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SOCIAL STATUS AND INEQUALITY IN AN INTEGRATED WALRASIAN-GENERAL EQUILIBRIUM AND NEOCLASSICAL-GROWTH THEORY*

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This study deals with interactions between social status, economic growth and income and wealth distribution in an economic growth model of heterogeneous households with economic structure. The model emphasizes the role of social status on economic structural change and wealth and income distribution. It is influenced by the ideas related to economic growth and social status in the literature of economic growth and an integrated Walrasian general equilibrium theory and neoclassical growth theory. The economic system consists of one capital goods sector, one consumer goods sector, and any number (of types) of households. The motion is described by a set of differential equations. For illustration, we simulate the motion of the economic system with three groups of households. We identify the existence of a unique stable equilibrium point. We also carry out comparative dynamic analysis. The comparative analyses provide some insights into the complexity of economic growth with social status.

Keywords: Walrasian General Equilibrium Theory, Social Status, Neoclassical Growth Theory, Income and Wealth Distribution, Preference Change
JEL Classification: O41; Z1

1. INTRODUCTION

Since Veblen (1899) published his The Theory of the Leisure Class, many economists have studied economic consequences of conspicuous consumption and social status. According to Veblen, people are interested in pursuing conspicuous consumption as it signals wealth and social status. Duesenberry (1949) held that people may try to improve social status by imitating the consumption standard of the social or

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classes above them. The purpose of this study is to introduce social status into a growth economic theory with heterogeneous households. In a recent study by Rege (2008), it is argued that people is concerned with social status because it serves a signal of non-observable abilities. According to Rege (2008), "By investing in social status a person can thus improve his chance of engaging in a complementary interaction with a high ability person. The idea that status can serve as a signal of abilities is not new and has been captured in several models. It has, for example, been demonstrated that workers can signal their ability to employers by undertaking some seemingly irrelevant but costly activity interpreted as status consumption (Frank, 1985) or social culture (Fang, 2001) and that people can "burnmoney" on fashions to signal abilities in a "dating game" (Pesendorfer)." Introduction of social status makes traditional growth models more robust in explaining economic growth processes (see also, Cole et al., 1992; Konrad, 1992; Fershtman et al., 1996; Rauscher, 1997). This study is concerned with social status and growth with inequalities in income and wealth. The way that social status are integrated into our growth model is influenced by the literature that studies the macroeconomic effects of consumers' wealth-induced preferences for social status. In this literature social status is considered as functions of private wealth within neoclassical growth models (Zou, 1994, 1995; Bakshi and Chen, 1996; Chang, 2006; Chang and Tsai, 2003; Corneo and Jeanne, 2001; Chang, et al. 2004; Clemens, 2004; Fisher and Hof, 2005; Chen and Guo, 2009, 2011).

This study deals with social status within an integrated framework of the Walrasian general equilibrium and neoclassical growth theories. The two theories are the core models in the development of formal economic theories in modern times. The Walrasian general equilibrium theory was initially developed by Walras (e.g., Walras, 1874; Arrow and Debreu, 1954; Gale, 1955; Nikaido, 1956, 1968; Debreu, 1959; McKenzie, 1959; Arrow and Hahn, 1971; Arrow, 1974; and Mas-Colell et al., 1995). The theory explains equilibrium of pure economic exchanges with heterogeneous supplies and households. Although many efforts have been made in economics, few formal models are successful in extending the theory to include endogenous wealth. Walras did not succeed in developing a general equilibrium theory with endogenous saving and capital accumulation (e.g., Impicciatore et al., 2012). Over years many economists attempted to further develop Walras' capital accumulation within Walras' framework (e.g., Morishima, 1964, 1977; Diewert, 1977; Eatwell, 1987; Dana et al. 1989; and Montesano, 2008). Although the traditional Walrasian general equilibrium theory is not proper for addressing issues related to growth and structural change with wealth and income distribution, the neoclassical growth theory directly models endogenous wealth accumulation with microeconomic foundation (e.g., Ramsey model). Zhang (2012, 2013) has recently integrated the neoclassical growth theory with the Walrasian general equilibrium theory for studying dynamic interactions among growth, wealth and income distribution, and economic structures. It should be noted that some other studies also tried to integrate the neoclassical growth theory and the general equilibrium analysis (e.g., Jensen and Larsen, 2005). As reviewed by Shoven and Whalley (1992), "Most contemporary applied general models are numerical analogs of traditional two-sector general equilibrium models popularized by James Meade, Harry Johnson, Arnold Harberger, and others in the 1950s and 1960s." Only a few formal dynamic models explicitly deal with distribution issues among heterogeneous households in the neoclassical growth theory (Solow, 1956; Burmeister and Dobell, 1970; and Barro and Sala-i-Martin, 1995). As far as the Walrasian general equilibrium theory and the traditional capital theory are concerned, the issues examined by Polterovich's approach with heterogeneous capital and heterogeneous households (Polterovich, 1977, 1983; Bewley, 1982; Amir and Evstigneev, 1999) are quite similar to the model in this study. The main different is in modeling household behavior. Polterovich's approach to household is basically based on the Ramsey model, while Zhang's models is based on Zhang's approach. This study introduces social status to Zhang's theoretical framework. We develop a model to deal with interdependence between wealth and income distribution between heterogeneous groups with endogenous social status, based on Zhang (2012, 2013). The paper is organized as follows. Section 2 develops the growth model of wealth and income distribution among heterogeneous households with endogenous social status. Section 3 examines dynamic properties of the model and simulates the model with three groups. Section 4 carries out comparative dynamic analysis. Section 5 concludes the study.

2. THE BASIC MODEL

Basing on Zhang (2013), we consider an economic system consisting of capital goods and consumer goods sectors. The capital goods and consumer goods sectors are the same as in the Uzawa two sector model (Uzawa, 1961; Burmeister and Dobell 1970; and Barro and Sala-i-Martin, 1995). Services are classified as consumer goods. Capital goods are be used as inputs in the two sectors. Capital depreciates at a constant exponential rate δ_k, $(0 < \delta_k < 1)$, which is independent of the manner of use. Households own assets of the economy and distribute their incomes to consume and save. Exchanges take place in perfectly competitive markets. Factor markets work well; factors are inelastically supplied and the available factors are fully utilized at every moment. Saving is undertaken only by households. All earnings of firms are distributed in the form of payments to factors of production, labor, managerial skill and capital ownership. Each group has a fixed population, $\bar{N}_j$, $(j = 1, \cdots, J)$. It should be noted that in the Walrasian general equilibrium theory, $\bar{N}_j = 1$. Let prices be measured in terms of capital goods and the price of the commodity be unity. We denote the wage rate of worker of type j and rate of interest by $w_j(t)$ and $r(t)$, respectively. Let $p(t)$ denote the price of consumer goods. The total capital stock $K(t)$ is allocated between the two sectors. We use subscript index, i and s to stand for capital goods and consumer goods sectors, respectively. We use $N_m(t)$ and $K_m(t)$ to stand for the labor force and capital stocks employed by sector m. The total population $\bar{N}$ and total qualified labor supply N are

$$\bar{N} = \sum_{j=1}^{J} \bar{N}_j, \; N = \sum_{j=1}^{J} h_j \bar{N}_j, \tag{1}$$

in which h_j is the human capital of group j. The assumption of labor force being fully employed implies

$$N_i(t) + N_s(t) = N. \tag{2}$$

2.1. The Capital Goods Sector

Let $F_m(t)$ stand for the production function of sector , $m = i, s$. The production function of capital goods sector is specified as follows

$$F_i(t) = A_i K_i^{\alpha_i}(t) N_i^{\beta_i}(t), \; \alpha_i + \beta_i = 1, \; \alpha_i, \beta_i > 0, \tag{3}$$

where A_i, α_i, and β_i are positive parameters. The marginal conditions for the capital goods sector are given by

$$r(t) + \delta_k = \frac{\alpha_i F_i(t)}{K_i(t)}, \; w(t) = \frac{\beta_i F_i(t)}{N_i(t)}, \tag{4}$$

where $w(t)$ is the wage rate of per qualified labor input. The wage rate of ethnic group j is

$$w_j(t) = h_j w(t).$$

2.2. Consumer Goods Sector

The production function of consumer goods sector is

$$F_s(t) = A_s K_s^{\alpha_s}(t) N_s^{\beta_s}(t), \; \alpha_s + \beta_s = 1, \; \alpha_s, \beta_s > 0 \tag{5}$$

where A_s, α_s, and β_s are the technological parameter of the service sector. The marginal conditions are

$$r(t) + \delta_k = \frac{\alpha_s p(t) F_s(t)}{K_s(t)}, \; w(t) = \frac{\beta_s p(t) F_s(t)}{N_s(t)}. \tag{6}$$

