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Abstract

The model presents the dynamics and the equilibrium of an overlapping generation economy when there is informal employment, a pension system and altruistic agents. The model inspires from stylised facts on developping and Euro-Mediteranean countries where family plays a central role in risk insurance. The rational is emphasised by lower costs compared to private and public insurance systems. Given an initial distribution of the informally employed individuals, the model captures the effects of social security decisions and anticipated bequests on the preference of the agents for formal or informal employment. The impact of fiscal policies on the distribution of employment to formal and informal categories is analysed through the political competition. We show that opportunist behaviour would amplify the relative size of the informal employment.

1 Introduction

Reforms of social security systems have recently become a major concern in many countries. Since the problem has many dimensions i.e. demographics, characteristics of labour market, economic, governmental and institutional constraints, an optimal social security design is not straightforward and increasingly complicated with interconnections and externalities. Furthermore,

the question is highly political and there is a need for a long lasting social agreement, which makes the final picture even blurrier. Many policy recommendations point out the necessity of parametric and structural social security system reforms combined with active labor market policies to decrease budgetary burdens of social security expenditures. Within this scope, informal employment[1] reveals as a major topic for policy makers especially in developing countries and interestingly enough in developed Euro-Mediteranean countries where informal employment is higher than European average. This part of population who are not participating to public insurance system will probably face welfare fluctuations and generate larger health and pension expenditures to be financed. As the share of informal employment grows, the burden of these expenditures on the budget will get increasingly important. Aside from the fact that there is an informal demand of labour there is a striking characteristic on supply side: people may prefer not to insure themselves against these risks of fluctuations in welfare and quality of life. Why individuals accept to work as unregistered?

Traditionally, informal sector is seen as the disadvantaged segment of a dualistic labor market[2] (Lewis (1954), Harris-Todaro (1970) and Fields (1990)), however recent literature (Maloney (1999), Maloney (2004) and Gindling (1991)) point out that workers may choose informal employment voluntarily[3]. De Soto (1989) argues in a similar vein that informal workers

[1]Here, by informality, we mean the noncompliance with the legal and administrative regulations rather than with social regulations following the characterisation of Portes (1994). This definition differs from the official definition of informal labour (the International Conference of Labour Statisticians (ICLS) in 1993) where an informal enterprise as one whose size in terms of employment is below a certain threshold (determined nationally) and/or which is not registered under specific forms of national legislation, such as factories or commercial acts, tax or social security laws, established by national legislative bodies.

[2]Lewis (1954) described informality through a familiar picture of urban informal employment as: "the phenomenon [of "disguised" unemployment] is not, however, by any means confined to the countryside. Another large sector to which it applies is the whole range of casual jobs –the workers on the docks, the young men who rush forward asking to carry your bags as you appear, the jobbing gardener... petty retail trading".

[3]This school of thought questions the preferability of formal sector jobs along the vari-

may develop their own laws and institutions to cover for the shortcomings of the official legal system[4]. Galiani and Weinschelbaum (2007) proposes a general equilibrium model with heterogeneous firms (workers) choosing optimally whether to operate (work) formally or informally and shows that worker's decisions are important in determining the equilibrium of the economy and an increase in the participation of secondary workers would tend to raise the level of informality in the economy. We can argue that economic and social factors influence the decision making process in a complex interactive manner. We propose an evolutionary model to consider the choice of informality by workers. The model is mainly inspired from the stylised facts about social insurance in developing countries and also Euro-Mediterranean countries where family support is acting as an insurance mechanism against a wide range of risks and may substitute or complete public insurance or any other insurance services as workers and sometimes even public authorities perceive the cost of family support cheaper than public insurance. This institutional feature of social security arrangements is supported by Kotlikoff and Spivak (1981) finding out that family support can substitute as much as

ous dimensions mentioned in the traditional literature i.e. if formal employment is linked with the provision of pension benefits or health care benefits, in less developed countries, these fringe benefits are not definitely conceived as good because of the potential raid of pension funds by government and the low quality of health services or unnecessary because of family coverage through another member of the household. Especially when we consider formal and informal social protection as alternatives, we see that informal employment might be prefered due to the existence informal alternatives to formal pensions, of which traditional family support has been most important historically. In countries where family plays a central role in income insurance, low level of female participation to labour market or high informal female employment is observed due to inadequate labor market conditions i.e. the lack of greater range of part-time jobs and generalised childcare services etc. High unemployment rate is another factor. The informal sector offers a greater job opportunity with less security.

[4]Brazil Jobs Report (2002) provides evidence from Brazilian Labour Market supporting this view: roughly four out of every five self-employed Brazilians prefer an informal job to one in the formal sector. However, the traditional view has grounds as informal wage workers appear to be rationed out of regulated employment, and would -if possible- rather work in the formal sector because of the major drawback of informality, little or no access to income support programs such as no salarial and unemployment insurance.

70% of the coverage of a complete annuity market without additional cost or risk such as moral hazard and adverse selection and Jowett (2003) concluding by empirical evidence from Vietnam that individuals living in highly cohesive communities are far less likely to find public voluntary health insurance attractive enough to purchase. Bugra and Keyder (2006) underlines the role of family in Turkish welfare regime where under the prevailing unfavourable labour market structure (high level of self-employment, large proportion of unpaid family workers and important share of informal employment) formal social security system offers very limited social protection and family takes a central role in the insurance against risky situations and substitute formal safety nets to provide care for the elderly and points out the similarities with Southern European social protection model (Ferrera (1996)). Another issue is the composition and size of family as Gonzalez de la Rocha and Gantt (1995) show that workers can move to riskier but better rewarded jobs if other family members can hedge against risk. Consequently, this informal insurance mechanism appears crucial in the analysis of the choice of informal employment. We have shown using an evolutionary model accounting for family support that there will be a positive share of informal employment in the economy.

