STEADY STATE LAFFER CURVE WITH THE UNDERGROUND ECONOMY

Ministero del Tesoro, Il Dipartimento del Tesoro – Direzione I

28 gennaio, 2010

Francesco Busato and Bruno Chiarini

(University of Naples, Parthenope, Dip. Studi Economici "Salvatore Vinci")
Introduction

- Models with Underground & Tax Evasion: advantages and limitations
- Laffer Policy Discussion & Empirical data
- Arithmetic effect, economic effect & compliance effect
Questions…

- **.... from economic theory:**
  - Existence of a Laffer mechanism;
  - Measuring *peacks* for income and corporate tax rates;
  - Qualitative and quantitative assessment of the *tax gap*;

- **Policy questions:**
  - Compliance Vs Punishment?
  - Agents’ myopia…
Our answers from a stylized equilibrium model

- **Theoretical perspective:**
  - A Laffer mechanism may exist for the ITA economy;
  - Estimating peaks:
    - For income tax rate – 61% (65% with tax evasion);
    - For corporate tax rate – 62% (67% with tax evasion).
  - Measuring tax gap:
    - For income tax rate – 8 percent;
    - For corporate tax rate – 11 percent.

- **Policy perspective:**
  - Compliance better than Punishment.
Why studying underground economy?

- Unreported activities make a sizeable contribution to domestic production, to households’ income, to firms’ cash flow;

- Estimates for Italy:
  - Busato, Chiarini, Di Maro (’10, sample ‘70-’01) estimate 28 percent;
  - Istat (sample ‘92-’00) estimates range between 15 and 16 percent;
  - Bovi (1999, sample ‘70-’97) estimates 14 percent;
  - Zizza (‘02, sample ‘84-’92) estimates 16 percent;
  - Dell’Anno (‘04, sample ‘62-’00) estimates 21,40 percent.

- It would be difficult, therefore, to understand GDP growth or its fluctuations without some knowledge of the dynamic behavior of this constituent component.
Underground economy?

- no universal agreement;
- Tanzi (‘83): production missed in the official statistics (refers to tax evasion).
- Fleming et al. (‘00) distinguish between:
  - “Definitional Approach”: underground economy as non recorded production activities
  - “Behavioral approach”: a change in agents' behavior in response to institutional policies.

- System of National Accounts and the European System of National Accounts:
  - (a) underground production: area of production activities that are not directly observed due to economic reasons and statistical reasons;
  - (b) informal production: the economy characterized by low level of organization, no division between labor and capital inputs;
  - (c) illegal production: activities that are prohibited by law.
The Laffer Curve in dynamic models

- A lack in the literature: underground economy (tax evasion) implications over the existence and the shape of steady state Laffer curves;

- This is surprising since in many countries tax increases and tax cuts have been unsuccessful in terms of achieving the desired effect.

- Uhlig and Trabandt (‘07) + Agell Person (‘01)
  - build a LC within a (dynamic) equilibrium model, still not addressing relations with tax evasion and underground economy.

- **Our paper:**
  - attempts to shed light over the relationships between underground economy and the Laffer curve, using a well-defined economic (dynamic) structure.
Model in a nutshell

- dynamic general equilibrium model.

- Three classes of agents:
  - firms: homogeneous good; three production factors: physical capital, regular and irregular labor services (channel for tax evasion);
  - households: choose consumption, investment, and labor services on each date and in each sector (official and unofficial);
  - government: levies proportional taxes on revenues and incomes, and balances its budget (in expected terms) for each period.

- Labor market: regular and underground segments.
Corporate sector

- homogenous good produced with a quasi-linear technology:
  \[ y_t = k_t^\alpha n_{r,t}^{1-\alpha} + n_{u,t} \]

- Feasible (and desirable) to allow for corner solutions for \( n_{u,t} \)

- the underground segment: additional dimension along which firms optimize labor inputs allocation;
  - feasible to have only one segment ever producing, in the sense that only resources constraints are satisfied;
  - optimal for the agents in this model to use both segments to allocate their resources (under market clearing).
Revenues and tax evasion