2.3. Current Income and Disposable Income

In this study, we use an alternative approach to modeling behavior of households proposed by Zhang (1993). Let $\bar{k}_j(t)$ stand for per capita wealth of group j. We have

$\bar{k}_j(t) = \bar{K}_j(t)/\bar{N}_j$, where $\bar{K}_j(t)$ is the total wealth held by group j. Per capita current income from the interest payment $r(t)\bar{k}_j(t)$, and the wage payment $h_j w(t)$, is

$$y_j(t) = r(t)\bar{k}_j(t) + h_j w(t).$$

The per capita disposable income is the sum of the current disposable income and the value of wealth. That is

$$\hat{y}_j(t) = y_j(t) + \bar{k}_j(t). \tag{7}$$

2.4. Description of Social Status

Before we specify functional forms of w, we review a few approaches to social status in formal growth models. Following Zhou (1994, 1995) and assuming that each household provides fixed labor supply and maximizing its lifetime utility U, Chen and Guo (2009) introduce social status as a function of wealth as follows

$$U = \int_0^\infty \left[\frac{c(t)^{1-\sigma}-1}{1-o} + \beta\frac{k(t)^{1-\sigma}-1}{1-o}\right] e^{\rho t} dt,$$

where $c(t)$ and $k(t)$, are, respectively, the household's consumption and capital stock, ρ is the time discount rate, and β measures the degree for the spirit of capitalism. It should be noted that Kurz (1968) first uses both consumption flows and capital stocks as components of utility functions. Different from the traditional approaches, the study assumes that the household derives utilities from social status which is represented by the level of capital ownership. This study uses similar approach but with an alternative utility function proposed by Zhang (1993). In another study, Chen and Guo (2011) investigates effects of relative wealth-induced preferences for social status on equilibrium growth in a standard one-sector AK model. The model predicts that there is a positive output-growth effect in response to changes of the strength for social status. The utility is specified as follows

$$U = \int_0^\infty \frac{\left[c(t)\left(k(t)/K(t)\right)^{\beta}\right]^{1-\sigma}-1}{1-\sigma} e^{-\rho t} dt.$$

The household is assumed to derive utilities from the wealth-based social status which is represented by its physical-capital ownership $k(t)$ relative to the economy-wide level of physical capital stock $K(t)$. They interpret $\beta > 0$ as the degree of the spirit of capitalism. In another research by Corneo and Jeanne (1999), the utility function is specified as

$$U = \int_0^\infty \left[u\left(c(t)\right) + v(t)\right] e^{\rho t} dt,$$

where $v(t)$ is a variable called an individual's social esteem or status utility.

Inspirited by the literature on economic growth with social status, we introduce the following social status function

$$\omega_j((\bar{k}_j(t))) = \omega_{j0} + \omega_{jL}\bar{k}_j(t), \tag{10}$$

where ω_{j0} and ω_{jL} positive parameters. The specified form implies that social status is positively related to the household's wealth. This is a simplified form of possible social status functions as social status can be dependent on many other variables such as education, human capital, family heritage, human networks with celebrities, relative richness in the same group position, and the like. In particular, we should consider social status as functions of relative richness within each group and between groups. We neglect this important problem simply because the problem becomes too complicated.

2.5. Budget and Utility Function

The disposable income is used for saving and consumption. The representative household from group j would distribute the total available budget between savings $s_j(t)$ and consumer goods $c_j(t)$. The budget constraint is

$$p(t)c_j(t) + s_j(t) = \hat{y}_j(t). \tag{8}$$

In our model, at each point of time, consumers have two variables to decide. We assume that utility level $U_j(t)$ is dependent on $c_j(t)$ and $s_j(t)$ as follows

$$U_j(t) = c_j(t)^{\xi_{j0}(\omega_j(t))} s_j(t)^{\lambda_{j0}(\omega_j(t))}, \ \xi_{j0}(\omega_j(t)), \ \lambda_{j0}(\omega_j(t)) > 0$$

where $\xi_{j0}(\omega_j(t))$ is the propensity to consume consumer goods and $\lambda_{j0}(\omega_j(t))$ the propensity to save. We assume that the propensity to save and to consume are affected by social status function $\omega_j(t)$. It should be noted that although there are many heterogeneous-households growth models with endogenous wealth accumulation, the heterogeneity in these studies is by the differences in the initial endowments of wealth among different types of households rather than in preferences (see, for instance, Chatterjee, 1994; Caselli and Ventura, 2000; Maliar and Maliar, 2001; Penalosa and Turnovsky, 2006; and Turnovsky and Penalosa, 2006). Different households are essentially homogeneous in the sense that all the households have the same preference utility function in the approach. In our approach we consider different groups have different utility functions.

2.6. Social Status and Propensities to Save and to Consume

Rather than using capital stock as a decision variable, we consider that it is through affecting the propensities to consume and to save that social status affect growth and inequality. We assume that the propensities to consume and to save are related to social status in the following way

$$\xi_{j0}(\omega_j(t)) = \bar{\xi}_{j0} + \tilde{\xi}_{j0}\omega_j(t),\ \lambda_{j0}(\omega_j(t)) = \bar{\lambda}_{j0} + \tilde{\lambda}_{j0}\omega_j(t), \tag{11}$$

where $\bar{\xi}_{j0}$ and $\bar{\lambda}_{j0}$ are positive parameters, and $\tilde{\xi}_{j0}$ and $\tilde{\lambda}_{j0}$ are parameters which may be either positive, zero, or negative. The propensity to consume may be enhanced by social status, for instance, through the so-called conspicuous consumption. The propensity to save is influenced by social status as more wealth tends to enhance social status. The so-called spirit of capitalism affects the propensity to save. Although social status may interact with propensities through so many channels, this study accepts the above linear form for convenience of analysis.

2.7. Optimal Household Behavior

Maximizing the utility subject to (8) yields

$$p(t)c_j(t) = \xi_j((\bar{k}_j(t)))\hat{y}_j(t),\ s_j(t) = \lambda_j((\bar{k}_j(t)))\hat{y}_j(t), \tag{9}$$

where

$$\xi_j((\bar{k}_j(t))) \equiv \rho_j((\bar{k}_j(t)))\xi_{j0}((\bar{k}_j(t))), \lambda_j((\bar{k}_j(t))) \equiv \rho_j((\bar{k}_j(t)))\lambda_{j0}((\bar{k}_j(t))),$$

$$\rho_j((\bar{k}_j(t))) \equiv \frac{1}{\xi_{j0}((\bar{k}_j(t))) + \lambda_{j0}((\bar{k}_j(t)))}.$$

2.8. Wealth Accumulation

According to the definition of $s_j(t)$, the change in the household's wealth is given by

$$\dot{\bar{k}}_j(t) = s_j(t) - \bar{k}_j(t). \tag{12}$$

This equation simply states that the change in wealth is equal to saving minus dissaving.

