curbing the rising share of self-employment[7] (Boeri and Garibaldi, 2019; Di Porto and Tealdi, 2024).[8] Given this context, we consider five key labour market states in our analysis: inactive, unemployed, temporary employed, permanent employed and self-employed.[9]

Table 1. Labour market characteristics for a select sample of European countries.

Country	**Self-employment** (% total employment)	**Temporary-employment** (% dependent employment)	**Unemployment** (% labour force)	**Labour force participation** (% working age)
Greece	31.9	12.5	17.5	68.4
Italy	**22.7**	**17.0**	**10.2**	**65.7**
Portugal	16.9	20.8	6.7	75.5
Spain	15.7	26.3	14.2	75.0
United Kingdom	15.6	5.2	4.0	78.8
Ireland	14.4	9.8	4.5	73.1
Belgium	14.3	10.9	5.4	69.0
France	12.1	16.4	8.5	71.7
Germany	9.6	12.0	3.2	79.2
EU average	**15.3**	**13.2**	**6.4**	**74.2**

Source: OECD, 2019.

[7]In Italy, the category of para-subordinate workers—individuals who are legally self-employed but often economically dependent on a single employer—is relatively large. These workers face disadvantages compared to employees, particularly in terms of welfare provisions (Raitano, 2018).

[8]Specifically, in March 2014, the Decreto Poletti increased flexibility in temporary contracts. In March 2015, the Jobs Act reformed open-ended contracts, introducing tenure-based firing costs. Finally, in July 2018, the Decreto Dignità tightened restrictions on temporary contracts.

[9]While age, gender, and education would be valuable additional dimensions to explore, they are beyond the scope of this paper.