Employment Flows, Capital Mobility, and Policy Analysis

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Abstract

This paper extends Hopenhayn and Rogerson's analysis of firing taxes by introducing a flexible form of capital and considering transitionary dynamics. The paper finds that capital is not important for understanding the long run and welfare effects of firing taxes. However, capital is crucial for determining the short run consequences of eliminating this type of policy.

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1. Introduction

Many countries have adopted policies that restrict the job turnover process in important ways. Of particular interest are firing restrictions, since they are commonly blamed for the poor performance of European labor markets relative to the U.S. (see, for example, Emerson 1988, Piore 1986, and Lazear 1990). In fact, several European countries impose large penalties on employers for firing workers: Lazear (1990) reports that, in countries such as Italy, Norway, and Spain, the required severance payments for blue collar workers with ten years of service exceed one year of wages.

The goal of this paper is to evaluate the consequences of this type of policy. For this purpose, a general equilibrium model of establishment dynamics is introduced, calibrated to U.S. data, and analyzed to determine the effects of firing taxes. The paper is closely related to Hopenhayn and Rogerson (1993), who studied the effects of firing taxes in a similar framework.[2] It extends their analysis by introducing a flexible form of capital and considering transitionary dynamics. These extensions allow the paper to analyze the short run effects of firing taxes (in addition to the long run effects), and to explore the importance of capital mobility on the effects of firing taxes. Since transitionary dynamics are explicitly considered, the paper is also able to provide a more accurate estimate of the welfare cost of firing restrictions.[3]

The economy considered is similar to the neoclassical growth model except for output, which is produced by a large number of establishments subject to idiosyncratic productivity

[2] An earlier investigation, by Bentolila and Bertola (1990), used a partial equilibrium model to study the consequences of firing and hiring costs in the labor demand of a monopolist.

[3] Similarly to Hopenhayn and Rogerson (1993), the paper abstracts from any potential benefits of firing restrictions, focusing on the costs. An analysis that allows for potential benefits is found in Alvarez and Veracierto (1998), who study the effects of firing restrictions in an economy plagued with reallocation frictions and market imperfections.

shocks that induce them to expand and contract over time. Introducing firing taxes distorts the job turnover process by making establishments less willing to hire and fire workers. This creates a production inefficiency that induces agents to substitute away from the market sector towards home activities, reducing aggregate employment and decreasing capital accumulation. The purpose of the quantitative analysis of the paper is to determine the magnitude of these effects.

There are three reasons why introducing capital mobility and transitionary dynamics could affect the analysis of firing taxes. First, if labor and capital were close substitutes and capital were freely movable, establishments could easily use capital in place of labor to adjust to changes in their idiosyncratic productivity shocks. Under those circumstances, the distortions that firing taxes introduce in the adjustment process would be less severe.[4] Second, dynamic capital accumulation decisions could amplify these distortions quite substantially. In particular, output would fall not only because of the direct effects of these distortions, but also because of their indirect effects on investment. Third, the welfare gains of removing the firing restrictions could be considerably smaller: resources would be needed along the transition path to accumulate the larger stock of capital and number of establishments at the steady state without interventions. While the first and third reasons for introducing capital and transitional dynamics work towards delivering lower effects of firing taxes, the second reason works in opposite direction. As a consequence, analysis is needed to determine which effect will dominate.

Similarly to Hopenhayn and Rogerson (1993), the paper finds that firing taxes equal to one year of wages have large long run effects: they decrease steady state output, capital, consumption, and wages by 7.84 percent, and steady state employment by 6.62 percent. When

[4] In a different context, Caballero and Hamour (1998) emphasize the importance of the elasticity of substitution between capital and labor (at different time horizons) for understanding the evolution of European labor markets. They argue that it played a crucial role in determining the ability of labor for appropriating specific quasi-rents from capital.

the analysis is restricted to steady state comparisons, a firing tax of this magnitude decreases welfare by 3.22 percent, in terms of consumption. As expected, considering transitional dynamics reduces this estimate, but only to 2.82 percent. The paper finds that the transitionary dynamics are rather fast: the long run effects dominate the welfare consequences of firing taxes.

To explore the role of capital in the analysis, firing restrictions are introduced in a version of the model without capital. The paper finds that the steady state effects of firing taxes are similar in both economies, suggesting that capital is not crucial for understanding the long run effects of firing taxes. However, capital affects in important ways the short run response of the economy to removing the firing restrictions. In particular, it generates transitional dynamics that are absent when capital is not present. Moreover, the elasticity of substitution between capital and labor plays an important role in determining the shape of the transitional dynamics that the model generates. Furthermore, the paper finds that capital accumulation plays a crucial role in amplifying the initial productivity gains of removing the firing restrictions. In fact, the amplification effect is so large that firing taxes end up producing somewhat larger long run effects in the economy with capital, despite the smaller distortions in the adjustment process.

