The Emersion Effect: an analysis on labor tax evasion in Italy

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Abstract

We analyze how different policy interventions can drive emersion from tax evasion. We have studied in particular the emersion of undeclared labor and we have based our analysis on the Italian labour market over the period 1998-2003. Our empirical investigation suggests that 2003 Italian labor market reform, even tough it was aimed at creating the necessary conditions to lead to a reduction in the shadows activities, it wasn't able to reach its objectives. We develop a searching and matching model, á la Mortensen, on the basis of our empirical investigation in order to determine the right mix of policy interventions to obtain emersion. Our preliminary findings shows that differentiate the forms of taxations and enforcement should work together to achieve emersion from tax evasion.

1 Introduction

Despite tax evasion is a topic deeply studied in economic literature, it is still debated about which were the instruments to get deterrence. Increasing the probability of being caught by a tax enforcement agency or simply augmenting the fines for this non compliant behaviors, seem to be commonly considered the first measures against evasion, anyway in both of the cases, there are discordant evidences on the effect of these instruments on tax compliance (Mittone, Alm, Di Porto 2011). The problem is still more complex when we move from the simple deterrence to the case of emersion. Emersion from tax evasion is defined, in the case of labor tax evasion, in Di Porto and Elia 2011WP, as a shift of a worker from a state of

activity in the undeclared sector to a state of activity in the declared sector. More generally, we can define emersion in any tax evasion declination i.e VAT, income taxes, housing taxes etc., as a shift of a fraction of an evaded quantity (i.e. dollars, rents, hours worked etc.) from a state of non declaration to the tax authorities to a restored state of declaration. As noticed by Di Porto and Elia emersion can be *pure* when the same quantity evaded passes from a state to another, or just *partial*, when in the process of emersion a part of the evaded quantity get lost, in this case we have a contraction in the total quantity evaded but we do not have a similar correspondent expansive declaration to the tax authorities. It is worth to notice that deterrence and emersion are related concepts but are not synonymous. To get the idea, think about a context in which a tax authority can commit its audit strategy and can inspect with probability 1 all the non compliant tax payers. In this case the optimal audit scheme in equilibrium provides full deterrence, everybody is compliant and therefore we do not have any quantity to let emerge. We can conclude that emersion starts when deterrence fails and that study emersion it is studiyng a setting in which full deterrence is considered a myth. As noted by Boeri and Garibaldi (2002) and Schneider (2002), in recent years undeclared activity has flourished. This suggests that shadow activities are tolerated to some extent, or the same, that deterrence it is a difficult task to implement. As we noticed when deterrence fails, emersion can play a role to restore compliance. This paper is about emersion. Even if it is not the first paper that speak "around" emersion, we are sure that we are the first to clarify this point on the difference between deterrence and emersion. This is not just a mere question of classification given that, as it is clear in the example above, we are in two different economic settings.

We are aware that this is a very complex task, and how aim is in fact to demonstrate that just amix of interventions could guarantee some kind of emersion, therefore we will analized a very specific and peculiar settings: labor tax evasion. This paper focuses on undeclared labor. Undeclared work is nothing more than labor tax evasion perpetrated by an employer against public institutions collecting social security contributions. In several countries, (e.g. Italy, France, Germany), employers are in charge of collecting the social security contributions for their workers. Evading these payments is just the same as under-declaring a part of the hours worked. Undeclared work is, in terms of size, one of the main ingredients of contemporaneous labor markets. A recent study by OECD asserts that out of a global working population of 3 billion workers, nearly two-thirds (1.8 billion) are undeclared or informal workers (Jutting and Laiglesia, 2009). Schneider (2000) estimates that in the European area the number of persons working in the unofficial economy doubled from 1978 to 1998. According to a report of the Pew Hispanic Center, the number of illegal immigrants living in the United States was 11.9 million in March 2008, of which 8.3 million were part of the U.S. labor force (Passel and Cohn, 2009). Estimates of the number of illegal immigrants in Canada by police and immigration personnel range between 50,000 and 200,000 according to the Canadian Encyclopedia. BRIC countries (Brazil, Russia, India, China) and eastern European countries are also involved, with similar or larger percentages.

Which are the political instruments that we can use in order to let at least a part of this workers emerge? This paper try to give a first answer taking one's cue from Italian

labor market reform 2003. As we noticed above deterrence in general do not work to let everything being declared, we studied therefore the introduction of a second ingredient, namely the introduction of short term employment contratcs in the Italian labor market as a source for emersion.

Short-term employment contracts have been deployed rapidly across the rigid EU economies since the early 1990s. Featuring short (fixed) duration, lower costs, and more straightforward hiring procedures, they are designed to be an agile instrument to increase labor market flexibility and, in turn, to reduce unemployment. In Italy, there are two additional reasons which motivated the implementation of these reforms. First, short-term contracts might have helped increase labor force participation, which is particularly low among women. Second, they might have contributed significantly to reduce the share of undeclared work, and therefore labor tax evasion, which is estimated to account for 17% of the Italian GDP. In order to target the last objective, the Italian Government approved a number of reforms, which introduced several types of short-term contracts to target specific situations, in which undeclared work might have prevailed. As of today, in Italy the workers unions count up to 46 different types of employment contracts. Moreover, the Italian share of short-term employment jumped from 5% in 1990 to approximately 13% in 2010. The objective of this paper is, firstly, to test empirically whether these reforms have been successful in reducing the share of undeclared work (letting them emerged to the declared sector). By estimating several econometric specification based on microeconomic Italian data, we investigates whether and how the undeclared work has changed after the reforms have been implemented, and so if the extensive introduction of short term contract could have been considered a good instrument to start emersion. Then, we use these empirical findings as the basis for developing a search model. This is intended to explain workers and firms behaviors when different types of contracts are available and when firms may decide whether to hire workers legally or illegally. Latu sensu, have different types of contract is the same that differentiate the opportunity to pay taxes, introducing new form of taxations for a similar kind of services. therefore it is credible to verify a distortion in the tax payer behavior after the policy intervention. We design a search model in the spirit of Diamond (1982) and Mortensen (1984) to we calibrate it to evaluate potential emersion interventions. In the model we account for workers' heterogeneity, social security contribution, and differentiated contracts. In addition, we distinguish between formal and informal jobs and we endogenize the decision of the firms to hire in the formal or informal sector when they open a vacancy. The motivation relies on our objective to explain the different performance of job findings rates of declared and undeclared jobs. We assume that firms post generic vacancies and when they are ready to hire the worker, they decide whether to hire her legally or illegally. In addition, they decide whether to hire her on a short-term basis or permanently. If a worker is hired legally, the firm has to pay social security taxes to the tax authority. If the work is hired illegally, the firms do not pay social security taxes, but the firm might be caught by the tax enforcement authority and be subject to the payment of a penalty fee. The type of contract and the sector (declared or undeclared) are chosen by the firm according to several parameters, such as the quality of the match, the social security fees, the probability to be caught, if acting illegally. In the

model, we also allow for transitions from decalred to undeclared sector and viceversa. The calibration of the model allows us to draw conclusions regarding the rationale behind the firms' decisions and to evaluate the effects of several policy interventions .