2.9. Demand and Supply of the Two Sectors

The demand and supply equilibrium for the consumer goods sector is

$$\sum_{j=1}^{J} c_j(t)\bar{N}_j = F_s(t). \tag{13}$$

As output of the capital goods sector is equal to the depreciation of capital stock and the net savings, we have

$$S(t) - K(t) + \delta_k K(t) = F_i(t), \tag{14}$$

where

$$S(t) \equiv \sum_{j=1}^{J} s_j(t)\bar{N}_j, \ K(t) = \sum_{j=1}^{J} \bar{k}_j(t)\bar{N}_j.$$

2.10. Capital being Fully Utilized

Total capital stock $K(t)$ is allocated to the two sectors

$$K_i(t) + K_s(t) = K(t). \tag{15}$$

We completed the model. The model is obviously built on some strict assumptions in our model. Nevertheless, the model is structurally general in the sense that some well-known models in economics can be considered as its special cases. For instance, if the population is homogeneous, our model is structurally similar to the neoclassical growth model by Solow (1956) and Uzawa (1961). It is structurally similar to the Walrasian model if the wealth is fixed and depreciation is neglected. The new aspect of economic growth in this study is the interaction between social status and wealth accumulation (and other variables).

3. THE DYNAMICS AND ITS PROPERTIES

As the dynamic system consists of any (finite) number of (types of) households, it should be nonlinear and highly dimensional with wealth accumulation. As it is difficult to get explicitly analytical properties of the nonlinear dynamic system, we conduct computer simulation to follow the motion of the dynamic system. The following lemma shows that the dimension of the dynamical system is the same as the number of groups. We also provide a computational procedure for calculating all the variables at any point in time. First, we introduce a new variable $z(t)$

$$z(t) \equiv \frac{r(t)+\delta_k}{w_j(t)/h_j}.$$

Lemma: *The motion of the economic system is determined by J differential equations with $z(t)$ and $\{\bar{k}_j(t)\} \equiv (\bar{k}_2(t), \cdots, \bar{k}_J(t))$ as the variables*

$$\dot{z}(t) = \Lambda_1\big(z(t), \{\bar{k}_j(t)\}\big), \ \dot{\bar{k}}_j(t) = \Lambda_j\big(z(t), \{\bar{k}_j(t)\}\big), \ j = 2, \cdots, J \tag{16}$$

in which $\Lambda_j(t)$ are unique functions of $z(t)$and $\{\bar{k}_j(t)\}$ defined in the Appendix. At any point in time the other variables are unique functions of $z(t)$ and $(\bar{k}_j(t))$ determined by the following procedure: we get $r(t)$ and $w_j(t)$ by (A3) $\rightarrow$ $\bar{k}_1(t)$ by (A14) $\rightarrow$ $\xi_j(t)$ by (A13) $\rightarrow$ $N_s(t)$ by (A7)$\rightarrow$$N_i(t)$ by (A8) $\rightarrow$ $w(t) = w_1(t)/h_1$ $\rightarrow$ $\hat{y}_j(t)$ by (A5) $\rightarrow$ $K_s(t)$ and $K_i(t)$ by (A1) $\rightarrow$ $F_i(t)$ and $F_s(t)$ by the definitions $\rightarrow$ $p(t)$ by (A4) $\rightarrow$ $c_j(t)$ and $s_j(t)$ by (13) $\rightarrow$ $K(t) = K_i(t) + K_s(t)$.

It should be noted that as the expressions are too complicated, it is difficult to provide a clear and simple analytical interpretation of the result. The lemma gives a computational procedure for following the motion of the economic system with any number of types of households. It is well known that calibration of general equilibrium involves solving high-dimensional nonlinear equations. With regard to the Arrow-Debreu concept of general equilibrium the final stage of analysis is to find a price vector at which excess demand is zero (Judd, 1988). There are numerical approaches for calculating equilibria (e.g., Scarf, 1967; Scarf and Hansen, 1973). We can apply these traditional methods to find how the prices and other variables are related to the variables in the differential equations. As it is difficult to get explicit analytical solution, we simulate the model. It should be noted the procedure in the lemma is valid for any functional forms of $\xi_{0j}((\omega_j(t)))$ and $\lambda_{0j}((\omega_j(t)))$ (if they satisfy mathematical properties such as existence of first derivatives).

We simulate the model with three groups. We specify parameter values as follows

$$A_i = 1.3,\ A_s = 1,\ \alpha_i = 0.34,\ \alpha_s = 0.3,\ \delta_k = 0.05,$$
$$\begin{pmatrix} \bar{N}_1 \\ \bar{N}_2 \\ \bar{N}_3 \end{pmatrix} = \begin{pmatrix} 10 \\ 30 \\ 60 \end{pmatrix}, \begin{pmatrix} h_1 \\ h_2 \\ h_3 \end{pmatrix} = \begin{pmatrix} 4 \\ 2 \\ 1 \end{pmatrix}, \begin{pmatrix} \omega_{10} \\ \omega_{20} \\ \omega_{30} \end{pmatrix} = \begin{pmatrix} 0.01 \\ 0.01 \\ 0.01 \end{pmatrix}, \begin{pmatrix} \omega_{1L} \\ \omega_{2L} \\ \omega_{3L} \end{pmatrix} = \begin{pmatrix} 0.01 \\ 0.008 \\ 0.005 \end{pmatrix}, \begin{pmatrix} \bar{\lambda}_{10} \\ \bar{\lambda}_{20} \\ \vec{\lambda}_{30} \end{pmatrix} = \begin{pmatrix} 0.8 \\ 0.75 \\ 0.7 \end{pmatrix}$$
$$\begin{pmatrix} \tilde{\lambda}_{10} \\ \tilde{\lambda}_{20} \\ \tilde{\lambda}_{30} \end{pmatrix} = \begin{pmatrix} 0.1 \\ 0.1 \\ 0.1 \end{pmatrix}, \begin{pmatrix} \tilde{\xi}_{10} \\ \tilde{\xi}_{20} \\ \tilde{\xi}_{30} \end{pmatrix} = \begin{pmatrix} 0.12 \\ 0.18 \\ 0.2 \end{pmatrix}, \begin{pmatrix} \bar{\xi}_{10} \\ \bar{\xi}_{20} \\ \bar{\xi}_{30} \end{pmatrix} = \begin{pmatrix} 0.05 \\ 0.05 \\ 0.05 \end{pmatrix} \tag{17}$$

The population of group 3 is largest, while the population of group 2 is the next. The choice of population sizes is not important as far as our purposes of providing some insights into mechanisms of economic dynamics and demonstrating working the model are concerned. The capital goods and consumer goods sector's total productivities are respectively 1.3 and 1. We specify the values of the parameters, α_j, in the Cobb-Douglas productions for the capital goods and consumer goods sectors approximately equal to 0.3 (for instance, Miles and Scott, 2005; Abel et al., 2007). The depreciation rate of physical capital is specified at 0.05. In the literature of economic growth physical depreciation rates are often fixed near 0.05. In their empirical studies Nadiri and Prucha (1993) estimate the depreciation rate of physical capital 0.059. It should be noted that there are different empirical results in estimation of depreciation rates of physical capital and knowledge (e.g., Nadiri and Prucha, 1993; Fraumenti, 1997;

Hall, 2007). The parameter values related to reference changes relatively small. As our comparative dynamic analysis will examine how changes in the specified parameter values affect motion of the system, it does not matter so much with specified values (as far as stability properties are not affected with changes of the parameter values). We specify the initial conditions as follows

$$z(0) = 0.06,\ \bar{k}_2(0) = 10,\ \bar{k}_3(0) = 4.$$

The motion of the variables is plotted in Figure 1. In Figure 1, the national income is

$$Y(t) = F_i(t) + p(t)F_s(t).$$

Due to the fixed positions of the initial state, the national output and wealth/capital fall over time. The output level of the capital goods sector rises and the output level of the consumer goods sector fall slightly overtime. The price of consumer goods falls. The rate of interest falls in association with rising wage rates. Group 1's per capita wealth, per capita consumption, social status and propensity to save are all reduced. The other two groups' per capita wealth levels, per capita consumption levels, social status and propensities to save are all enhanced. The wealth inequalities between group 1 and other two groups are reduced over time.