Moreover, an important feature of informal employment in developing countries is that governments do not struggle in an intensive manner to formalise informally employed workers since if informal market is formalised and legal minimum wage and associated payroll taxes are paid, these will induce a higher unemployment and welfare loss. In other words, the choice of informal employment based on social realities is coupled with a tolerant government. In Turkey, this view have influenced initial social insurance design and policy makers have been considering family[5] as the major pillar

[5]The fact that in Turkey, law dated 1976 on non-contributory social protection (Social Protection and Old Age Pension) regime that concerns disabled individuals and elderly who are not covered by any social insurance requires that potential beneficiaires should not have any close relatives reflect that particular outlook where family solidarity and

of public social insurance which caused high non-contributory expenditures and a misconception of public insurance system:

> "The official social policy discourse still refers to the family as the central welfare institution, and defines the role of the government as providing support to the family because it is supposed to fulfil the task of assuring social protection to the individual" (Bugra and Keyder (2006)).

This lack of consideration is analysed through the behaviour of politicians. Given an initially existing informal employment, we see that under electoral concerns, this segment prevails and there will not be any fight against this informality. Empirical evidence suggests that successful political parties give priority to the interests and liberties of electors and collective demand. As this informal category will benefit both from bequests from social network and non-contributory protection regimes, political discourse will respond to this existing distribution of labour market and contribute to the informalisation. The results of the model analysed are in accordance with this observation.

2 THE MODEL

This model accounts for labour supply decision when participation to formal social security is affected by bequests. The general set up of the labour market is inspired by recent empirical research where the clear cut traditional segmentation of labour market into formal and informal segments is more and more questioned. In this context, we characterise labour market by a continuity of employment alternatives rather than comprehending labour market as segmented. Agents live two periods for an easy interpretation of life cycle behaviour: working period and retirement period. We suppose that there

other networks of charity are seen as the proper means of dealing with poverty.

are two employment alternatives for the representative worker: formal and informal employment. In line with Maloney (2004) and Gindling (1991) and following Dickens and Lang (1985), for a homogeneous population of workers in terms of their characteristics, we set two different wage equations for formal and informal employment while allowing workers to choose employment type. The formal employment is differentiated with an unemployment risk. We include government with a balanced budget. We suppose that retirement is financed through contributions to an unfunded social security system in formal employment and bequests are the only income of retirees in informal category.

2.1 Population

We consider an economy where agents live two periods: the first period is the working period and the second period is the retirement period. We suppose that population can be summarised into one representative family where a representative working and retired member coexist. There are two types of employment alternatives that we classify as formal and informal. The superscript $k \in \{F, I\}$ denotes employment alternative where F is used for formal and I for informal. For the generation t, s_t is the share of formal labour and $1 - s_t$ will be the share of informal labour. At the first period the representative worker is endowed with one unit of labour that he inelastically supplies in the labour market. Note that workers have no intrinsic preferences for the sector they work for.

We refer, on the relationship between formal and informal wages, to the theory of equalising differences recognising the combination of wages and job attributes as the relevant "price" of labour. Rosen (1986) analyses accordingly observed wage differentials by considering both pecuniary and non-pecuniary rewards of employment. The choice of informal employment can be discussed in this context when social security benefits and altruistic transfers are considered as fringe benefits of formal and informal jobs respectively.

In that sense, the "price" of informal and formal employment is no longer the bare wage rate and requires that the expected utility from that particular job is higher than elsewhere. At any point in time, the coexistence of both type of jobs in the labour market implies that the expected utility of both type of jobs must be equal in that particular point. Thus, we can say that with no barriers to entry to formal jobs and without any segmentation in the labour market, rewards of formal jobs can become even with rewards of informal jobs in an altruistic setting of intergenerational relationships taking into account the negative effect of risk of unemployment and the level of taxes for formal jobs and the positive effect of public services and altruistic transfers for informal jobs, even if the initial wage rates differ between both categories. We can note as well that given that fringe benefits generate costs to the employer, we can not definitely affirm that wages are lower in the informal sector, and empirical evidence is required to establish the relative wage levels.

Regarding unemployment, we can refer to Tokman (1989) alleging that the "modern" sector is incapable of generating sufficient employment and small firms of the informal sector then act as a second-best in easily-entered, competitive markets. As such, unemployment duration may differ between two employment alternatives. Empirical evidence from Brazil suggests that formal workers are more likely to remain unemployed than informal workers when they have lost their jobs[6]. This is in one hand due to employment regulations reducing worker turnover in the formal sector and on the other hand to unemployment supports which may financially facilitate this duration and allow formal worker to be more selective. We try to capture this difficulty by introducing a probability of being unemployed ε if worker chooses to work in formal jobs. This may be conceived in the context of queuing for formal jobs. The expected wage for formal employment is then $w^F = (1-\varepsilon)y^F + \chi\varepsilon y^F$ where $w^{F,e} = y^F$ is formal wage rate and $w^{F,u} = \chi y^F$ is unemployment ben-

[6] See Domeland and Fiess (2006).

efit. In what follows we will note employment status by $i \in \{e, u\}$. w^I is the wage rate for an informal job[7].

The agents derive utility from consumption of private and public goods. The instantaneous utilities of a working agent $u(c_t^k, g_t)$ and an elderly agent $u(d_t^k, g_t)$ are supposed to have the following properties: $u_c \geq 0$ and $u_{cc} < 0$, $u_d \geq 0$ and $u_{dd} < 0$ with c_t^k working period consumption, d_t^k retirement period consumption and g_t public goods and services. We suppose that the utility is additively separable in consumption of private and public goods as in Agenor (2007)[8]. The income of formal workers is allocated to consumption c_t^k after the payment of social security contribution, wage income tax and bequest at rates θ, τ and q^k respectively and informal workers consume all their income after bequests.