The result of this long analysis bring evidence on how to obtain emersion we should intervene at different levels, mixing deterrent policies and differentiating the opportunity to pay taxes (i.e. introducing new contracts in the labor market). From the empirical analysis, we conclude that the 2003 reforms "alone" were indeed not effective in reducing the share of undeclared work. In addition, we show that short-term contracts are not a substitute for undeclared work. The correlation between the two growth rates is positive and significant. When we calibrate the model according to the Italian regulations and institutions we test the effects of several policy interventions, such as the increase of the monitor rate of the informal sector, the increase of the penalty fee, the reduction of the social security fees. We conclude that emersion is possible just with a well designed mix of policies that work at different levels. Temporary jobs can be a good holder for emerge workers just under certain precise conditions.

1.1 Literature review

There are several strands of literature related to this paper.

First of all, this study is linked to the extensive empirical literature on short-term employment contracts and their impact on European labor markets. Studies such as Berton (2007) and Guell and Petrongolo (2007) investigate the way short-term contracts have changed the pattern dynamics across states and contracts. Specifically, their objective is to identify the role of short-term contracts as screening device or as an instrument for firms to reduce costs. Their results show that both in Italy and in Spain short-term contracts are used for both purposes. In addition, Pfeifer (1994) shows that in Germany short-term contracts are utilized by firms to adjust the workforce according to business cycle fluctuations. A parallel strand of the literature studies the effects of short-term contracts on labor market aggregates, such as employment and unemployment rates. Berton (2009) investigates whether short-term contracts have been effective in reducing the high rate of long-term unemployment in Italy. His findings provide a negative answer. However, Guell (2000) finds that in Spain the rate at which workers leave unemployment is higher after the reforms. Regarding the effect of short-term contracts on employment, Giannelli (2009) shows that in Italy short-term contracts did not help increase the length of the first employment spell and they are associated with high uncertainty. However, Aguirregabiria (1999) finds that in Spain short-term contracts had a positive effect on employment and job turnover. This paper complements the existing literature, by testing for the first time whether the introduction of short-term contracts has been effective in reducing the share of undeclared work in Italy.

Second, this paper is related to the literature on black economy, tax evasion and undeclared work. Tax evasion is a problem widely reported since the antiquities. However, it is very difficult to be investigated both from the theoretical and the empirical perspective. Overall, theoretical models based on taxpayer rationality have shown to be unable to describe properly the behavior of agents involved in tax evasion. On the other hand, both game

theory and any rational choice approach to the problem of tax compliance, level of penalties and enforcement appears to be insufficient in explaining the degree of concurrence with the tax law. As a consequence, in the last 15 years economists have started investigating the behavioral and experimental aspects of tax evasion, by analyzing the variety of psychological reasons influencing the choice to pay taxes, such as honesty, fear, sense of group membership (Chorvat 2006, Alm et al. 1992). On the empirical side, the lack of reliable data on tax evasion has raised concerns on the robustness of the findings. Typically, data on tax evasion are part of administrative audit databases, which often carry a selection problem and not always provide sufficient information to solve this issue. Some progress in this direction has been achieved during the last years by using ad hoc surveys (Saez, 2011 WP, Lemieux et al. 1994) and/or by relying on individual audit data, where the provided information is detailed enough to allow the adoption of a proper selection model (Di Porto, 2011 and Di Porto et al. WP).

Finally, this paper relates to the search model of dynamic labor demand of Mortensen and Pissarides (1994). We extend their framework, by allowing firms to hire workers in different sectors (formal or informal). Moreover, as in Tealdi (2010), firms are allowed to offer different types of contracts (permanent or short-term) to the workers and are bound to pay social security fees whenever they hire a worker in the formal sector. Within this literature, this model specifically relates to studies which use the search theory to address the issue of undeclared work (Bouev (2005), Kolm and Larsen (2010), Fugazza dn Jacques (2004), Albrecht (2009), Boeri and Garibaldi (2001)). The paper which most closely resembles our work is the one by Bosch and Esteban-Pretel (2011), in which direct transitions from the formal to the informal sector (and viceversa) are allowed. While they use this set up to analyze the undeclared work phenomenon in developing countries, it serves our purpose to test the effects of the reforms implemented in Italy to increase labor market flexibility.

2 Facts and stats

TBD

3 Empirical Models and Results

This section shows the empirical models we use in order to test our main hypotheses , namely that law 30/2003 does not affect the relative supply of undeclared workers, $\log(U/D)$, while positively impact the relative supply of temporary workers, $\log(T/P)$. We apply different models specifications as well as we provide some robustness checks.

Firstly, we want to test whether by easing restriction on the use of temporary contracts may influence the distribution of undeclared and declared workers. We accomplish this by estimating the following equation:

$$\log(U/D)_{r,t} = c + \beta_0 D_{BIAGI} + \beta_1 X_{r,t} + \delta_r + \zeta_t + \epsilon_{r,t} \tag{1}$$

where $\log(U/D)_{r,t}$ is the ratio of undeclared to declared workers in the region r at time t, D_{BIAGI} is a dummy varibale which takes on the value of one for the years following after the implementation of the policy, δ_r are regional fixed effects, ζ_t are time fixed effects and $\epsilon_{r,t}$ is an error term. $X_{r,t}$ is a matrix of regional covariates. Table (1) show the estimates of different version of the equation (1). The baseline model which controls only for regional and time fixed effects is shown in column (1). Model (2) adds the regional unemployment rate, while models in column (3) and (4) use cubic time trend instead of time dummies. In addition, model (5) and (6) take into account some regional confounding covariates, such as the average age, the share of graduates, the share of women, as well as the share of construction, transport and family services at the regional level. As a robustness check, columns (7) to (9) do the same exercise as before using as the dependent variable just the share of undeclared workers.