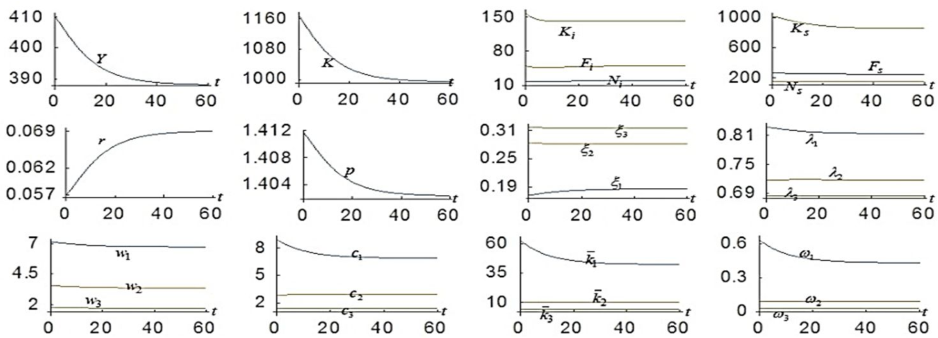

Figure 1. The Motion of the Economic System

It is straightforward to confirm that all the variables become stationary in the long term. This implies the existence of an equilibrium point. We also simulate the model with other initial conditions which lead to the same equilibrium point. It should be remarked that the existence of equilibrium is guaranteed with the specified parameter values. It is possible that the system may not have a meaningful equilibrium if we specify parameter values otherwise. We list the equilibrium values in (18)

$$Y = 388.1,\ \bar{K}_1 = 423.6,\ \bar{K}_2 = 312.3,\ \bar{K}_3 = 257.9,\ r = 0.069,\ p = 1.40,$$
$$w_1 = 6.74,\ w_2 = 3.37,\ w_3 = 1.69,\ F_i = 49.69,\ F_s = 241.3,$$
$$N_i = 19.46,\ N_s = 140.54,\ K_i = 141.8,\ K_s = 852.1,$$
$$\omega_1 = 0.43,\ \omega_2 = 0.09,\ \omega_3 = 0.03,\ \lambda_1 = 0.81,\ \lambda_2 = 0.72,\ \lambda_3 = 0.68,$$
$$\xi_1 = 0.19,\ \xi_2 = 0.28,\ \xi_3 = 0.32$$
$$\bar{k}_1 = 42.36,\ \bar{k}_2 = 10.41,\ \bar{k}_3 = 4.30,\ c_1 = 6.90,\ c_2 = 2.92,\ c_3 = 1.41. \quad (18)$$

It is straightforward to calculate the three eigenvalues as follows

$$\{-0.24, -0.18, -0.09\}.$$

The eigenvalues are real and negative. The equilibrium is locally stable. This guarantees the validity of exercising comparative dynamic analysis with the same initial conditions.

4. COMPARATIVE DYNAMIC ANALYSIS

We simulated the motion of the national economy under (17). It is significant to examine how the economic system reacts to exogenous changes. As the lemma provides the computational procedure to calibrate the motion of all the variables, it is straightforward to examine effects of change in any parameter on transitory processes as well stationary states of all the variables. We introduce a variable $\bar{\Delta} x_j(t)$ which stands for the change rate of the variable, $x_j(t)$, in percentage due to changes in the parameter value.

4.1. Group 1's Spirit of Capitalism Rises

We now examine the effects of the following change in the parameter: $\omega_{1L}: 0.01 \Rightarrow 0.012$. We may interpret as that group 1's spirit of capitalism rises. The simulation result is plotted in Figure 2. We see that the change has a strong impact on the national economy. As group 1 strengthens its spirit of capitalism, its social status is enhanced. The group's propensity to save and wealth are augmented. The consumption level of consumer goods is reduced initially and is augmented in the long term. The other two groups' wealth and consumption levels are increased. The price of consumer goods is increased. The rate of interest is reduced in tandem with rising wage rates. The national output and wealth are increased. Some of the labor force is shifted from the consumer goods sector to the capital goods sector. The output levels and capital inputs of the two sectors are increased. The inequality between group 1 and the other two groups are enlarged. This confirms that if the rich strengthen its spirit of capitalism, the inequality between the rich and the poor is enlarged. It should be noted that in their research on interaction between pecuniary emulation and inequality, Corneo and Jeanne (1999) conclude: "On the one hand, the presence of pecuniary emulation tends to underscore the conventional view that equality has a positive impact on growth. A more equal distribution of wealth, by reducing the distance between the wealth levels of classes, makes pecuniary emulation easier for the poor. Hence, equality strengthens the incentive to accumulate for status reasons, and is beneficial for economic growth. This mechanism has already been put forward by Cole et al. (1992) and Fershtman et al. (1996), and is thoroughly investigated in our companion paper Corneo and Jeanne (1997b)." It is straightforward to show that in our model if ω_{3L} is increased, then economic growth is encouraged and inequality between group 1 and group 3 is reduced.

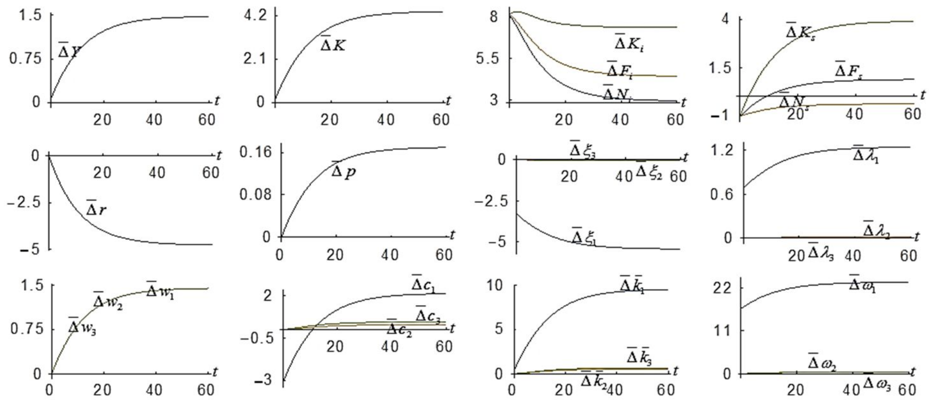

Figure 2. Group 1's Spirit of Capitalism Rises

4.2. The Total Factor Productivity of the Capital Goods Sector being Enhanced

As the economy improves its technology, its productivity is enhanced. It is interesting to examine how technological changes affect the relationship between growth, social status, and inequality. We now allow the total factor productivity of the capital goods sector to be increased as follows: $A_i: 1.3 \Rightarrow 1.32$. The simulation result is plotted in Figure 3. It is reasonable to expect that the technological improvement augments the national output and national wealth. As the technological change takes place in the capital goods sector, the price of consumer goods is enhanced. The rate of interest rises in the short term and falls in long term. The wage rates of all the groups are increased. Although each group's social status is enhanced, group 1's is enhanced more than group 2's and group 2's social status is enhanced more than group 3's social status. As wealth is a linear function of social status, we see that the change rate in wealth is the same as the change rate in social status. The consumption levels of the three groups' representative households fall initially and rise in the long term. We conclude that the technological change enlarge gaps in social status and wealth.

