A dynamic model of shirking and unemployment: Private saving, public debt, and optimal taxation

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A R T I C L E I N F O

A B S T R A C T

This paper introduces private saving and public debt into the shirking-unemployment model of Shapiro and Stiglitz (1984), while relaxing their exclusive focus on steady states. After generalizing their no-shirking constraint to accommodate asset accumulation, and demonstrating that the resulting economy's equilibrium is saddle-path stable, we use our dynamic model to obtain significant departures from the Shapiro–Stiglitz prescriptions for optimal policy. Most notably, wage income should be taxed (not subsidized) in the long run if the labor market is sufficiently distorted. Furthermore, interest income should be (exhaustively) taxed only during an initial interval of time, as in Chamley's (1986) full-employment model.

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1. Introduction

A prominent explanation of unemployment is based on the efficiency-wage hypothesis, according to which labor productivity is positively related to the real wage rate. Shapiro and Stiglitz (1984) use an optimizing framework to develop an important version of this explanation, in which firms set the wage rate to prevent shirking, because they cannot perfectly monitor labor effort. The no-shirking wage is greater than the marginal cost of effort, and thus the efficiency-wage equilibrium produces a labor-market distortion, characterized by involuntary unemployment. This unemployment serves as a "worker discipline device", because employees are fired if caught shirking.[1]

Two significant limitations of the Shapiro–Stiglitz (1984) model are its exclusive focus on steady states, and its exclusion of the saving/investment process. Kimball (1994) and Phelps (1994, Chapter 15) extend the model to relax, respectively, the first and second of these limitations.

However, as Phelps (1994, p. 264) points out, "The intertemporal microeconomics of saving and shirking in the presence of imperfect monitoring is … not an analytically convenient subject." The main challenge is that the no-shirking wage depends on wealth, which varies across individuals because of their different employment (unemployment) histories. Thus, the distribution of wealth needs to be pinned down, in order to derive a tractable relation for determining the no-shirking wage. Brecher et al. (2002) make some progress in this regard, but only for steady states.

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  [1] For an alternative type of disciplinary mechanism, see Alexopoulos (2003, 2006), who assumes that detected shirkers are fined (a fraction of their wage) rather than fired.

The present paper generalizes the Shapiro–Stiglitz (1984) model to incorporate both optimal saving and transitional dynamics. To simplify the analysis, we assume that each household makes saving and shirking decisions for its many members, using an aggregate (household) utility function. This simplification suppresses the role of wealth differences across individuals, and enables us to derive a no-shirking wage relation for the entire transitional path (including steady state), thereby nesting the Shapiro–Stiglitz (1984) analysis as a special case.

Our model also provides a representative-agent framework for analyzing optimal taxes (subsidies) on capital and labor incomes in the presence of shirking and unemployment. Intuitively, it seems reasonable to conjecture that the government should continuously implement a wage subsidy financed by an interest tax. Indeed, Shapiro and Stiglitz (1984) show that the optimal policy prescription in their model – with its fixed stock of capital – is to tax away all interest income and use this revenue to subsidize wages.[2]

Our analysis, however, qualifies this Shapiro–Stiglitz (1984) prescription in three significant ways. First, although the tax on capital income should indeed be maximal in the short run, this tax should be completely eliminated in the long run. Second, rather than immediately spend all short-run interest-tax revenue on labor subsidies, it might be better for the government to divert some of this revenue toward accumulation of public assets (negative debt) that finance a wage subsidy in the long run. Third, and more surprisingly, it might even be optimal to tax (rather than subsidize) labor in steady state.

These departures from the results of Shapiro and Stiglitz (1984) arise because our model incorporates two additional elements – private saving and public debt – which change the trade-offs faced by the government. With endogenous saving (investment), a tax on capital income introduces an intertemporal distortion, which limits the optimal duration of this tax. The resultant limited-time revenues can be used for retiring debt (to reduce the need for future distortionary taxation), or for subsidizing employment (to decrease current labor-market distortions). Given these competing uses for the temporary interest-tax revenues, it may not be optimal to completely eliminate the debt. In this case, to service the remaining debt, a wage tax is necessary in steady state.

In models of full employment, Chamley (1980, 1986) and Judd (1985) show that the optimal tax on capital income is zero in the long run, if the economy converges to steady state. Recently, there is considerable interest in optimal policy for economies with unemployment based on search-and-matching frictions. Part of the related literature examines whether the Chamley–Judd result holds with this type of unemployment. In particular, Domeij (2005) and Arseneau and Chugh (2006) find instead that capital income should generally be taxed or subsidized in the long run, to yield labor-market (search-matching) gains that outweigh the costs of intertemporal (savings/investment) distortion induced by the policy. We complement this literature by analyzing optimal taxation in a framework belonging to another major class of unemployment models, based on efficiency-wage considerations. In the present case, the intertemporal distortion is always too costly to justify a steady-state tax or subsidy on capital income. Thus, we retain the Chamley–Judd result, even though our labor market is distorted.

Under optimal taxation, steady-state equilibrium depends on the initial levels of aggregate capital, total employment and public debt. To explore this link, we use numerical methods to solve our model dynamically, for alternative sets of initial conditions. This procedure allows us to construct and analyze concrete examples with a positive tax on wages in steady state.

In sum, the present paper makes several distinct contributions. First, it develops a tractable dynamic model of efficiency-wage unemployment with optimal saving, and explores both transitional and steady-state properties of this model. Then, to demonstrate an application of the model, we derive the dynamic counterpart to the policy prescription of Shapiro and Stiglitz (1984). This application also suggests that optimal fiscal policy depends importantly on whether unemployment is of the efficiency-wage variety versus some other (e.g., frictional) type. Finally, using a numerical solution of the present model, we construct examples in which optimal policy departs significantly from the Shapiro–Stiglitz prescription.

Sections 2 and 3 derive the fundamental no-shirking condition and the related equilibrium wage, respectively. To elucidate the basic workings of the model, Section 4 investigates the steady-state equilibrium and dynamic stability of our efficiency-wage economy in the laissez-faire case, free from government intervention. Then, Section 5 tackles the more complex problem of optimal taxation by an active government. To shed additional light on this problem, Section 6 undertakes numerical analysis of our model. We offer some concluding remarks in Section 7.

2. To shirk or not to shirk

This section discusses optimization by households, and shows that there will be no shirking if and only if a certain condition is satisfied. For this purpose, we set up a one-good model that incorporates key features of the Shapiro–Stiglitz (1984) efficiency-wage framework, but allows also for asset accumulation and transitional dynamics. At time t, the employment status of individual i is represented by $z_i(t)$, which equals 1 or 0 as the individual is, respectively, employed or unemployed. The shirking behavior of an employee is given by $S_i(t)$, which (for simplicity) equals 1 if there is shirking or 0

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[2] Their one-factor economy with decreasing returns to scale can, without loss of generality, be interpreted as a two-factor economy with constant returns to scale. Thus, their (pure) profits can be viewed as returns to capital.