As it is clear from Table(1) the coefficient on the dummy policy variable always positive with a magnitude around 1, and significantly different from zero in most of the equations. This results is consistent with our hypothesis of no negative correlation between the Biagi law and the share of undeclared workers. Rather, the coefficients suggest a positive correlation. This can be the consequence of a higher turnover of temporary workers, who probably are more subject to enter into the informal employment at the end of the contract. The effect of the other covariates are mostly insignificant different from zero; this is not surprising because lots of the variance of the dependent variable is captured by the regional fixed effects.

We attempt to put more causal meaning on the policy coefficient by building DiD-like empirical model. Since we do not have a treatment and comparison group at the regional level (the policy had effect on all region simultaneously), we are not able to apply a DiD strategy properly. However, to avoid the confounding effect of differential trend in the growth of the ratio of undeclared workers to declared workers, we estimates the following equation:

$$\log(U/D)_{r,t} = c + \gamma D_{BIAGI} + \eta_{t-1} + \theta(D_{BIAGI} \times \eta_{t-1}) + \beta_1 X_{r,t} + \delta_r + \zeta_t + \epsilon_{r,t} \qquad (2)$$

where η_{t-1} is dummy which takes on the value of one for the years 2002 and 2006, before and after the policy implementation. We run this equation on the restricted sample from 2002 to 2006 as well as on the overall sample form 1995 to 2008. Table (2) shows the estimated coefficients of different specifications of equation (2). In columns (1) to (4), the coefficient of the interaction term is always not significant different from zero, even when we control for the regional covariates as in equation (1). As a result, even when controlling for differential trend in the period before and after the policy implementation we ar enot able to detect any significant effect on the growth of undeclared workers. The remaining columns of Table (2) display estimates of equation (2) when the dependent variable is the regional level and share of undeclared workers. Even in this case we detect no policy effect.

A different and more interesting question is whether the relative supply of undeclared workers can help predicting the relative supply of temporary job compared to permanent ones.

$$\log(\frac{h_t}{h_p})_{r,t} = c + \beta_0 D_{BIAGI} + \beta_1 X_{r,t} + \gamma \log(\frac{U}{D})_{r,t} + \pi D_{BIAGI} \log(\frac{U}{D})_{r,t} + \delta_r + \zeta_t + \epsilon_{r,t} \quad (3)$$

The coefficients of interest are β_0, γ and π. In particular is interesting to see how β_0 in this case is positive and significative. This means that 2003 reforms had indeed an effect. Despite what was expected anyway the reform instead to decrease the use of undeclared contract have shifted the behavior of employers which seem to start hiring more temporary jobs and less permanent.

An expansion or a contraction in relative undeclared work supply do not affect the temporary/permanent ratio, γ is not significant and also π this means that 2003 reforms wasn't able to create that communicating vessels between temporary and undeclared. Summing up all the evidence it seems that 2003 reform have moved employers choice but just inside the declared market, leaving unaltereted the undeclared sector. The two sectors declared undeclared seem to be two world a part.

4 A search and matching model

We model the labour market before the reforms, when only permanent contracts are available and employers may hire workers in the formal or in the informal market. We compare it with the labour market post-reforms, when short-term contracts represent an additional option for the firms. Therefore, employers may decide to hire the workers in the formal market by offering them either a permanent or a short-term contract, or in the informal market. One of the innovative features of this approach is the fact that we are able to compare the market before and after the reforms to analyze the impact of short-term contracts. Both models are continuous time search and matching models a la Mortensen and Pissarides. We assume that workers and firms meet in the labour market and from their match a positive surplus is generated. Matches occur randomly and according to a matching function $m(u, v)$ which depends on the total number of unemployed individuals u and the total number of vacancies v. The matching function is increasing in both arguments, concave and homogeneous of degree one. When the firm opens a vacancy, it may meet an unemployed worker according to a Poisson process with arrival rate $\lambda(\theta)) = m(u, v)/v$, where $\theta = u/v$ is defined as the market tightness. The arrival rate of a job offer for unemployed workers is $\gamma(\theta) = m((u, v)/u$.

Workers are ex ante homogeneous. When the match worker-firm is formed the productivity is revealed. The productivity of the worker has two components: a constant component p, which is the same for all workers and a random component ϵ, which is specific to each match and which is drawn from the random distribution $G : [\underline{\epsilon}, \overline{\epsilon}] \to [0, 1]$. Depending on the productivity level the firm decides which contract to offer to the worker.

4.1 The model pre-reforms

Firms can decide to offer a formal (permanent) contract or an informal contract to the unemployed worker they meet. The choice depends on the productivity level of the match. If a formal contract is offered, the firm is required to pay payroll taxes, whose marginal rate is τ, for the entire length of the contract and firing costs F, when the formal employment is terminated. If an informal contract is offered, the firm is not subject to the payroll taxes, however the firm might be caught by Government authorities according to a Poisson process with arrival rate ϕ and might be forced to pay a penalty fee σ. In addition the employment relationship is terminated. In this framework, we allow informal workers to search on the job for better opportunities. Therefore according to a Poisson process with arrival rate $\chi\gamma$, the informal worker may find a new job, terminate the ongoing working relationship and force the firm to open a new vacancy.

After the match worker-firm is formed at arrival rate α a productivity shock may hit the relationship and a new ϵ is drawn from a sector specific distribution $H^j : [\underline{\epsilon}, \overline{\epsilon}] \to [0, 1]$, where $j = (F, I)$ (formal, informal). The new productivity levels are i.i.d. across workers and time. The future of the worker-firm relationship depends on the new level of productivity of the match: they might decide to change sector, keep the relationship unchanged or terminate it.

In order to understand the labour market dynamics, we will analyze in detail in the next paragraph the firm's and worker's problems.

4.1.1 The firm's problem

We define V as the value for a firm to open a vacancy and $J^j, j = (F, I)$ as the sector specific value of having a filled position. The value for a firm to open a vacancy is equal to:

$$rV = -c + \lambda \int_{\underline{\epsilon}}^{\overline{\epsilon}} \max[J^F(\epsilon'^I(\epsilon'), V] dG(\epsilon') - \lambda V \tag{4}$$

$$\tag{5}$$

The firm has to pay a cost c for the time the vacancy being open. At rate λ the firm meets an unemployed worker, the productivity level of the match is revealed and the firm decides whether to offer a formal job, an informal job or to keep the vacancy. If the firm decides to hire the worker legally, the value function for the firm will be:

$$rJ^F(\epsilon) = p + \epsilon - (1 + \tau)\omega^F(\epsilon) + \alpha^F \int_{\underline{\epsilon}^F}^{\overline{\epsilon}^F} \max[J^F(\epsilon'^I(\epsilon') - F, V - F] dH^F(\epsilon') \tag{6}$$