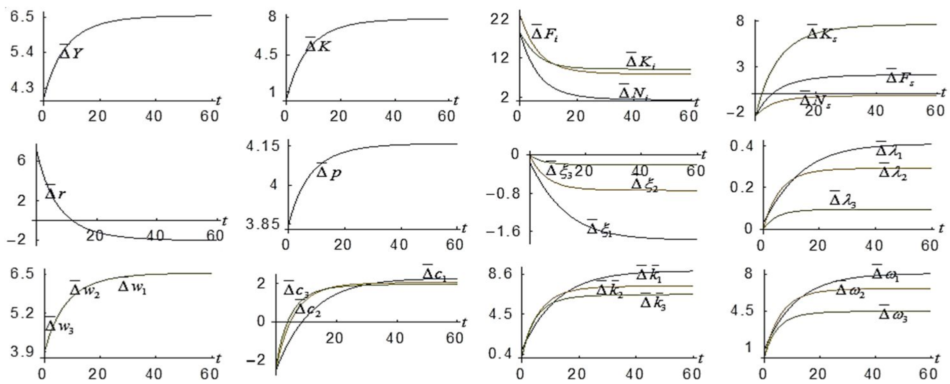

Figure 3. The Total Factor Productivity of the Capital Goods Sector Being Enhanced

4.3. Group 1's Social Status more Strongly Affecting Its Propensity to Save

In our approach social status affects propensity to save and propensity to consume. We now allow group 1's propensity to save to be more strongly affected by its social status as follows: $\tilde{\lambda}_{10}: 0.1 \Rightarrow 0.12$. The simulation result is plotted in Figure 4. We see that the group's propensity to save is increased and the other two groups' preferences are slightly affected. Group 1's social status and wealth are increased more than the other two groups' social status and wealth. Although group 1's consumption is reduced in the short term and the other two groups' consumption levels are increased slightly, group 1's consumption level is increased more than the other two groups' in the long term. This implies that in the long term group 1 consumes even more and has even more wealth than the other two groups by weighing more social status on the propensity to save. The inequality gaps between the rich and the other two groups are enlarged. Some of the labor force is shifted from the consumer goods sector to the capital goods sector. The national output and wealth are increased. The price of consumer goods is enhanced. The rate of interest falls and the wage rates of all the groups are increased.

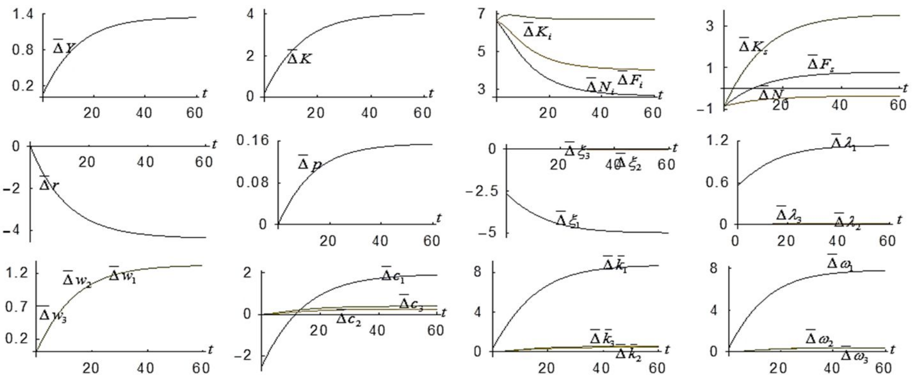

Figure 4. Group 1's Social Status More Strongly Affecting Its Propensity to Save

4.4. Group 3's Population being Increased

We now examine what happen to the economic system when group 3's population is increased as follows: N_3:60 ⇒ 62. The simulation result is plotted in Figure 5. As the population is increased, it is reasonable to expect that the national output and national wealth are augmented. The output levels and two factor inputs of the two sectors are augmented. The price of consumer goods is slightly affected. The rate of interest is enhanced and the wage rates of all the groups are reduced. Group 1's social status, propensity to save, consumption level and wealth are all increased, while the other two groups' social status, propensity to save, consumption level and wealth are all slightly reduced. We conclude that group 3's population expansion enlarges gaps in social status and wealth between group 1 and the other two groups.

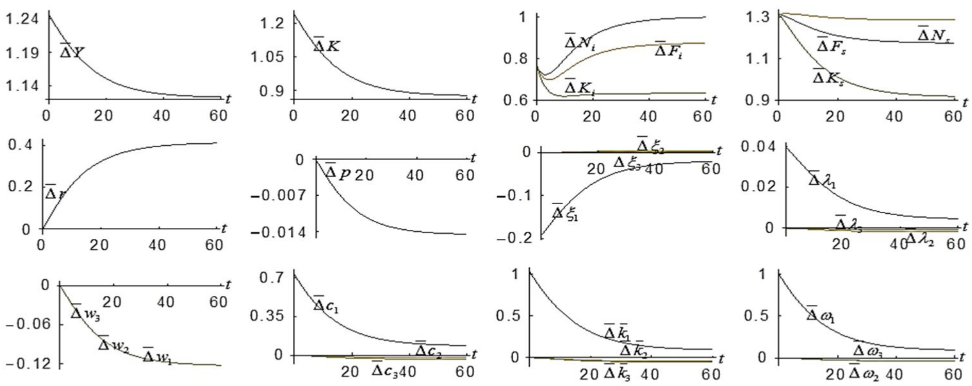

Figure 5. Group 3's Population Being Increased

4.5. The Depreciation Rate of Physical Capital Rises

We now allow the depreciation rate to be increased as follows: $\delta_k: 0.05 \Rightarrow 0.055$. The simulation result is plotted in Figure 6. As physical capital depreciates faster, the national output and wealth are reduced. The output level and two factor inputs of the capital goods sector are augmented. The output level and two factor inputs of the consumer goods sector are reduced. The price of consumer goods, the rate of interest falls and the wage rates of all the groups are all reduced. All the groups' social status, propensities to save, consumption levels and wealth levels are all reduced. Group 1's social status, propensities to save, consumption levels and wealth levels are reduced more than group 2's; group 2's social status, propensities to save, consumption levels and wealth levels are reduced more than group 3's. This implies that faster capital depreciation reduces the inequalities.

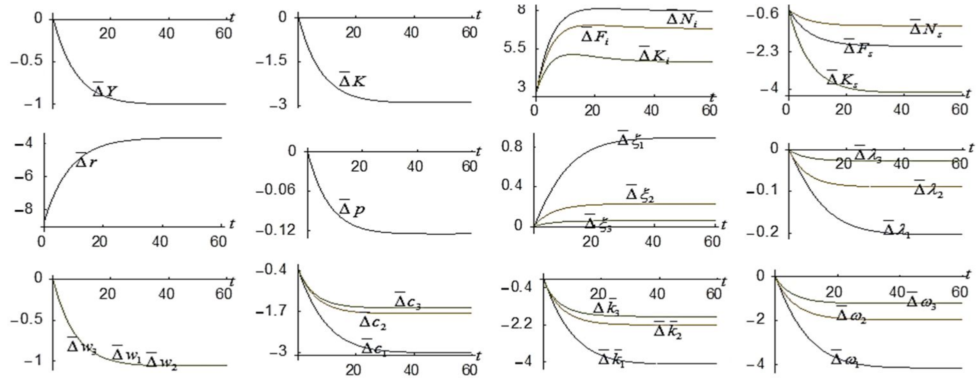

Figure 6. The Depreciation Rate of Physical Capital Rises

4.6. Group 3's Human Capital Rises

We now examine what happen to the economic system when group 3's human capital is enhanced as follows: $h_3: 1 \Rightarrow 1.5$. The simulation result is plotted in Figure 7. The national output and national wealth are augmented. The output levels and two factor inputs of the two sectors are augmented. The price of consumer goods is slightly affected. The rate of interest is reduced initially and enhanced in the long term. Group 3's wage is increased and the other two groups' wage rates are slightly affected. Group 3's and group 1's social status, propensity to save, consumption level and wealth are all increased, while group 2's social status, propensity to save, consumption level and wealth are all slightly changed. The inequalities between group 1 and group 3 are reduced and the inequalities between group 2 and group 1 are enlarged.