- Regular revenues are taxed at the rate $\tau_Y, \tau_F$;
- Firms:
  - do not pay taxes on underground produced revenues;
  - may be discovered evading, with probability $p \in (0,1)$;
  - pay the tax rate increased by a surcharge factor, $s > 1$

\[
R_{t} \rightarrow \text{Detected (}\sim p) \quad R_{D,t} = (1 - \tau_F)y_{r,t} + (1 - s\tau_F)y_{u,t}
\]

- Not Detected $\sim (1 - p)$
  \[
  R_{ND,t} = (1 - \tau_F)y_{r,t} + y_{u,t}
  \]
Expected revenues and comments

- **Expected revenues:**
  \[
  \mathbb{E}_t R_t = (1 - \tau_F) y_{r,t} + (1 - pS\tau_F) y_{u,t}
  \]

- **Comments**
  - The effective tax rate paid when firms are detected is higher than the statutory one \(\tau_F s > \tau_F \Rightarrow s > 1\);
  - the expected paid when evading should be less than the statutory one \(\tau_F sp < \tau_F \Rightarrow sp < 1\).

- These facts imply that \(s > 1; sp < 1\)
representative firm solves a myopic profit maximization problem, on a period-by-period basis (Prescott and Mehra, ‘80)

\[
\max_{(n_{r,t}, n_{u,t}, k_t)} \mathbb{E}_t \pi_t = \mathbb{E}_t R_t - w_r n_{r,t} - w_u n_{u,t} - r_t k_t
\]

s.t. \( y_{r,t} = k_t^{a} n_{r,t}^{1-a}, y_{u,t} = n_{u,t} \)

\[
\mathbb{E}_t R_t = (1 - \tau_F)y_{r,t} + (1 - ps\tau_F)y_{u,t}
\]

Firm's optimality first order conditions are

\[
(1 - \tau_F)(1 - \alpha)k_t^{a} n_{r,t}^{-a} = w_{r,t}
\]

\[
(1 - ps\tau_F) = w_{u,t}
\]

\[
(1 - \tau_F)\alpha k_t^{(\alpha-1)} n_{r,t}^{1-\alpha} = r_t
\]
Households, part 1

\[ U_t = \log(c_t) + BM \frac{(1-n_{r,t}-n_{u,t})^{1-\rho}}{1-\rho} - BU \frac{n_{u,t}^{1+\xi}}{1+\xi}, \quad BM, BU \geq 0 \]

- Utility from leisure \( BM \frac{(1-n_{r,t}-n_{u,t})^{1-\rho}}{1-\rho} \) idiosyncratic disutility \( BU \frac{n_{u,t}^{1+\xi}}{1+\xi} \)

- To make it even simpler, assume:
  - \( n_{r,t} \) is a fraction \( \omega_t \) of total labor supply;
  - \( n_{u,t} \) is the remaining counterpart \( 1 - \omega_t \);
  - \( n_t = 1; \)

\[ U_t = \log(c_t) - BU \frac{(1-\omega_t)^{1+\xi}}{1+\xi}, \quad BU \geq 0 \]
the customary budget constraint (properly modified):
\[ c_t + i_t = (1 - \tau_Y)(w_{r,t}\omega_t + r_t k_t) + w_{u,t}(1 - \omega_t) \]

a customary K accumulation equation
\[ k_{t+1} - (1 - \delta)k_t = i_t \]

Optimality conditions
\[-B_U(1 - \omega_t)\xi(-1) + (c_t)^{-1}[(1 - \tau_Y)w_{r,t} - w_{u,t}] = 0 \]
\[(1 - \tau_Y)(w_{r,t}\omega_t + r_t k_t) + w_{u,t}(1 - \omega_t) - c - k_{t+1} + (1 - \delta)k_t^r \]
\[(c_t)^{-1} = \beta\mathbb{E}_t(c_{t+1})^{-1}((1 - \tau_Y)r_{t+1} + 1 - \delta) \]
Moonlighting production (discussion)

- Underground activities has a structural and a marginal side;

- The underground production can be carried out
  - by fully irregular firms (the so-called ghost firms)
  - by firms operating in both sectors and choosing, on a period by period basis, how many resources to allocate in each sector (the so-called moonlighting firms);

- Our interpretation:
  - class of ghost firms - the structural part;
  - Class of moon-lightening firms - marginal side.
Equilibrium characterization