$$- \alpha^F J^F(\epsilon) \tag{7}$$

$$\tag{8}$$

The firm will receive a productivity flow equal to $p + \epsilon$ and in exchange will pay the worker a salary equal to $\omega^F(\epsilon)$. In addition, the firm will have to pay payroll taxes, whose marginal rate is equal to τ. A rate α^F a productivity shock may hit the match and a new productivity level ϵ is drawn from the distribution H^F. Together, workers and firms will decide to keep

the relation formal, to turn into an informal one or to terminate the contract. In the latter two cases, the firm is required to pay a firing cost F. In case the firm decides to offer an informal contract while hiring a worker, the value function is:

$$\begin{aligned} rJ^I(\epsilon) &= p + \epsilon - \omega^I(\epsilon) + \alpha^I \int_{\underline{\epsilon}^I}^{\overline{\epsilon}^I} \max[J^F(\epsilon'^I(\epsilon'), V] dH^I(\epsilon'^I J^I(\epsilon) && (9) \\ &+ \phi(V - J^I(\epsilon)) - \phi\sigma + \eta(V - J^I(\epsilon)) && (10) \\ & && (11) \end{aligned}$$

The firm still receives the productivity flow $p + \epsilon$ and will pay to the worker the salary $\omega^I(\epsilon)$, however the firm will not pay payroll taxes. At rate α^I the match will be hit by a productivity shock and as a result the relation may stay unchanged or may be turned into a formal one or may be terminated, according to the new productivity level. In addition, at rate ϕ Government authorities may discover the illegal activity of the firm, terminate the relationship and charge the firm with a penalty fee equal to σ.

4.1.2 The worker's problem

The value function for an unemployed worker is:

$$\begin{aligned} rU &= b + \gamma \int_{\underline{\epsilon}}^{\overline{\epsilon}} \max[W^F(\epsilon'^I(\epsilon'), U] dG(\epsilon') - \gamma U && (12) \\ & && (13) \end{aligned}$$

The worker receives unemployment benefits b until he is unemployed. At rate γ the worker meets a firm and the productivity level of the match is revealed. The worker may receive a formal offer, an informal offer or no offer and continue to be unemployed. If he receives an offer, this might be formal and informal and the corresponding value functions are:

$$\begin{aligned} rW^F(\epsilon) &= \omega^F(\epsilon) + \alpha^F \int_{\underline{\epsilon}^F}^{\overline{\epsilon}^F} \max[W^F(\epsilon'^I(\epsilon'), U] dH^F(\epsilon') && (14) \\ &- \alpha^F W^F(\epsilon) && (15) \\ rW^I(\epsilon) &= \omega^I(\epsilon) + \alpha^I \int_{\underline{\epsilon}^I}^{\overline{\epsilon}^I} \max[W^F(\epsilon'^I(\epsilon'), U] dH^I(\epsilon'^I W^I(\epsilon) && (16) \\ &+ \phi(U - W^I(\epsilon)) + \chi\gamma \int_{\underline{\epsilon}}^{\overline{\epsilon}} \max[W^F(\epsilon'^I(\epsilon'), U] dG(\epsilon'^I(\epsilon) && (17) \\ & && (18) \end{aligned}$$

The formal worker receive a salary $\omega^F(\epsilon)$ and at rate α^F his employment relation may be unchanged or may change by becoming informal or by being terminated, according to the

newly drawn productivity level. If the worker is offered an informal job, the worker receives a salary $\omega^I(\epsilon)$ and at rate α^I, his productivity level will change. His employment relation may become informal or terminate or may be unchanged. Moreover, at rate ϕ he may lose his job because the illegal relation has been discovered by the authorities. Finally, informal workers may also look for better jobs while working and find a new position at rate $\chi\gamma$. Since the effort spent in looking for jobs while employed is lower than while unemployed, the probability for employed people to find a job is lower compared to unemployed workers and therefore $\chi < 1$.

4.1.3 Surplus and wage bargaining

The surplus of the match changes according to the type of employment. If the signed contract between firm and worker is formal, the firing cost which the firm has to pay at termination enters in the surplus equation and affects the wage bargaining. Moreover the marginal payroll tax rate is accounted for in the wage negotiations. The Nash bargaining mechanism is used to compute the wage, where $\beta^j, j = (F, I)$ represents the bargaining power of the worker respectively in the formal and informal sector. We believe that the bargaining power of the worker in the informal sector is lower than in the formal sector. For simplicity reasons, we assume that $\frac{\beta^F}{(1-\beta^F)(1+\tau)} = \frac{\beta^I}{(1-\beta^I)}$, which satisfies the above mentioned belief that $\beta^I < \beta^F$. Workers and firms always agree on the decision to terminate the contract, thus there is no room in this model for involuntary unemployment.

$$S^F(\epsilon) = J^F(\epsilon) + W^F(\epsilon) - (V - F) - U \tag{19}$$
$$\beta^F[J^F(\epsilon) - (V - F)] = (1 - \beta^F)(1 + \tau)[W^F(\epsilon) - U] \tag{20}$$

$$S^I(\epsilon) = J^I(\epsilon) + W^I(\epsilon) - V - U \tag{21}$$
$$\beta^I[J^I(\epsilon) - V] = (1 - \beta^I)[W^I(\epsilon) - U] \tag{22}$$

As a result of the Nash bargaining, according to the sector, the following wage equations are derived:

$$\omega^F(\epsilon) = \frac{\beta^F}{(1 + \tau)}(p + \epsilon + c\theta + rF) + (1 - \beta^F)b \tag{23}$$

$$\omega^I(\epsilon) = \beta^I(p + \epsilon - \phi\sigma + (1 - \chi)c\theta) + (1 - \beta^I)b \tag{24}$$

4.1.4 Steady State

In order to compute the steady state of the model, we solve five equations in five unknowns. We recognize four productivity thresholds and the market tightness as the parameters which

identify the equilibrium. The five equations summarize the job creation and job destruction conditions as well as the free market condition $V = 0$.