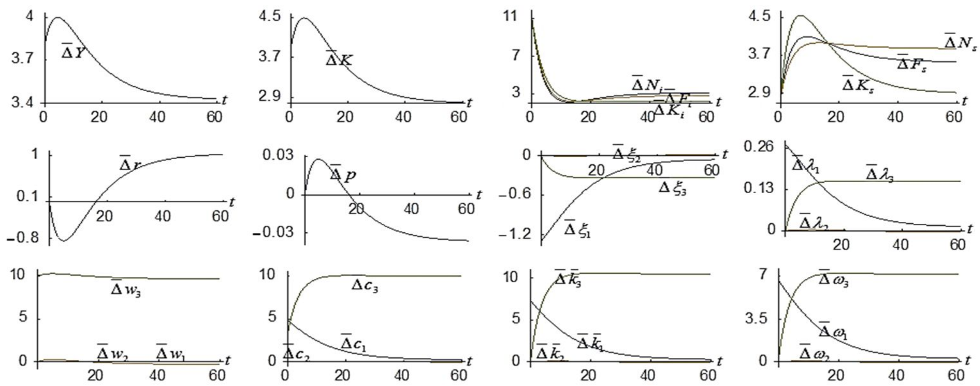

Figure 7. Group 3's Human Capital Rises

4.7. A Rise in the Output Elasticity of Capital of the Capital Goods Sector

We now examine the following rise in the output elasticity of capital of the capital goods sector: $\alpha_i: 0.34 \Rightarrow 0.35$. A rise in the parameter implies that the share of capital contribution to the output is increased. The simulation result is plotted in Figure 8. The national output and national wealth are augmented. The output levels and capital inputs of the two sectors are augmented. Initially some of the labor force is shifted from the consumer goods sector to the capital goods sector, in the long term some of the labor force is shifted from the capital goods sector to the consumer goods sector. In the long term all the groups' social status, propensities to save, consumption levels and wealth levels are all increased. From Figure 8 we see that these variables are increased differently. In the long term the inequalities between group 1 and the other two groups are enlarged.

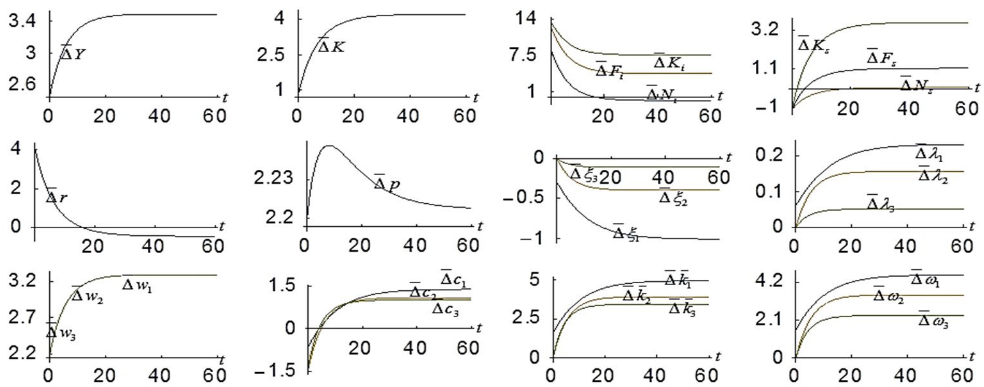

Figure 8. A Rise in the Output Elasticity of Capital of the Capital Goods Sector

5. CONCLUDING REMARKS

This study dealt with interactions between social status, economic growth and income and wealth distribution in an economic growth model of heterogeneous households with economic structure. The model emphasized the role of social status on economic structural change and wealth and income distribution. It is influenced by the ideas related to economic growth and social status in the literature of economic growth and is developed within the framework of an integrated Walrasian general equilibrium theory and neoclassical growth theory. The economic system consists of one capital goods sector, one consumer goods sector, and any number (of types) of households. The motion is described by a set of differential equations. For illustration, we simulated the motion of the economic system with three groups of households. We identified the existence of a unique stable equilibrium point. We also carry out comparative dynamic analysis with regard to spirit of capitalism, the total factor productivity of the capital goods sector, effect of social on propensity to save, a group's population, the depreciation rate of physical capital, a group's human capital, and the output elasticity of capital of the capital goods sector. We examined how changes in these parameters affect inequalities and economic growth. From our simulation, we see that relations between inequality and economic growth are complicated in the sense that these relations are determined by many factors. The relation are expectably ambiguous or development-dependent in the sense that one may observe positive or negative relations according the parameter values combinations and state of economic development. As our analytical framework is quite general, it is possible to generalize and extend the model in different aspects. One important direction is to introduce taxation into the general dynamic equilibrium model with social status, for instance, along the directions in the literature (e.g., Ng, 1987; Ireland, 1994, 1998; Bagwell and Bernheim, 1996; Corneo and Jeanne, 1997a; and Rege, 2008).

APPENDIX

A. 1. Proving the lemma

By (4) and (6), we obtain

$$z \equiv \frac{r+\delta_k}{w} = \frac{N_i}{\bar{\beta}_i K_i} = \frac{N_s}{\bar{\beta}_s K_s}, \tag{A1}$$

where $\bar{\beta}_j \equiv \beta_m/\alpha_m$. From (A1) and (15), we obtain

$$\bar{\beta}_i K_i + \bar{\beta}_s K_s = \frac{N}{z}. \tag{A2}$$

Insert (A1) in (4)

$$r = \alpha_r z^{\beta_i} - \delta_k, \; w_j = \alpha_w h_j z^{-\alpha_i}, \tag{A3}$$

where

$$\alpha_r = \alpha_i A_i \bar{\beta}_i^{\beta_i}, \; \alpha_w = \beta_i A_i \bar{\beta}_i^{-\alpha_i}.$$

Hence, we determine the rate of interest and the wage rates as functions of z. From (5) and (6), we have

$$p = \frac{\bar{\beta}_s^{\alpha_s} z^{\alpha_s} w}{\beta_s A_s}, \tag{A4}$$

where $w = w_1/h_1$. From (A3) and the definitions of $\hat{y}_j$, we have

$$\hat{y}_j = (1 + r)\bar{k}_j + h_j w. \tag{A5}$$

Insert $pc_j = \xi_j \hat{y}_j$ in (13)

$$\sum_{j=1}^{J} \xi_j \bar{N}_j \hat{y}_j = pF_s. \tag{A6}$$

Substituting (A5) in (A6) yields

$$N_s = \sum_{j=1}^{J} \tilde{g}_j \bar{k}_j + \tilde{g}, \tag{A7}$$

where we use $pF_s = w\, N_s/\beta_s$ and

$$\tilde{g}_j \equiv \beta_s \xi_j W \bar{N}_j, \; \tilde{g} \equiv \beta_s \sum_{j=1}^{J} h_j \xi_j \bar{N}_j, \; W \equiv \frac{1+r}{w}.$$