We suppose that all agents provide bequests to informal elderly. These bequests will constitute the income of the elderly members of their families who are not protected by any social security scheme. We can easily understand this behaviour from the perspective of informal workers as they would live out of bequests in their retirement. However, from the view point of rational formal workers, this bequest rate should be zero. We suppose that formal workers are required by legal and/or social enforcements -which also apply for informal workers- to take care of elderly members of the family

[7]The wages for formal and informal workers are given so that we can study a specific labour supply decision. This particular choice is based on an implicit assumption of infinitely elastic labour demand. As the purpose of this study is to analyse the impact of institutional factors on labour supply decisions, we have not determined any relationship for the establishment of wage levels for formal and informal workers. If we had to consider any labour demand side impact, by allowinga finite elasticity labour demand and flexible wages, we could have introduced a general equilibrium setting thereby analysed the effect of labour market adjustments on relative wages. The intuition suggests that in that case, elasticity differences for formal and informal workers would be important in the determination of equilibrium informality, unemployment rate and benefit would be important as high unemployment would increase the transition to informality and provision of unemployment benefits would affect adversely.

[8]We follow the theoretical formulation in Agenor (2007) which is in line with the empirical evidence provided by Karras (1994), McGrattan et al. (1997), Chiu (2001) and Okubo (2003).

having no social insurance. This behavioural difference is reflected in the difference of bequest rates for formal and informal workers[9].

Remark 1 *We suppose that agents do not invest in capital markets or we may also say that savings are done through non-market means, namely by social networks. Bequests act as a kind of saving or social insurance mechanism. This feature of the model is consistent with non-market saving behaviour of agents in underdeveloped and developing countries, this study aims to analyse. The reason behind this is twofold: first there is the social rule to protect elderly members without any social security and second there is the positive probability to work in informal segment and to become a future unprotected elderly member of the family.*

At the second period, both type of workers are retired. Their incomes are after tax social security benefits b_t^k for formal workers and family bequests for informal workers. We consider an unfunded or Pay-As-You-Go (PAYG) scheme. The principle of PAYG is to finance the social security benefits of retirees by the contributions of current workers. Given the contribution rate θ, the budget constraint of PAYG scheme is then as follows:

$$s_t \theta w^{F,i} = s_{t-1} b_t^{F,i}$$

where the collection of contributions equal the payment of social security benefits and from this equation we calculate the social security benefit in the formal labour category as $b_t^{F,i} = \frac{s_t \theta w^{F,i}}{s_{t-1}}$[10]. At the retirement period, they consume their total incomes. The resulting consumption level for each

[9]Note that we have not given any explicit value for these rates as informal support networks can hardly be homogeneous. A suggestion is that rational informal workers would determine their transfers by maximising expected lifetime utility and formal workers would be inclined to provide transfers so as to respect legal/social enforcements as long as there is not a very big gap between welfare accorded with public pension scheme and welfare provided by social support to informal elderly.

[10]We suppose that there is no population growth without loss of generality.

category and both periods in consideration are given by:

$$\begin{aligned} c_t^{F,i} &= (1-q^F)(1-\tau)(1-\theta)w^{F,i} \\ c_t^I &= (1-q^I)w^I \\ d_t^{F,i} &= (1-\tau)b_t^{F,i} = (1-\tau)\frac{s_t\theta w^{F,i}}{s_{t-1}} \\ d_t^I &= \frac{s_t q^F(1-\tau)(1-\theta)w^F + (1-s_t)q^I w^I}{1-s_{t-1}} \end{aligned} \tag{1}$$

Remark 2 *Notice that an elderly informal agent is expected to receive bequests from both category of labour according to their shares. Here population acts like a family as a whole. Both category provides income to informal members. Notice also that the share of formal retired will be* s_{t-1} *and informal retired* $1-s_{t-1}$.

2.2 Government

In this economy government imposes a tax on wage income ($s_t\tau w^F$) to finance unemployment benefits and government expenditures ($g_t+s_t\varepsilon\chi y^F$). As public budget is balanced public expenditure will follow the determination of income tax rate. The latter in return is set through electoral competition. The budget constraint for the government is then as follows:

$$g_t + s_t\varepsilon\chi y^F = s_t\tau(1-\theta)w^F + \tau s_t\theta w^F \tag{2}$$

where unemployment benefits and government expenditures equals fiscal revenue as $g_t = s_t(\tau w^F - \varepsilon\chi y^F)$.

2.3 Labour supply decisions

The movement of workers between the formal and informal sectors and unemployment, and the other way around is subject to theoretical and empirical

analysis and it has been shown that a non-negligible share of the labour force over time moves between states. This movement is mostly studied in relationship to business cycles however, given the fact that informal employment is not declining while the economy is growing suggests that these moves from formal to informal self-employment can very well be generalised to increases in earnings (see Jütting et al. (2008), Packard (2007), Duryea et al. (2006) and Bosch and Maloney (2006)).