When the firm hires an unemployed worker or an informal worker and the productivity level is equal to ϵ_R the firm is indifferent whether to offer a formal or an informal job.

$$J^F(\epsilon_R) = J^I(\epsilon_R) \tag{25}$$

This equation defines the flows of workers from unemployment to formal and informal employment. When the firm transforms a formal job into an informal job the threshold productivity level is equal to ϵ_T. This threshold differs from the one described above, because when transforming a formal job into an informal one the firm is subject to the payment of a firing cost.

$$J^F(\epsilon_T) + F = J^I(\epsilon_T) \tag{26}$$

Therefore, this equation defines the flow of workers from to informal jobs. Finally, the two job destruction conditions from a formal or an informal job are defined by:

$$J^F(\epsilon_F) + F = 0 \tag{27}$$
$$J^I(\epsilon_I) = 0 \tag{28}$$

From equation 26 by plugging in the expression for the wage for formal workers $\omega^F(\epsilon)$ as in 57 we obtain:

$$J^F(\epsilon) + F = \frac{(1-\beta^F)(\epsilon - \epsilon_F)}{r + \alpha^F} \tag{29}$$

From equation 25 by plugging in the expression for the wage for formal workers $\omega^I(\epsilon)$ as in 58 we obtain:

$$J^I(\epsilon) + F = \frac{(1-\beta^I)(\epsilon - \epsilon_I)}{r + \phi + \eta + \alpha^I} \tag{30}$$

The equilibrium of the model is therefore defined by the following set of equations:

$$\frac{1+\tau(1-\beta^F)}{(1+\tau)(1-\beta^F)}\left[\frac{(1-\beta^F)(\epsilon_R-\epsilon_F)}{r+\alpha^F}-F\right]=\frac{(\epsilon_R-\epsilon_I)}{r+\phi+\eta+\alpha^I} \tag{31}$$

$$\left[\frac{1+\tau(1-\beta^F)(\epsilon_T-\epsilon_F)}{r+\alpha^F}\right]=\frac{(\epsilon_T-\epsilon_I)}{r+\phi+\eta+\alpha^I} \tag{32}$$

$$\epsilon_F=-rF-p+(1-\tau)b+\frac{\beta^F}{(1-\beta^F)}c\theta- \tag{33}$$

$$\alpha^F\left[\int_{\epsilon_F}^{\epsilon_T}\frac{(1+\tau)}{1+\tau(1-\beta^F)}\frac{(\epsilon'-\epsilon_I)}{(r+\phi+\eta+\alpha^I)}dH^F(\epsilon'|_{\epsilon_T}^{\bar{\epsilon_F}}\frac{(\epsilon'-\epsilon_F)}{(r+\alpha^F)}dH^F(\epsilon')\right] \tag{34}$$

$$\epsilon_I=-p+b+\frac{\beta^I}{(1-\beta^I)}(1-\chi)c\theta+\phi\sigma- \tag{35}$$

$$\alpha^I\left[\int_{\epsilon_I}^{\epsilon_R}\frac{(\epsilon'-\epsilon_I)}{(r+\phi+\eta+\alpha^I)}dH^I(\epsilon'|_{\epsilon_R}^{\bar{\epsilon_I}}\frac{1+\tau(1-\beta^F)}{(1+\tau)}\left[\frac{(\epsilon'-\epsilon_F)}{(r+\alpha^F)}-\frac{F}{(1-\beta^F)}\right]dH^I(\epsilon')\right] \tag{36}$$

$$\frac{c}{\lambda}=\int_{\underline{\epsilon}}^{\epsilon_R}\frac{(1-\beta^I)(\epsilon'-\epsilon_I)}{(r+\phi+\eta+\alpha^I)}dG(\epsilon'|_{\epsilon_R}^{\bar{\epsilon}}\left[\frac{(1-\beta^F)(\epsilon'-\epsilon_F)}{(r+\alpha^F)}-F\right]dG(\epsilon') \tag{37}$$

By analyzing the equations above we can claim that the equilibrium exist and is unique. Higher θ increases the left hand side of Equation 69 and it lowers both formal and informal surplus, by decreasing the right hand side of equation 69 as both thresholds ϵ^F and ϵ^I depend positively on θ, while ϵ^R does not affect the expected profit from opening a vacancy. Therefore, there is a unique value of θ that satisfies the equation.

We can now retrieve the steady state value of unemployment and formal and informal employment, by looking at the workers flows. Normalizing the labor force to unity, we get:

$$n^I=1-n^F-u \tag{38}$$

$$u=\frac{\alpha^F H^F(\epsilon_F)n^F+\alpha_I H^I(\epsilon_I)n^I+\phi n^I}{\lambda} \tag{39}$$

$$n^F=\frac{[\chi\gamma(1-G(\epsilon_T))+\alpha^I(1-H^I(\epsilon_T))]n^I+\gamma(1-G(\epsilon_R))u}{\alpha^F H^F(\epsilon_F)n^F} \tag{40}$$

4.2 The model post-reforms

We now extend the previous model by including the possibility for the firm to hire workers in the formal sector for a fixed period of time (temporary contracts). Temporary contracts are designed to be more flexible, since at expiration the firm can let the worker go without incurring in any firing cost. Moreover, generally, the marginal rate of the payroll tax associated with temporary contracts is lower compared to permanent contracts. In addition, workers are willing to search for better jobs while employed, so the firm may incur the risk of losing the worker at rate $\xi\gamma$. Compared to the previous set up, the firm's and worker's problems get slightly more complicated.

4.2.1 The firm's problem

Whenever a firm opens a vacancy it incurs in a cost c as long as the firm meets a worker at rate λ. In this instant the productivity of the match is revealed and the two parities agree on the future of the relationship. If the productivity is very high, the worker is offered a permanent contract. If the productivity is very low, the firm keeps the vacancy opened. In the intermediate situation, the worker may either get a temporary contract or may be hired in the informal market.

$$rV = -c + \lambda \int_{\underline{\epsilon}}^{\overline{\epsilon}} \max[J^P(\epsilon'^T(\epsilon'^I(\epsilon'), V]dG(\epsilon') - \lambda V \tag{41}$$

$$\tag{42}$$

Once the worker is hired permanently, the firm receives a productivity flow equal to $p+\epsilon$ and pays to the worker a salary $\omega^P(\epsilon)$ and to the Government the payroll tax equal to $\tau^P\omega^P(\epsilon)$. At rate α^P the match is hit by a productivity shock and the relation may change according to the new drawn productivity level (Eq **??**). If the worker is hired on a temporary basis, the firm receives a productivity flow equal to $p+\epsilon$ and pays to the worker a salary $\omega^T(\epsilon)$ and to the Government the payroll tax equal to $\tau^T\omega^T(\epsilon)$, where $\tau^T < \tau^P$ since the payroll taxes associated with temporary contracts are lower compared to permanent contracts. At rate α^T the match is hit by a productivity shock and the relation may change according to the new drawn productivity level. In addition at rate δ the worker may find a better job and quit his current position, leaving the firm with an open vacancy (Eq **??**). If the worker is hired in the informal market, the firm receives a productivity flow equal to $p+\epsilon$ and pays to the worker a salary $\omega^I(\epsilon)$. However, the firm pays no payroll taxes to the Government. At rate α^I the match is hit by a productivity shock and the relation may change according to the new drawn productivity level. In addition at rate ϕ the firm may be caught by the Government authorities, subject to the payment of a penalty fee equal to $\phi\sigma$ and forced to open a new vacancy. Finally, at rate η the worker may find a better job and quit his current

position, leaving the firm with an open vacancy (Eq 43).