From (2) and (A7)

$$N_i = N - N_s, \tag{A8}$$

From (A1) and (15)

$$\frac{N_i}{\bar{\beta}_i} + \frac{N_s}{\bar{\beta}_s} = zK. \tag{A9}$$

Insert (A8) in (A9)

$$\frac{\bar{\beta}N}{\beta_i} + N_s = \bar{\beta}zK, \tag{A10}$$

where

$$\bar{\beta} \equiv \left(\frac{1}{\beta_s} - \frac{1}{\beta_i}\right)^{-1}.$$

From (A10) and

$$\sum_{j=1}^{J}\left(h_j + W\bar{k}_j\right)\bar{N}_j\xi_j = \frac{\bar{\beta}zK}{\beta_s} - \frac{\bar{\beta}N}{\beta_s\bar{\beta}_i}. \tag{A11}$$

Insert $K = \sum_{j=1}^{J}\bar{k}_j\bar{N}_j$ in (A11)

$$\left(h_1 + W\bar{k}_1\right)\xi_1 - W_0\bar{k}_1 = \bar{W}, \tag{A12}$$

where

$$W_0(z) \equiv \frac{\bar{\beta}z}{\beta_s},\ \bar{W}\left(z,\{\bar{k}_j\}\right) \equiv \left(W_0\sum_{j=2}^{J}\bar{k}_j\bar{N}_j - \sum_{j=2}^{J}\left(h_j + W\bar{k}_j\right)\bar{N}_j\xi_j - \frac{\bar{\beta}N}{\beta_s\bar{\beta}_i}\right)\frac{1}{\bar{N}_1}.$$

From the definitions of ξ_j, (10) and (11), we have

$$\xi_j = \frac{\bar{\omega}_{j0} + \bar{k}_j}{\tilde{\omega}_{j0} + \hat{\omega}_{j0}\bar{k}_j}, \tag{A13}$$

where

$$\bar{\omega}_{j0} \equiv \frac{\bar{\xi}_{j0} + \tilde{\xi}_{j0}\omega_{j0}}{\tilde{\xi}_{j0}\omega_{\mathrm{jL}}},\ \tilde{\omega}_{j0} \equiv \frac{\bar{\xi}_{j0} + \bar{\lambda}_{j0} + (\tilde{\xi}_{j0} + \tilde{\lambda}_{j0})\omega_{j0}}{\tilde{\xi}_{j0}\omega_{\mathrm{jL}}},\ \hat{\omega}_{j0} \equiv \frac{\tilde{\xi}_{j0} + \tilde{\lambda}_{j0}}{\tilde{\xi}_{j0}}.$$

Insert (A13) for the case of $j = 1$ in (A12)

$$\bar{k}_1^2 + f\bar{k}_1 + f_0 = 0, \tag{A14}$$

where

$$f(z,\{\bar{k}_j\}) \equiv \frac{\bar{\omega}_{10}W + h_1 - \tilde{\omega}_{10}W_0 - \hat{\omega}_{10}\bar{W}}{W - \hat{\omega}_{10}W_0},\ f_0\left(z,\{\bar{k}_j\}\right) \equiv \frac{\bar{\omega}_{10}h_1 - \bar{W}\tilde{\omega}_{10}}{W - \hat{\omega}_{10}W_0}.$$

Solve (A14)

$$\bar{k}_1 = \varphi(z, \{\bar{k}_j\}) = -\frac{f}{2} \pm \sqrt{\frac{f^2}{4} - f_0}. \tag{A14}$$

The problem has two solutions. We will determine meaningful solutions by simulation. In our simulation there is a unique meaningful solution given by

$$\bar{k}_1 = \varphi(z, \{\bar{k}_j\}) = -\frac{f}{2} + \sqrt{\frac{f^2}{4} - f_0}.$$

It is straightforward to confirm that all the variables can be expressed as functions of z and $\{\bar{k}_j\}$ by the following procedure: r and w_j by (A3) → $\bar{k}_1$ by (A14) → ξ_j by (A13) → N_s by (A7)→ N_i by (A8)→ $w = w_1/h_1$ → $\hat{y}_j$ by (A5) → K_s, and K_i by (A1) → F_i and F_s by the definitions → p by (A4) → c_j and s_j by (13) →$K = K_i + K_s$. From this procedure and (12), we have

$$\dot{\bar{k}}_1 = \Lambda_0(z, \{\bar{k}_j\}) \equiv \lambda_1 \hat{y}_1 - \bar{k}_1, \tag{A15}$$

$$\dot{\bar{k}}_j = \Lambda_j(z, \{\bar{k}_j\}) \equiv \lambda_j \hat{y}_j - \bar{k}_j, \; j = 2, \cdots, J. \tag{A16}$$

Taking derivatives of equation (A14) with respect to t implies

$$\dot{\bar{k}}_1 = \frac{\partial \varphi}{\partial z} \dot{z} + \sum_{j=2}^{J} \Lambda_j \frac{\partial \varphi}{\partial \bar{k}_j}, \tag{A17}$$

where we use (A16). In summary, we proved the lemma. Equal (A17) and (A15)

$$\dot{z} = \left(\Lambda_0 - \sum_{j=2}^{J} \Lambda_j \frac{\partial \varphi}{\partial \bar{k}_j}\right) \left(\frac{\partial \varphi}{\partial z}\right)^{-1}. \tag{A18}$$

REFERENCES

Abel, A., B.S. Bernanke, and D. Croushore (2007), *Macroeconomics*, New Jersey: Prentice Hall.

Amir, R. and I.V. Evstigneev (1999), "Stochastic Version of Polterovich's Model: Exponential Turnpike Theorems for Equilibrium Paths," *Macroeconomic Dynamics*, 3, 149-66.

Arrow, K.J. (1974), "General Economic Equilibrium: Purpose, Analytic Techniques, Collective Choice," *American Economic Review*, 64, 253-72.

Arrow K.J. and G. Debreu (1954), "Existence of an Equilibrium for a Competitive Economy," *Econometrica*, 22, 265-90.

Arrow, K.J. and F.H. Hahn (1971), *General Competitive Analysis*, San Francisco: Holden-Day, Inc.

Bagwell, L.S., and D.B. Bernheim (1996), "Veblen Effects in a Theory of Conspicuous Consumption," *American Economic Review*, 86, 349-73.

Bakshi, G.S., and Z. Chen (1996), "The Spirit of Capitalism and Stock-Market Prices," *American Economic Review*, 86, 133-57.

Barro, R.J., and X. Sala-i-Martin (1995), *Economic Growth*, New York: McGraw-Hill, Inc.

Bewley, T. (1982), "An Integration of Equilibrium Theory and Turnpike Theory," *Journal of Mathematical Economics*, 10, 233-67.

Burmeister, E., and A.R. Dobell (1970), *Mathematical Theories of Economic Growth*, London: Collier Macmillan Publishers.

Caselli, F., and J. Ventura (2000), "A Representative Consumer Theory of Distribution," *American Economic Review*, 90, 909-26.

Chang, W.Y. (2006), "Relative Wealth, Consumption Taxation, and Economic Growth," *Journal of Economics*, 88, 103-29.

Chang, W.Y., and F.H. Tsai (2003), "Money, Social Status, and Capital Accumulation in a Cash-in-Advance Model: A Comment," *Journal of Money, Credit, and Banking*, 33, 657-61.

Chang, W.Y., H.F. Tsai, and C.C. Lai (2004), "Taxation, Growth, and the Spirit of Capitalism," *European Journal of Political Economy*, 20, 1011-25.

Chatterjee, S. (1994), "Transitional Dynamics and the Distribution of Wealth in a Neoclassical Growth Model," *Journal of Public Economics*, 54, 97-119.

Chen, H.J., and J.T. Guo (2009), "Social Status and the Growth Effect of Money," *Japanese Economic Review*, 60, 133-141.

_____ (2011), "Money, Social Status and Endogenous Growth in a Generalized Cash-in-Advance Model," *Pacific Economic Review*, 16(3), 267-84.