Given this empirical fact and social framework, workers will choose formal or informal employment when they enter labour market and this choice will determine their first and second period consumption levels and therefore their lifetime utility. We suppose that workers are boundedly rational in the sense that the choice of employment alternative is not done based on intertemporal maximisation, instead we suppose that initially economy is populated with agents in both categories of labour market and population evolves in a manner favouring better performing choices in the long run. The payoff of any choice is given in this setup by the calculation of an estimated lifetime utility for each category, since workers can observe the utilities of formal and informal workers and retirees, they simply calculate a weighted average of utilities in working and retirement period within formal and informal categories, $u^F(c_t^F, d_t^F, g_t)$ and $u^I(c_t^I, d_t^I, g_t)$ respectively, where this weight is denoted by p. We suppose that this parameter reflects the intertemporal preference of workers. Note that within the representative family, the optimal strategy may imply formal employment for some members providing social protection and other benefits to the entire family, and informal employment for the rest of the family deciding by taking into account these

fringe benefits[11]. Thus we have the following utilities:

$$u^F(c_t^F, d_t^F, g_t) = p\left((1-\varepsilon)u(c_t^{F,e}, g_t) + \varepsilon u(c_t^{F,u}, g_t)\right) \tag{3}$$
$$+(1-p)\left((1-\varepsilon)u(d_t^{F,e}, g_t) + \varepsilon u(d_t^{F,u}, g_t)\right)$$
$$u^I(c_t^I, d_t^I, g_t) = pu(c_t^I, g_t) + (1-p)u(d_t^I, g_t)$$

where $g_t = s_t(\tau w^F - \varepsilon\chi y^F)$. Here we describe the evolution of choices through time according to which choices giving higher payoff will be imitated and their share in the population will increase. This will induce the following continuous time dynamics (the detailed description of the evolutionary dynamics and the transformation of discrete-time dynamics to continuous-time dynamics are provided in Appendix A):

$$\dot{s} = 2\beta(1-s)(u^F(c^F, d^F, g) - u^I(c^I, d^I, g))s \tag{4}$$

It is clear that better performing choices have a higher growth rate which does not necessarily imply that the average utility grows. The reason is that even if a worker is replaced by a worker choosing a more rewarding employment alternative, this new distribution of workers may reduce the utility of some other workers. We will determine stable rest points of this dynamics and most importantly we will explore if starting from an initial non-negative share of informal labour, the population will evolve in such a way that there will always be a positive percentage of informal labour.

Proposition 3 *All the rest points of the evolutionary dynamics are given by the solution of the right hand side of equation (4). Notice that a population consisting only of formal and informal workers i.e.* $s = 1$ *and* $s = 0$ *are rest*

[11] Galiani and Weinschelbaum (2007) find that secondary workers are more likely to chose informal employment if someone in the household has a formal job. Maloney (1999) argues that the marginal value of formal sector benefits for a second worker in the family may be zero and which explains why individuals in larger households may choose informal jobs.

points of equation (4).

However we are only interested if an interior solution is stable or not i.e. the stability of $s \in (0,1)$ will be explored. Those rest points are given by the solution of the equality of formal and informal expected utility:

$$u^F(c^F, d^F, g) = u^I(c^I, d^I, g) \tag{5}$$

This remark will lead us to the following result.

Proposition 4 *If* $u^F(c^F, d^F, g)\big|_{s=0} > u^I(c^I, d^I, g)\big|_{s=0}$ *there is a stable* $s^* \in (0,1)$.

The proof of the proposition is provided in Appendix B. The proposition states that if the economy is populated by both types of labour then there will be an informal labour share because of the specific characteristics of the economy. Another result of the proposition is that an economy populated with only formal workers is not stable ($s^* = 1$), social network providing support in retirement will always create an incentive for being informal. Next we explore the effect of tax levels on the share of formal and informal labour. For instance, when we take the utility function to be $u(c, g) = \ln c + \eta \ln g$, s^* is obtained as a function of fiscal, social security and preference parameters. In this case $s^* = \frac{\omega^F - \omega^I}{\omega^F - \omega^I + \kappa}$ where $\omega^F = \left((1-\theta)(1-q^F)(1-\tau)y^F\right)^{\frac{p}{1-p}} \theta(1-\tau)y^F \chi^{\frac{\varepsilon}{1-p}}$, $\omega^I = \left((1-q^I)w^I\right)^{\frac{p}{1-p}} q^I w^I$ and $\kappa = \left((1-q^I)w^I\right)^{\frac{p}{1-p}} (1-\theta)q^F(1-\tau)w^F$, we have $s^* > 0$, $s^* < 1$ with $\frac{\partial s^*}{\partial \tau} < 0$. We see that the size of informal employment will grow with the level of income tax given the previous economic environment. We can generalise this result for the range of parameters defined in the following proposition:

Proposition 5 *If* $-u_{c^F} p(1-\theta)(1-q^F)y^F - u_{d^F}(1-p)\theta y^F < -u_{d^I} \frac{(1-p)(1-\theta)q^F w^F s}{1-s}$ *then* $\frac{\partial s^*}{\partial \tau} < 0$, *where* $u_{c^F} = (1-\varepsilon)u_{c^{F,e}} + \varepsilon\chi u_{c^{F,u}}$ *and* $u_{d^F} = (1-\varepsilon)u_{d^{F,e}} + \varepsilon\chi u_{d^{F,u}}$.

This condition is obtained through differentiation of equation (5) with respect to tax level. This result shows that if the impact of an increase in tax burden is more important for formal rather than informal category then the increase in tax level will contribute to an informalisation in the economy. The left (right) hand side of the condition is the impact of the change in tax level to the expected lifetime utility of a formal (informal) agent. We see that the share of formal agents will be negatively affected with a change in income tax level if the impact of tax policy is more important for the formal category. If we reformulate this condition as $\frac{s^*}{1-s^*} < \frac{y^F}{u_{d^I} q^F \tilde{w}^F}(\frac{u_{c^F} p(1-q^F)}{1-p} + \frac{u_{d^F}\theta}{1-\theta})$, we notice that this condition is more likely to be satisfied for lower levels of s^* formal employment or higher levels of informal employment. Accordingly, tax policy will adversely affect the share of informal employment in economies where there is initially a considerable level of informal employment.