$$
\begin{aligned}
rJ^P(\epsilon) &= p + \epsilon - (1+\tau^P)\omega^P(\epsilon) \qquad (43)\\
&+ \alpha^P \int_{\underline{\epsilon}^P}^{\bar{\epsilon}^P} \max[J^P(\epsilon'^T(\epsilon'^I(\epsilon') - F, V - F] dH^P(\epsilon'^P J^P(\epsilon)\\
rJ^T(\epsilon) &= p + \epsilon - (1+\tau^T)\omega^T(\epsilon) \qquad (44)\\
&+ \alpha^T \int_{\underline{\epsilon}^T}^{\bar{\epsilon}^T} \max[J^P(\epsilon'^T(\epsilon'^I(\epsilon') - F, V - F] dH^T(\epsilon'^T J^T(\epsilon)\\
&+ \delta(V - J^I(\epsilon))\\
rJ^I(\epsilon) &= p + \epsilon - \omega^I(\epsilon) + \alpha^I \int_{\underline{\epsilon}^I}^{\bar{\epsilon}^I} \max[J^P(\epsilon'^T(\epsilon'^I(\epsilon'), V] dH^I(\epsilon'^I J^I(\epsilon) \qquad (45)\\
&+ \phi(V - J^I(\epsilon)) - \phi\sigma + \eta(V - J^I(\epsilon))
\end{aligned}
$$

4.2.2 The worker's problem

When the worker is unemployed he receives unemployment benefits b and meets a firm with an open vacancy at rate γ. If he receives a permanent position, he will get a salary $\omega^P(\epsilon)$ and at rate α^P his productivity level may change as well as his employment status. He might therefore become unemployed, transit to the informal sector or to a temporary position (Eq. 46).

$$
\begin{aligned}
rU &= b + \gamma \int_{\underline{\epsilon}}^{\bar{\epsilon}} \max[W^P(\epsilon'^T(\epsilon'^I(\epsilon'), U] dG(\epsilon') - \gamma U \qquad (46)\\
rW^P(\epsilon) &= \omega^P(\epsilon) + \alpha^P \int_{\underline{\epsilon}^P}^{\bar{\epsilon}^P} \max[W^P(\epsilon'^T(\epsilon'^I(\epsilon'), U] dH^P(\epsilon') \qquad (47)\\
&- \alpha^P W^P(\epsilon)
\end{aligned}
$$

If he is hired on a temporary basis (Eq. **??**), he receives a salary $\omega^T(\epsilon)$, he may get hit by a productivity shock at rate α^T and at rate $\xi\gamma$ he may find a better job. Finally, if he is hired in the informal sector he receives a salary equal to $\omega^I(\epsilon)$ and he may be hit by a productivity shock equal to α^I. In addition at rate ϕ he will lose his job because of the

Government authorities intervention. Finally at rate $\chi\gamma$ he will find a better job (Eq. 48).

$$\begin{aligned} rW^T(\epsilon) &= \omega^T(\epsilon) + \alpha^T \int_{\underline{\epsilon}^T}^{\bar{\epsilon}^T} \max[W^P(\epsilon'^T(\epsilon'^I(\epsilon'), U]dH^T(\epsilon') \\ &- \alpha^T W^T(\epsilon) + \xi\gamma \int_{\underline{\epsilon}}^{\bar{\epsilon}} \max[W^P(\epsilon'^T(\epsilon'^I(\epsilon'), U]dG(\epsilon') \\ &- \xi\gamma W^T(\epsilon) \end{aligned} \tag{48}$$

$$\begin{aligned} rW^I(\epsilon) &= \omega^I(\epsilon) + \alpha^I \int_{\underline{\epsilon}^I}^{\bar{\epsilon}^I} \max[W^P(\epsilon'^T(\epsilon'^I(\epsilon'), U]dH^I(\epsilon'^I W^I(\epsilon) \\ &+ \phi(U - W^I(\epsilon)) + \chi\gamma \int_{\underline{\epsilon}}^{\bar{\epsilon}} \max[W^P(\epsilon'^T(\epsilon'^I(\epsilon'), U]dG(\epsilon') \\ &- \chi\gamma W^I(\epsilon) \end{aligned} \tag{49}$$

4.2.3 Surplus and wage bargaining

The surplus of the match changes according to the sector as well as the type of contract. Therefore, three types of surplus are computed: for permanent contracts, for temporary contracts and for the informal sector. The firing cost F and the payroll taxes τ enter in the bargaining equations and affect the equilibrium wages. To make the problem tractable we assume that $\frac{\beta^P}{(1-\beta^P)(1+\tau^P)} = \frac{\beta^F}{(1-\beta^F)(1+\tau^F)} = \frac{\beta^I}{(1-\beta^I)}$, thus the division of the surplus across jobs is the same.

$$S^P(\epsilon) = J^P(\epsilon) + W^P(\epsilon) - (V - F) - U \tag{50}$$

$$\beta^P[J^P(\epsilon) - (V - F)] = (1 - \beta^P)(1 + \tau^P)[W^P(\epsilon) - U] \tag{51}$$

$$S^T(\epsilon) = J^T(\epsilon) + W^T(\epsilon) - V - U \tag{52}$$

$$\beta^T[J^T(\epsilon) - V)] = (1 - \beta^T)(1 + \tau^T)[W^T(\epsilon) - U] \tag{53}$$

$$S^I(\epsilon) = J^I(\epsilon) + W^I(\epsilon) - V - U \tag{54}$$

$$\beta^I[J^I(\epsilon) - V] = (1 - \beta^I)[W^I(\epsilon) - U] \tag{55}$$

As a result of the Nash bargaining, we can compute the equilibrium wages for the three types of workers:

$$\omega^P(\epsilon) = \frac{\beta^P}{(1 + \tau^P)}(p + \epsilon + c\theta + rF) + (1 - \beta^P)b \tag{56}$$

$$\omega^T(\epsilon) = \frac{\beta^T}{(1+\tau^T)}(p + \epsilon + (1-\xi)c\theta) + (1-\beta^T)b \tag{57}$$

$$\omega^I(\epsilon) = \beta^I(p + \epsilon - \phi\sigma + (1-\chi)c\theta) + (1-\beta^I)b \tag{58}$$

4.2.4 Steady State

The equilibrium steady state is defined by eight equations and eight unknown parameters. The parameters which define the models include eight productivity thresholds and the market tightness. The equations include the job destruction and job creation conditions and the free entry condition $V = 0$.