Clemens, C. (2004), "Status, Risk-Taking and Intertemporal Substitution in an Endogenous Growth Model," *Journal of Economics*, 2, 103–23.

Cole, H.L., G.J. Mailath, and A. Postlewaite (1992), "Social Norms, Savings Behavior, and Growth," *Journal of Political Economy*, 100, 1092-1125.

Corneo, G., and O. Jeanne (1997a), "On Relative Wealth Effects and the Optimality of Growth," *Economics Letters*, 54, 87-92.

_____ (1997b), "Status, the Distribution of Wealth, and Growth," Discussion paper A-561, University of Bonn.

_____ (1999), "Social Organization in an Endogenous Growth Model," *International Economic Review*, 40, 711–25.

_____ (2001), "On Relative Wealth Effects and Long-run Growth," *Research in Economics*, 55, 349–58.

Dana, R.A., M. Florenzano, and D. Levy (1989), "Production Prices and General Equilibrium Prices: A Long-run Property of a Leontief Economy," *Journal of Mathematical Economics*, 18, 263-80.

Debreu, G. (1959), *Theory of Value: An Axiomatic Analysis of Equilibrium*, London: Yale University Press.

Diewert, W. (1977), "Walras' Theory of Capital Formation and the Existence of a Temporary Equilibrium," in: Schwödiauer, G. eds., *Equilibrium and Disequilibrium in Economic Theory*, Dordrecht: Reidel.

Duesenberry, J. (1949), *Income, Saving and the Theory of Consumer Behavior*. Cambridge: Harvard University Press.

Eatwell, J. (1987), "Walras' Theory of Capital," in: Eatwell, J., M. Milgate, and P. Newmann, eds., *The New Palgrave Dictionary of Political Economy*, London: MacMillan.

Fershtman, C., K.M. Murphy, and Y. Weiss (1996), "Social Status, Education and Growth," *Journal of Political Economy*, 106, 108-32.

Fisher, W.H., and F.X. Hof (2005), "Status Seeking in the Small Open Economy," *Journal of Macroeconomics*, 27, 209-32.

Frank, R. (1985), "The Demand for Non-Observable and Other Non-Positional Goods," *American Economic Review*, 75, 101-16.

Fraumeni, B.M. (1997), "The Measurement of Depreciation in the U.S. National Income and Product Accounts," *Survey of Current Business*, 77, 7-23.

Gale, D. (1955), "The Law of Supply and Demand," *Mathematica Scandinavica*, 3, 33-44.

Hall, B.H. (2007), "Measuring the Returns to R&D: The Depreciation Problem," NBER Working Paper, No. 13473.

Impicciatore, G., L. Panaccione, and F. Ruscitti (2012), "Walras's Theory of Capital Formation: An Intertemporal Equilibrium Reformation," *Journal of Economic Theory*, 106, 99-118.

Ireland, N.J. (1994), "On Limiting the Market for Status Signals," *Journal of Public Economics*, 53, 91-110.

_____ (1998), "Status-Seeking, Income Taxation and Efficiency," *Journal of Public Economics*, 70, 99-113.

Jensen, B.S., and M.E. Larsen (2005), "General Equilibrium Dynamics of Multi-Sector Growth Models," *Journal of Economics*, 10, 17-56.

Judd, K.L. (1998), *Numerical Methods in Economics*, Cambridge: MIT Press.

Konrad, K. (1992), "Wealth Seeking Reconsidered," *Journal of Economic Behavior and Organization*, 18, 215–227.

Kurz, M. (1968), "Optimal Economic Growth and Wealth Effects," *International Economic Review*, 9, 348-57.

Maliar, L., and S. Maliar (2001), "Heterogeneity in Capital and Skills in a Neoclassical Stochastic Growth Model," *Journal of Economic Dynamics and Control*, 38, 635-54.

Mas-Colell, A., M.D. Whinston, and J.R. Green (1995), *Microeconomic Theory*, New

York: Oxford University Press.
McKenzie, L.W. (1959), "On the Existence of General Equilibrium for a Competitive Market," *Econometrica*, 27, 54-71.
Miles, D. and A. Scott (2005), *Macroeconomics-Understanding the Wealth of Nations*, Chichester: John Wiley and Sons, Ltd.
Montesano, A. (2008), "A Restatement of Walras' Theory of Capitalization and Money," *History of Economics Review*, 47, 86-109.
Morishima, M. (1964), *Equilibrium, Stability and Growth*, Oxford: Oxford University Press.
_____ (1977), *Walras' Economics*, Cambridge: Cambridge University Press.
Nadiri, M.I., and I.R. Prucha (1993), "Estimation of the Depreciation Rate of Physical and R&D Capital in the U.S. Total Manufacturing Sector," NBER Working Paper, No. 4591.
Ng, Y.K. (1987), "Diamonds are a Government's Best Friend: Burden-Free Taxes on Goods Valued for Their Values," *American Economic Review*, 77, 186-191.
Nikaido, H. (1956), "On the Classical Multilateral Exchange Problem," *Metroeconomica*, 8, 135-45.
_____ (1968), *Convex Structures and Economic Theory*, New York: Academic Press.
Penalosa, C.G., and S.J. Turnovsky (2006), "Growth and Income Inequality: A Canonical Model," *Economic Theory*, 28, 25-49.
Polterovich, V. (1977), "Models of Equilibrium Economic Growth," *Matecon*, 13, 3-24.
_____ (1983), "Equilibrium Trajectories of Economic Growth." *Econometrica*. 51, 693-730.
Rauscher, M., (1997), "Conspicuous Consumption, Economic Growth, and Taxation," *Journal of Economics*, 66, 35-42.
Rege, M. (2008), "Why Do People Care about Social Status?" *Journal of Economic Behavior and Organization*, 66, 233-42.
Scarf, H.E. (1967), "The Approximation of Fixed Points of a Continuous Mapping," *SIAM Journal of Applied Mathematics*, 15, 1328-1343.
Scarf, H.E., and T. Hansen (1973), *The Computation of Economic Equilibria*, Yale: Yale University Press.
Shoven, J.B., and J. Whalley (1992), *Applying General Equilibrium*, Cambridge: Cambridge University Press.
Solow, R. (1956), "A Contribution to the Theory of Growth," *Quarterly Journal of Economics*, 70, 65-94.
Turnovsky, S.J. and C.G. Penalosa (2006), "Distributional Dynamics in a Neoclassical Growth Model: The Role of Elastic Labor Supply," *Journal of Economic Dynamics and Control*, 32, 1399-431.
Uzawa, H. (1961), "On a Two-Sector Model of Economic Growth," *Review of Economic Studies*, 29, 47-70.
Veblen, T. (1899), *The Theory of the Leisure Class*, New York: Modern Library.
Walras, L. (1874), *Elements of Pure Economics, translated from the French by W. Jaffé,*

1954, London: Allen and Unwin.

Zhang, W.B. (1993), "Woman's Labor Participation and Economic Growth-Creativity, Knowledge Utilization and Family Preference," *Economics Letters*, 42, 105-10.

_____ (2012), "Economic Growth with Heterogeneous Households, Gender Division of Labor, and Elastic Labor Supply," *Journal of Income Distribution*, 21, 15-37.

_____ (2013), "A Synthesis of the Uzawa-Lucas Model with the Walrasian-General-Equilibrium and Neoclassical-Growth Theories," *Economic Annals*, 58, 8-38.

Zou, H.F. (1994), "The Spirit of Capitalism and Long-run Growth," *European Journal of Political Economy*, 10, 279-93.

_____ (1995), "The Spirit of Capitalism and Savings Behavior," *Journal of Economic Behavior and Organization*, 28, 131-43.

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