Next we will use these results to analyse the determination of the income tax rate.

2.4 Political competition

In this section, we analyse the determination of income tax rate and government expenditure given the steady state informal labour share. As public budget is balanced, public expenditure will follow the determination of income tax rate. The population of voters are the family of workers having preferences over public and private consumption goods where public good is financed through taxation. Here, voters are heterogeneous as informal working and retired agents will not have to pay income tax while former working and retired agents do however all will benefit from publicly provided goods. The estimated utilities have been given above in equation (3) with respective utilities of formal and informal working voters. Notice that workers in different employment categories will have different preferences over policies and the ideal policy for each category will be given by the welfare maximising income tax rate. Welfare depends on income tax rate for all workers and for

retired informal workers, welfare will in turn depend on income tax rate as well as formal labour share which turns out to be function of income tax rate. Thus fiscal policy acts in the utility of workers through multiple channels.

The effect of an increase in income tax on *fiscal revenue* and therefore public expenditure is twofold: first it increases the tax collection for a given taxpayer population and second there is the impact through the share of formal employment. This increase in income tax decreases the share of formal workers who happen to be the only taxpayers in the economy and thus decreases fiscal revenue if economic environment is characterised according to the proposition (5). The effect of an increase in income tax on *welfare* can be classified into the effect on the consumption of private and public goods and services. As we have explained, the first changes with the labour category and the second is the result of the direct and indirect impacts of the change in income tax on fiscal revenue thus determined according to the economic environment analysed. This impact is negative for formal young and elderly, there is no effect for informal young and the impact for informal elderly depends to the change in bequests from formal workers which depend on income tax rate and the share of formal employment. Thus, these bequests will fall with the increase in income tax and vary with the share of employment. As we have mentioned, the impact of income tax rate on the share of formal workers giving bequests is given by the characteristics of the economic environment analysed.

2.5 Voters

We will denote the utilities of agents as $u_i^k(\tau)$ where $k \in \{F, I\}$ represents the employment category and $i \in \{w, r\}$ represents whether the agent is working or retired. The ideal tax policy for a voter is given by the income tax policy which maximises his utility, this ideal policy is given by the first order conditions of the utility maximisation problem over tax policies and noted by τ_i^k.

Remark 6 *Note that* τ_w^F, τ_r^F *and* $\tau_r^I < \tau_w^I$ *and when* $(\frac{u_{c^F}}{u_{d^F}} > \frac{\theta}{(1-\theta)(1-q^F)})$ *we have* $\tau_w^F \leq \tau_r^I \leq \tau_r^F$.

The proof of this remark is provided in Appendix C. We see that informal retirees suffering from income loss due to decrease in formal private transfers after a tax raise and as taxation increases informality, having to share their reduced income with more informal retirees, will prefer a lower tax rate compared with informal workers.

2.6 Politicians

Each period, there is a two-party electoral competition over the proportional tax rate to be levied on declared income to finance the public good. The unidimensional policy space is $\tau \in [0, 1]$. The population of politicians are supposed to be opportunist that is, we suppose that they do not have any preferences over policies but they want to win office and stay in power. The interpretation of this behaviour can be found in the search of a politician for the perks of the office or in the search of a party for the power to implement policies since only in the case the party is elected that it can implement its policies whether they coincide with their promise or not. In this Downsian political competition, the electoral competition is a competition over the number of votes. We assume that all agents vote and both political parties know the distribution of voters as well as their utility functions. However there is the uncertainty resulting from a tie of votes. In that case, we suppose that the winner of the election is given by a flip of a coin. If we note by $\pi_i(\tau_1, \tau_2)$ the payoff of party i, we can define the political equilibrium as follows:

Definition 7 *The political equilibrium is a policy pair* (τ_1^*, τ_2^*) *such that* $\forall \tau \in [0, 1]$ $\pi_1(\tau_1^*, \tau_2^*) \geq \pi_1(\tau, \tau_2^*)$ *and* $\forall \tau \in [0, 1]$ $\pi_2(\tau_1^*, \tau_2^*) \geq \pi_2(\tau_1^*, \tau)$.

If we denote the Condorcet winner by τ^c, the unique Downsian equilibrium is the case where both parties will propose the Condorcet winning

policy. The decision of a policy proposal with opportunist politicians coincides with the policy which pleases most of the population. In this case the following proposition applies:

Proposition 8 *If* $(\frac{u_{cF}}{u_{dF}} > \frac{\theta}{(1-\theta)(1-q^F)})$ *then* $\tau_i^* = \tau_r^I$ *or* $\tau_i^* = \tau_r^F$ *or* $\tau_i^* = s^*\tau_r^F + (1-s^*)\tau_r^I$.

The electoral competition will result in the choice over a policy which will favour the majority of the population. We know that the ideal tax policy of formal young (τ_w^F) is less than the policy that informal young will vote for (τ_w^I) and opportunist politicians competing for votes will not choose these two extremes and rather favour informal workers welfare over formal workers welfare and contribute to a further informalisation. Remember that the condition ($\frac{\partial s^*}{\partial \tau} < 0$) is more likely to be satisfied for economies with a considerable share of informal employment. Then in such economies we see that politicians will contribute to the informalisation rather than fighting with the prevailing informal employment.

2.7 Risk neutrality case

We would like to consider risk neutrality to give a more precise idea on the results provided in previous propositions and remarks. If we have risk neutral agents, the utility function will be $u(c, g) = c + \eta g$.