The threshold ϵ_G defines the level of productivity by which the firm is indifferent whether to offer a permanent or a temporary job. Therefore it defines the job creation condition from unemployment to formal employment (either permanent or temporary). The threshold ϵ_D defines the level of productivity by which the firm is indifferent whether to offer a temporary job in the formal sector or a job in the informal sector. Therefore it defines the job creation condition from unemployment to formal (temporary) and informal employment. Finally the threshold ϵ_B defines the level of productivity below which the firm is firing the worker and opens a new vacancy. Therefore it defines the job destruction condition from temporary employment to unemployment.

$$J^T(\epsilon_G) = J^P(\epsilon_G) \tag{59}$$
$$J^T(\epsilon_D) = J^I(\epsilon_D) \tag{60}$$
$$J^T(\epsilon_B) = 0 \tag{61}$$

The threshold ϵ_A defines the level of productivity by which the firm is indifferent whether to keep the worker as a permanent employee or offer him a temporary job. Therefore it defines the job transition from permanent to temporary employment. The threshold ϵ_S defines the level of productivity by which the firm is indifferent whether to transfer the worker to a temporary job in the formal sector or to a job in the informal sector. Therefore it defines the job transition from permanent to formal (temporary) and informal employment. Finally the threshold ϵ_Q defines the level of productivity below which the firm is firing the worker and opens a new vacancy. Therefore it defines the job destruction condition from permanent employment to unemployment.

$$J^P(\epsilon_A) + F = J^T(\epsilon_A) \tag{62}$$
$$J^P(\epsilon_S) + F = J^I(\epsilon_S) \tag{63}$$
$$J^P(\epsilon_Q) + F = 0 \tag{64}$$

The threshold ϵ_V defines the level of productivity by which the firm is firing the informal worker and opens a new vacancy. Therefore it defines the job destruction condition from informal employment to unemployment.

$$J^I(\epsilon_V) = 0 \tag{65}$$

From equation 62 by plugging in the expression for the wage for formal workers $\omega^P(\epsilon)$ as in 57

$$J^P(\epsilon) + F = \frac{(1-\beta^P)(\epsilon - \epsilon_Q)}{r + \alpha^P} \tag{66}$$

From equation 61 by plugging in the expression for the wage for formal workers $\omega^T(\epsilon)$ as in 58

$$J^T(\epsilon) = \frac{(1-\beta^T)(\epsilon - \epsilon_B)}{r + \delta + \alpha^T} \tag{67}$$

From equation 61 by plugging in the expression for the wage for formal workers $\omega^I(\epsilon)$ as in 58

$$J^I(\epsilon) = \frac{(1-\beta^I)(\epsilon - \epsilon_V)}{r + \phi + \eta + \alpha^I} \tag{68}$$

The steady state equilibrium is therefore defined by the following set of equations:

$$\frac{(1+\tau^P)(1-\beta^P) + \beta^P(1+\tau^T)}{(1+\tau^P)(1-\beta^P)} \left[\frac{(1-\beta^P)(\epsilon_G - \epsilon_Q)}{r + \alpha^P} - F \right] = \frac{(\epsilon_G - \epsilon_B)}{r + \delta + \alpha^T} \tag{69}$$

$$\frac{1+\tau^T(1-\beta^T)}{(1+\tau^T)} \frac{(\epsilon_D - \epsilon_B)}{r + \delta + \alpha^T} = \frac{(\epsilon_D - \epsilon_V)}{r + \phi + \eta + \alpha^I} \tag{70}$$

$$\frac{1+\tau^T(1-\beta^T)}{(1+\tau^T)(1-\beta^T)} \left[\frac{(1-\beta^P)(\epsilon_N - \epsilon_Q)}{r + \alpha^P} - F \right] = \frac{(\epsilon_N - \epsilon_V)}{r + \phi + \eta + \alpha^I} \tag{71}$$

$$\frac{(1+\tau^P)(1-\beta^P) + \beta^P(1+\tau^T)}{(1+\tau^P)} \left[\frac{(\epsilon_A - \epsilon_Q)}{r + \alpha^P} \right] = \frac{(1-\beta^T)(\epsilon_A - \epsilon_Q)}{r + \delta + \alpha^T} \tag{72}$$

$$\frac{1+\tau^P(1-\beta^P)}{(1+\tau^P)} \frac{(\epsilon_S - \epsilon_Q)}{r + \alpha^P} = \frac{(\epsilon_S - \epsilon_V)}{r + \phi + \eta + \alpha^I} \tag{73}$$

$$\epsilon_Q = -rF - p + (1+\tau^P)b + \frac{\beta^P}{(1-\beta^P)}c\theta - \alpha^P\left[\int_{\epsilon^Q}^{\epsilon_S}\frac{(1+\tau^P)}{1+\tau^P(1-\beta^P)}\frac{(\epsilon'-\epsilon_R)}{(r+\phi+\eta+\alpha^I)}\right]dH^P(\epsilon')$$
$$+\alpha^P\left[\int_{\epsilon_S}^{\epsilon_A}\frac{(\epsilon'-\epsilon_B)}{(r+\delta+\alpha^T)}dH^T(\epsilon'^{\bar{\epsilon}_P}_{\epsilon_A}\frac{(1+\tau^T)}{(1+\tau^T)(1-\beta^T)+\beta^T(1+\tau^P)}\frac{(\epsilon'-\epsilon_Q)}{(r+\alpha^P)}dH^P(\epsilon')\right] \quad (74)$$

$$\epsilon_B = -p + (1+\tau^T)b + \frac{\beta^T}{(1-\beta^T)}(1-\xi)c\theta - \alpha^T\left[\int_{\underline{\epsilon}^T}^{\epsilon_D}\frac{(1+\tau^T)}{1+\tau^T(1-\beta^T)}\frac{(\epsilon'-\epsilon_V)}{(r+\phi+\eta+\alpha^I)}\right]dH^P(\epsilon')$$
$$+\alpha^T\left[\int_{\epsilon_D}^{\epsilon_G}\frac{(1+\tau^P)}{(1+\tau^P)(1-\beta^P)+\beta^P(1+\tau^T)}\frac{(\epsilon'-\epsilon_B)}{(r+\delta+\alpha^T)}dH^P(\epsilon'^{\bar{\epsilon}_P}_{\epsilon_G}\frac{(\epsilon'-\epsilon_Q)}{(r+\alpha^P)}dH^P(\epsilon')\right] \quad (75)$$