- This analysis focuses on the deterministic steady state;
- impose certainty equivalence and aggregate consistency;

\[ B_U(1 - \omega)^{\xi} = (C)^{-1}[(1 - ps\tau_F) - (1 - \tau_Y)(1 - \tau_F)(1 - \alpha)(\frac{K}{\omega})^{\alpha}] \]

\[ (1 - \tau_Y)(1 - \tau_F)(K)^{\alpha}(\omega)^{1-\alpha} + (1 - ps\tau_F)(1 - \omega) + \delta K = C \]

\[ 1 = \beta(1 - \tau_Y)(1 - \tau_F)\alpha(\frac{K}{\omega})^{\alpha-1} + 1 - \delta \]
Proposition 1

- There exists a unique stationary capital stock $K^* > 0$, and a unique stationary equilibrium for regular labor share $\omega$, and underground labor share $1 - \omega$ such that

$$\omega^* \text{ solves } (1 - p s \tau_F) + AA\omega = BB(1 - \omega)^{-\xi}$$

$$K^* = \frac{1}{\alpha-1} \left\{ \frac{\beta^{-1} - 1 + \delta}{(1 - \tau_Y)(1 - \tau_F)\alpha} \right\}$$
Calibration

- The model is parameterized for the Italian economy, for two scenarios, with and without underground sector.
- All calibrated values (but p,s)- would fit the EU-15.
- Labor supply parameters \((B_M, B_U, \xi)\)
  - \(B_M=0.95\) matches the SS value for regular labor services
  - \(B_U=1.5\) matches the SS value for regular labor services
  - \(xi=1\) (free parameter, sufficiently robust)
Calibration

- Preference and Technology \((\alpha, \beta, \delta)\);
  - commonly used values in this literature; Fiorito-Kollintzas ‘94, Mendoza -Tesar ‘98, King -Rebelo ‘99, Uhlig -Trabandt ‘07;

- Evasion scheme
  - \(p=0.03\) and \(s=1.3\) (and sensitivity analysis exercises);
  - Ref. Busato and Chiarini (‘04); Busato Maffezzoli (‘10)

- steady state corporate tax rate \(\tau_F^* = 0.275\)
- steady state income tax \(\tau_Y^* = 0.325\)
Calibrated model Vs Actual economy

- the model is consistent with the selected long-run statistics measured for the Italian economy.

\[
\begin{align*}
\left( \frac{C}{Y} \right)^* &= 0.86 \\
\left( \frac{C_G}{Y} \right)^* &= 0.4632 \\
\left( \frac{I}{Y} \right)^* &= 0.1157 \\
\left( \frac{Y_U}{Y} \right)^* &= 0.1209 \\
\left( \frac{N_U}{N} \right)^* &= 0.2144
\end{align*}
\]

\[
\begin{align*}
\left( \frac{\hat{C}}{\hat{Y}} \right) &= 0.77 \\
\left( \frac{\hat{C}_G}{\hat{Y}} \right) &= 0.38 \\
\left( \frac{\hat{L}}{\hat{Y}} \right) &= 0.08 \\
\left( \frac{\hat{Y}_U}{\hat{Y}} \right) &= 0.16 \\
\left( \frac{\hat{N}_U}{\hat{N}} \right) &= 0.25
\end{align*}
\]

- the model could be consistently used for undertaking fiscal policy experiments.
We construct two plots of the Laffer curves for an economy with and without underground sector, for the baseline parameterization.

The "curves" are derived from the optimality equilibrium conditions evaluated at the stationary state;

The model shows that, given the parameterization, a Laffer curve exist with and without an underground sector.

Each panel reports the average tax rate and the peak of the curve, which reflects the maximum revenues.
Laffer curve (corporate tax rate)
Laffer curve (income tax rate)
Peacks estimation and the tax gap

- **Corporate tax rate:**
  - peak: 62% (67% with tax evasion)
  - Tax gap: 11%

- **Income tax rate:**
  - peak: 61% (65% with tax evasion)
  - Tax gap: 8 %
More effective detection system
Tighter punishment
Tightther punishment
Results and research agenda

- **Main results:**
  - A Laffer mechanism may exist for the ITA economy;
  - Estimated peaks and measured tax gap;
  - Compliance and punishment

- **Research agenda**
  - Endogenous labor supply and elasticity estimation;
  - Dynamic scoring;
  - Introducing public debt stock.
Thanks for your attention!
Back up