Proposition 9 $\exists$ *a stable interior solution* s^* *if* $\frac{w^F}{w^I} > \frac{p(1-q^I)+(1-p)q^I}{(1-\tau)(p(1-\theta)(1-q^F)+(1-p)\theta)}$.

2.7.1 Wages

The interior rest point of the evolutionary dynamics will be equal to $s^* = \frac{W^F - W^I}{W^F - W^I + K}$ where $W^F = p(1-\theta)(1-q^F)(1-\tau)w^F + (1-p)\theta(1-\tau)w^F$ is formal lifetime income, $W^I = p(1-q^I)w^I + (1-p)q^I w^I$ is informal lifetime income with retirement income consisting only of contributions from informal segment and $K = (1-p)(1-\theta)q^F(1-\tau)w^F$. The stability is ensured if the

relative wage rate is greater than a threshold level. We have not defined any relationship between formal and informal wages but we see that sufficiently high relative wages are necessary for the survival of informal labour segment i.e. formal wage should be higher than informal wage.

2.7.2 Private transfers

Regarding the relationship of private transfer rates with informality, we find that if we take $q_F = q_I = q$ and analyse the impact of private transfer rate, we see that $\frac{\partial s^*}{\partial q} < 0$ as informal retirement is only viable with private transfers but $\frac{\partial s^*}{\partial q^F} < 0$ and $\frac{\partial s^*}{\partial q^I} > 0$. Remark that social consensus requiring formal workers to support more than they desire, will increase informalisation. However, informal segment needing support from formal segment, will not be willing to contribute as much, as informal welfare will be less attractive.

Note that $\frac{\partial s^*}{\partial \tau} < 0$, suggesting that if agents are risk neutral, increase in taxation will contribute to informalisation. As far as desired tax rates are concerned, $\tau_w^F \leq \tau_r^I \leq \tau_r^F \leq \tau_w^I$.

3 Conclusion

The characterisation of informal employment as low-paid, unproductive and a last resort fails to capture reality for all informal workers. A non-negligeable share of people working outside the formal labour market, -in middle-income countries around a third of the population whereas in poor developing countries up to more than 80 per cent of the population (Jütting et al. (2008))- voluntarily *choose to work informally* either as entrepreneurs or wage employees. Empirical evidence suggests that many individuals engage in informal work as a part of risk-coping and income-generating strategies and informality is part of their survival strategy as the recent report on Latin American

Economies by OECD Development Center signals[12]. Here, we have shown in an evolutionary setup that this preference for working unregistered and excluded from formal social protection can be due to institutional factors such as family support and traditional social cohesion since in communities where this cohesive setup is still efficiently operating, it offers an alternative to public insurance and workers may evaluate informal employment opportunities given these fringe social benefits.

This result in line with the fact that informal employment is a choice, a strategy from a continuum of employment opportunities rather than the product of a dualistic labour market, brings us to question the relevance and effectiveness of existing labour market and social protection policies. Despite this empirical and theoretical evidence, existing policies do not seem to evolve accordingly. Social assistance programmes targeting poor individuals and households, are still based on the dichotomic picture of labour market and provides benefits to informal workers and self-employed, thus constitutes fringe benefits for informal employment while formal employment is basically covered by social protection policies. This dichotomic aspect of social assistance and protection policies is no longer adequate with the prevailing reality of labour market since if informality is heavily practiced, it has an income reducing effect through lower fiscal receipts and expenditure increasing effect through high percentage of elderly population without any insurance. The evident ignorance of this fact suggests that political parties have interest in preferring to preserve status quo to a riskier new policy alternative. In this context, we have shown with the current setup of the model that political competition contributes to the persistence and may even increase informality. The results presented are in accordance with the fact that the fight with

[12]In Latin American and Mediterrenean countries, workers choose voluntarily to work undeclared and excluded from the social security system contrary to Europe where informality is specifically directed to tax evasion, the "work" may be informal while the worker is still in the coverage of the social security system (self-employed and informally employed workers).

informality is less pronounced in countries with a high level of informalisation than countries with a higher share of formal employment.

Even if political competition results in the preservation of prevailing informal employment and even contributes to an informalisation, we have to remember that any policy to fight against informality is not costless. Many informal business owner are to poor to pay taxes and the formalisation of their activities can not lead to an increase of the fiscal revenues. We need to assess adequately the impact of informal employment on the economy: informal employment may be preferred from an individual perspective as we have shown, still there is a need to evaluate this choice from a societal perspective as even though a certain formalisation is necessary for adequate public services, informality may be used as a tool to reduce poverty and labour market segmentation. There is a need to reevaluate the cost of social security in line with adjustments on the equity of cost and benefits of taxes system as well.

A The evolutionary dynamics

Workers review their choices $r \geqslant 1$ times per time unit then $h = 1/r$ is the interval between two successive review [13] and a formal (informal) worker samples a worker in the other segment and observes the utility $u^F(c_t^F, d_t^F, g_t) + \epsilon$ and $u^I(c_t^I, d_t^I, g_t) + \epsilon'$ where ϵ and ϵ' are random variables representing preference differences and their difference is a random variable distributed according to ϕ. The formal (informal) worker will change his choice if the utility of the other segment is greater than his utility then the conditional probability of moving to informal (formal) segment is $\phi(u^I(c_t^I, d_t^I, g_t) - u^F(c_t^F, d_t^F, g_t))$ $(\phi(u^F(c_t^F, d_t^F, g_t) - u^I(c_t^I, d_t^I, g_t)))$. Then this setup induces the following pop-

[13] We suppose that agents are randomly drawn from the population and imitate a randomly drwan agent in working population if its choice is better performing then first period becomes a random multiple of length $h = 1/r$ which is a geometrically distributed random variable with mean $\mu = 1$ and variance $\sigma^2 = r - 1$.