$$\epsilon_V = -p + b + \frac{\beta^I}{(1-\beta^I)}(1-\chi)c\theta + \phi\sigma - \alpha^I\left[\int_{\epsilon_V}^{\epsilon_D}\frac{(\epsilon'-\epsilon_V)}{(r+\phi+\eta+\alpha^I)}dH^I(\epsilon')\right]$$
$$+\frac{\alpha^I}{(1-\beta^I\tau^T)}\left[\int_{\epsilon_D}^{\epsilon_G}\frac{(\epsilon'-\epsilon_B)}{(r+\delta+\alpha^T)}dH^I(\epsilon'^{\bar{\epsilon}_I}_{\epsilon_G}\left[\frac{(\epsilon'-\epsilon_Q)}{(r+\alpha^P)}-F\right]dH^I(\epsilon')\right] \quad (76)$$

$$\frac{c}{\lambda} = \int_{\underline{\epsilon}}^{\epsilon_D}\frac{(1-\beta^I)(\epsilon'-\epsilon_V)}{(r+\phi+\eta+\alpha^I)}dG(\epsilon') + \int_{\epsilon_D}^{\epsilon_N}\frac{(1-\beta^T)(\epsilon'-\epsilon_B)}{(r+\delta+\alpha^T)}dG(\epsilon'^{\bar{\epsilon}}_{\epsilon_N}\left[\frac{(1-\beta^P)(\epsilon'-\epsilon_Q)}{(r+\alpha^P)}-F\right]dG(\epsilon') \quad (77)$$

4.3 Discussion

TBD

4.4 Calibration and Policy Implication:How to drive emersion

TBD

5 Conclusions

We analized how different policy interventions can drive emersion from tax evasion.We have studied in particular the emersion of undeclared labor and we have based our analysis on the Italian labour market 1998-2003. Our emprical investigetion suggests that 2003 Italian labor market reform, despite aimed to create the necessary conditions to lead a reduction of shadows activities, it wasn't able to reach its objectives. We develop a searching and matching model on the basis of our emprical results in order to determine the right mix of policy interventions to obtain emersion. Our preliminary findings shows that differentiate the forms of taxations and enforcement should work together to achieve emersion of tax evasion.

References

Table 1: Fixed effect estimates

	(1) logUD	(2) logUD	(3) logUD	(4) logUD	(5) logUD	(6) logUD	(7) logU	(8) logU	(9) logU
D_{BIAGI}	1.081**	1.325***	0.670	0.554	0.634	0.674	1.148***	0.825	0.604
	(0.279)	(0.302)	(0.346)	(0.358)	(0.530)	(0.326)	(0.269)	(0.499)	(0.307)
unemployment		0.0820*		0.0895*	0.0195	0.0309		0.0310	0.0419
		(0.0384)		(0.0414)	(0.0477)	(0.0514)		(0.0484)	(0.0524)
age					0.0203	0.00783		0.0119	-0.00534
					(0.100)	(0.109)		(0.0981)	(0.105)
tertiary					0.0659***	0.0580**		0.0663***	0.0581**
					(0.0166)	(0.0188)		(0.0153)	(0.0174)
female					-0.0398	-0.0362		-0.0347	-0.0317
					(0.0282)	(0.0304)		(0.0277)	(0.0291)
industry3					0.0134	0.0117		0.00493	0.00530
					(0.0362)	(0.0367)		(0.0346)	(0.0350)
industry5					0.133	0.137*		0.110	0.115
					(0.0635)	(0.0637)		(0.0623)	(0.0636)
industry8					0.00393	-0.00437		0.00553	-0.00270
					(0.0272)	(0.0301)		(0.0256)	(0.0276)
year dummies	yes	yes	no	no	yes	no	yes	yes	no
cubic trend	no	no	yes	yes	no	yes	no	no	yes
N	132	132	132	132	132	132	132	132	132

Robust standard errors in parentheses
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 2: Difference in differences estimates.

	(1) logUD	(2) logUD	(3) logUD	(4) logUD	(5) logU	(6) logU	(7) logU	(8) logU	(9) share	(10) share	(11) share	(12) share
D_{BIAGI}	0.429	0.581	0.519**	0.337	0.475	0.685	0.841**	0.470	0.0114	-0.00187	0.00685	-0.0137
	(0.333)	(0.431)	(0.180)	(0.357)	(0.339)	(0.448)	(0.274)	(0.363)	(0.00627)	(0.0122)	(0.00409)	(0.0106)
change	0.170	0.240	0.284	0.276	0.165	0.271	0.485	0.337	0.0214	0.0100	0.0221	0.0115
	(0.341)	(0.324)	(0.255)	(0.361)	(0.329)	(0.318)	(0.306)	(0.343)	(0.0245)	(0.0167)	(0.0233)	(0.0178)
change*D_{BIAGI}	-0.542	-0.624	-0.632	-0.504	-0.575	-0.655	-0.832	-0.643	-0.0302	-0.0386	-0.0254	-0.0121
	(0.590)	(0.511)	(0.438)	(0.461)	(0.571)	(0.489)	(0.462)	(0.443)	(0.0311)	(0.0297)	(0.0275)	(0.0228)
controls	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes
sample	2000-2006		1995-2008		2000-2006		1995-2008		2000-2006		1995-2008	
N	76	76	132	132	76	76	132	132	74	74	130	130

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Fixed effects estimates

	(1) logTP	(2) logTP	(3) logTP	(4) logTP	(5) logTP	(6) logTP
D_{BIAGI}	0.449	0.923**	0.845**	0.0600	-0.327	-0.114
	(0.221)	(0.251)	(0.261)	(0.431)	(0.469)	(0.494)
logUD	-0.0816	-0.124*	-0.115			
	(0.0560)	(0.0498)	(0.0613)			
D_{BIAGI}*logUD	0.0444	0.104	0.0894			
	(0.0492)	(0.0573)	(0.0538)			
logU				-0.0687	-0.0999	-0.105
				(0.0565)	(0.0520)	(0.0615)
D_{BIAGI}*logU				0.0278	0.0613	0.0697
				(0.0449)	(0.0499)	(0.0465)
controls	no	unemp	yes	no	unemp	yes
N	94	94	94	94	94	94

Standard errors in parentheses
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$