ulation dynamics:

$$\begin{aligned} s_{t+h} &= s_t + h(1-s_t)(\phi(u^F(.)-u^I(.)) - \phi(u^I(.)-u^F(.)))s_t \\ \frac{s_{t+h}-s_t}{h} &= (1-s_t)(\phi(u^F(.)-u^I(.)) - \phi(u^I(.)-u^F(.)))s_t \\ \dot{s} &= (1-s)(\phi(u^F(.)-u^I(.)) - \phi(u^I(.)-u^F(.)))s \end{aligned}$$

as $\lim_{h\to 0}\frac{s_{t+h}-s_t}{h} = \dot{s}$. Without loss of generality we suppose that errors are uniformly distributed so that ϕ is an affine function ($\phi(z) = \alpha + \beta z$) then we will have a rescaling of replicator dynamics as:

$$\dot{s} = 2\beta(1-s)(u^F(c^F, d^F, g) - u^I(c^I, d^I, g))s$$

B The evolutionarily stable state

Proposition 4 If $u^F(c_t^F, d_t^F, g_t)\big|_{s=0} > u^I(c_t^I, d_t^I, g_t)\big|_{s=0}$ there is a stable $s^* \in (0,1)$.

Proof. Given a population state which consists of informal and formal workers ($s^* \in (0,1)$) and the monotonic selection evolutionary dynamic ξ, s^* is asymptotically stable if $u^F(s^*) > u^I(s^*)$ when $s^* = 0$ and $u^F(s^*) < u^I(s^*)$ when $s^* = 1$ as $\xi(s^*) > 0$ when $s^* = 0$ and $\xi(s^*) < 0$ when $s^* = 1$. In other words, s^* is asymptotically stable if $u^F(s^*) < u^I(s^*)$ when there are only formal employees in the economy and $u^F(s^*) > u^I(s^*)$ when there are only informal employees in the population. Notice that the formal and informal expected utilities are increasing for all $s \in (0,1)$ ($\frac{\partial u^F(s)}{\partial s} = \frac{\partial u}{\partial g}\frac{\partial g}{\partial s} \geqslant 0$ and $\frac{\partial u^I(s)}{\partial s} = \frac{q^F(1-\tau)(1-\theta)w^F}{(s-1)^2} + \frac{\partial u}{\partial g}\frac{\partial g}{\partial s} \geqslant 0$) and the increase in informal utility is more than the increase in formal utility for the same interval ($\frac{\partial u^I(s)}{\partial s} > \frac{\partial u^F(s)}{\partial s}$) with $u^F(s)\big|_{s=1} < u^I(s)\big|_{s=1}$ since $u^I(s)\big|_{s=1} = pu((1-q^I)w^I, g_1) + (1-p)u(\lim_{s\to 1}\frac{sq^F(1-\tau)(1-\theta)\tilde{w}^F + (1-s)q^I w^I}{1-s}, g_1) > p(1-\varepsilon)u((1-q^F)(1-\tau)(1-\theta)y^F, g_1) + p\varepsilon u((1-q^F)(1-\tau)(1-\theta)\chi y^F, g_1) + (1-p)(1-\varepsilon)u((1-\tau)\theta y^F, g_1) + (1-p)\varepsilon u((1-\tau)\theta\chi y^F, g_1) = u^F(s)\big|_{s=1}$ where the value of government expendi-

ture when $s = 1$ is $g_1 = \tau\tilde{w}^F - \varepsilon\chi y^F$ and the utility of informal employment is significantly larger as there less people to share bequests from both segments. Then if we satisfy the condition $u^F(s)\big|_{s=0} > u^I(s)\big|_{s=0}$ we make sure that there is one rest point which is stable. ■

C The income tax policy preference

The first order conditions are given by the following equations:

$$\begin{aligned}
\frac{\partial u_w^F}{\partial \tau} &= -(1-\theta)(1-q^F)y^F u_{c^F} + u_g s^* w^F + u_g(\tau w^F - \varepsilon\chi y^F)\frac{\partial s^*}{\partial \tau} = 0 \\
\frac{\partial u_r^F}{\partial \tau} &= -\theta y^F u_{d^F} + u_g s^* w^F + u_g(\tau w^F - \varepsilon\chi y^F)\frac{\partial s^*}{\partial \tau} = 0 \\
\frac{\partial u_w^I}{\partial \tau} &= u_g s^* w^F + u_g(\tau w^F - \varepsilon\chi y^F)\frac{\partial s^*}{\partial \tau} = 0 \\
\frac{\partial u_r^I}{\partial \tau} &= u_{d^I}\frac{q^F(1-\theta)w^F}{(1-s^*)}(-s^* + \frac{1-\tau}{1-s^*}\frac{\partial s^*}{\partial \tau}) + u_g s^* w^F + u_g(\tau w^F - \varepsilon\chi y^F)\frac{\partial s^*}{\partial \tau} = 0
\end{aligned}$$

Proof. The fourth condition can be simplified by differentiating equation (5) with respect to tax level to obtain $\frac{\partial s^*}{\partial \tau} = \frac{-u_{c^F}\frac{p(1-\theta)(1-q^F)y^F}{(1-p)} - u_{d^F}\theta y^F + u_{d^I}\frac{(1-\theta)q^F w^F s^*}{1-s^*}}{u_{d^I}\frac{(1-\tau)q^F(1-\theta)w^F}{(1-s^*)^2}}$. This condition becomes $\frac{\partial u_r^I}{\partial \tau} = -u_{c^F}p(1-\theta)(1-q^F)y^F - u_{d^F}(1-p)\theta y^F + u_g s^* w^F + u_g(\tau w^F - \varepsilon\chi y^F)\frac{\partial s^*}{\partial \tau} = 0$ which can be obtained by differentiating estimated lifetime utility of a formal worker, we have $\tau_r^I = p\tau_w^F + (1-p)\tau_r^F$. For $\tau_w^F \leq \tau_r^F$, we need $\frac{u_{c^F}}{u_{d^F}} > \frac{\theta}{(1-\theta)(1-q^F)}$ since $\frac{\partial u_r^F}{\partial \tau}\Big|_{\tau=\tau_w^F} = py^F((1-\theta)(1-q^F)u_{c^F} - \theta u_{d^F})$. We see that τ_w^F, τ_r^F and $\tau_r^I < \tau_w^I$ as $\frac{\partial u_i^k}{\partial \tau}\Big|_{\tau=\tau_w^I} < 0$. ■

References

[1] Agenor, P.-R. 2007. Fiscal policy and endogenous growth with public infrastructure, Oxford Economic Papers.

[2] Bosch, M. and W.F. Maloney. 2006. Gross worker flows in the presence of informal labour markets. Evidence from Mexico 1987-2002, World Bank Policy Research Working Paper 3883, World Bank, Washington D.C.

[3] Bugra, A. and Ç. Keyder. 2006. Turkish welfare regime in transformation. Journal of European Social Policy 16.

[4] Chiu, R.-L. 2001. The intratemporal substitution between government spending and private consumption: empirical evidence from Taiwan, Asian Economic Journal 15, pp. 313-24.

[5] De Laiglesia, J.R. (2008). Living with duality: fiscal policy and informality in Latin America. Policy Insights 81, OECD 2008.

[6] De Soto, H. (1989), The Other Path: The Invisible Revolution in The Third World, Basic Books, New York.

[7] Dickens, W.T. and K. Lang. 1985. A test of dual labour market theory. The American Economic Review 75 (4), pp. 792-805.

[8] Domeland, D. and N. Fiess. 2006. Unemployment and unemployment insurance. In F.G. Carneiro, I.S. Gill, and R. Paes de Barros, (Eds.), The Third Dimension of Labor Markets: Demand, Supply and Institutions in Brazil, pp. 169-197, New York. Nova Science Publishers.

[9] Duryea, S., G. Marquez, C. Pages and S. Scarpetta. 2006. For better or for worse: job and earnings mobility in nine middle- and low-income countries. Brookings Trade Forum, Washington, D.C.

[10] Ferrera, M. 1996. The "Southern Model" of welfare in social Europe. Journal of European Social Policy 6 (1), pp. 17–37.

[11] Fields, G. S. 1990. Labour market modeling and the urban informal sector: theory and evidence. In David Turnham, Bernard Salomé, and Antoine Schwarz, (Eds.). The Informal Sector Revisited. OECD, Paris.

[12] Galiani, S. and F. Weinschelbaum. 2007. Modeling informality formally: households and firms. Working Papers 0047, CEDLAS, Universidad Nacional de La Plata.

[13] Gindling, T. 1991. Labor market segmentation and the determination of wages in the public, private-formal and informal sectors in San-Jose, Costa-Rica. Economic Development and Cultural Change, pp. 585-603.

[14] Gonzalez De la Rocha, M. and B. Gantt. 1995. The urban family and poverty in Latin America. Latin American Perspectives 22 (2), pp. 12-31.

[15] Harris, J. and M. Todaro. 1970. Migration, unemployment and development: a two-sector analysis. American Economic Review 60, pp. 126–42.

[16] Jowett, M. 2003. Do informal risk sharing networks crowd out public voluntary health insurance? Evidence from Vietnam. Applied Economics, 35, pp. 1153-1161.

[17] Jütting, J., J. Parlevliet and T. Xenogiani. 2008. Informal employment re-loaded. OECD Development Center. Working Paper 266.

[18] Karras, G. 1994. Government spending and private consumption: some international evidence, Journal of Money, Credit, and Banking 26, pp. 9–22.

[19] Kotlikoff, L.J. and A. Spivak. 1981. The family as an incomplete annuities market. Journal of Political Economy, University of Chicago Press 89 (2), pp. 372-91.

[20] Lewis, A. 1954. Economic development with unlimited supplies of labour. Manchester School of Economic and Social Studies 22, pp. 139-91.

[21] Maloney, W.F. 1999. Does informality imply segmentation in urban labor markets? Evidence from sectoral transitions in Mexico. The World Bank Economic Review 13, pp. 275-302.

[22] Maloney, W.F. 2004. Informality revisited. World Development 32, 1159-1178.

[23] McGrattan, E.R., Rogerson, R., and Wright, R. 1997. An equilibrium model of the business cycle with household production and fiscal policy, International Economic Review 38, pp. 267–90.

[24] Okubo, M. 2003. Intertemporal substitution between private and government consumption: the case of Japan, Economics Letters 79, pp. 75–81.

[25] Packard, T.G. 2007. Do workers in Chile choose informal employment? A dynamic analysis of sector choice. World Bank Policy Research Working Paper 4232, World Bank, Washington D.C.

[26] Portes, A. 1994. The informal economy and its paradoxes, in N. Smelser and R. Swedberg, (Eds.) The Handbook of Economic Sociology. Princeton: Princeton University Press.

[27] Rosen, S. 1986. The theory of equalizing differences. In O. Ashenfelter, and R. Layard, (Eds.) Handbook of Labor Economics 1, pp. 641–692, Elsevier Science.

[28] Tokman, V. E. 1989. Policies for a heterogeneous informal sector in Latin America," World Development 17 (7), pp.1067-1076.

[29] World Bank, 2002. Brazil jobs report, Report No. 24408-BR.