The paper is organized as follows. Section 2 describes the model economy, Section 3 describes a competitive equilibrium with firing taxes, Section 4 calibrates the model to U.S. observations, Section 5 examines the effects of firing taxes in the benchmark economy, provides a sensitivity analysis, and explores the role of capital in the results obtained, Section 6 concludes the paper. An algorithm to compute equilibria is provided in the Appendix.

2. The model economy

The framework is similar to the neoclassical growth model except for the production technology, which delivers the following features: a determinate size and number of establishments, heterogeneity across establishments, individual establishments which expand and contract over time, and entry and exit of establishment. A full description of the environment follows.

The economy is populated by a measure one of ex-ante identical infinitely lived agents. Their preferences are described by the following utility function:[5]

$$E \sum_{t=0}^{\infty} \beta^t \left[\log c_t + v(l_t)\right]$$

where c_t and l_t are consumption and leisure, and $0 < \beta < 1$ is the subjective time discount factor. The time endowment of each agent is equal to ω. There is an institutionally determined workweek of fixed length which is normalized to one, so leisure can only take values of ω or $\omega - 1$. This assumption delivers a determinate number of workers at each plant, so that changes in the labor input at an establishment can be identified with changes in the number of workers employed.

In every period output is produced by a large number of establishments. Each establishment uses capital k_t and labor n_t as inputs in the following production function:

$$f_t(s_t, k_t, n_t) = s_t \left(1+g\right)^{(1-\theta-\gamma)t} \left[\theta k_t^{\rho} + \gamma \left(1+g\right)^{\rho t} n_t^{\rho}\right]^{\frac{\theta+\gamma}{\rho}} \tag{2.1}$$

where s_t is an idiosyncratic productivity shock, g is the steady state growth rate of the economy, $\theta > 0$, $\gamma > 0$, $\theta + \gamma < 1$, and $\rho < 1$. This production function displays constant elasticity of substitution $\frac{1}{1-\rho}$, constant elasticity of scale $\theta + \gamma$, and is consistent with steady state growth. When $\rho = 0$, it reduces to the following Cobb-Douglas specification:

$$f_t(s_t, k_t, n_t) = s_t \left(1+g\right)^{(1-\theta)t} k_t^{\theta} n_t^{\gamma}.$$

Under free entry, the decreasing returns to scale implied by $\theta + \gamma < 1$ would lead to an infinite number of establishments of infinitesimal size. The introduction of a fixed entry

[5] Preferences are restricted to be separable in consumption and leisure for computational reasons. Among separable utility functions, log c_t was chosen because it is the only functional form consistent with steady state growth. For a time period equal to one quarter, log preferences imply an empirically reasonable elasticity of intertemporal substitution as well.

cost below will preclude this possibility, and will generate a well defined size distribution of establishments.

The idiosyncratic shock s_t follows a stochastic process that is common to all establishments. Realizations are independent across establishments and take values in the set

$$\Omega = \{0\} \cup [1, \infty).$$

The shock s_t follows a first order Markov process with transition function Q, where $Q(s, S)$ is the probability that $s_{t+1} \in S$ conditional on $s_t = s$. This process is assumed to be such that starting from any initial value, with probability one s_t reaches zero in finite time, and that once s_t reaches zero, there is zero probability that s_t will receive a positive value in the future. Given these assumptions, it is natural to identify a zero value for the productivity shock with the death of an establishment. Since there are no fixed costs to operate an establishment already created, exit will take place only when the idiosyncratic productivity shock takes a value of zero.[6]

New establishments can be created through an entrepreneurial activity. Even though agents are ex-ante identical in every period, ex-post they differ in their entrepreneurial abilities. Every period, an agent receives an entrepreneurial ability ξ randomly drawn from a distribution μ. These draws are independent across agents. If an agent of ability ξ spends a full workweek in the entrepreneurial activity, ξ new establishments are created the following period. The initial productivity shock s_t of a newly created establishment is randomly drawn from a distribution ψ. These draws are independent across establishments as well. Observe that the entrepreneurial input will act as an entry cost and lead to a well determined size of establishments.

[6] An alternative would be to introduce a fixed cost to operate a plant (as in Hopenhayn and Rogerson 1993) and solve for a threshold productivity level under which establishments decide to exit. The main advantage of the current formulation is that it allows for the computation of transitionary dynamics, which is a central issue analyzed in this paper.

In what follows it will be convenient to define the following function:

$$A(\nu) = \int_{[\xi^*,\infty)} \xi\mu(d\xi), \quad \text{where } \mu([\xi^*,\infty)) = \nu.$$

This function gives the maximum number of new establishments that can be obtained when a fraction ν of the popultation of agents is ex-post allocated to the entrepreneurial activity. Clearly, the maximum number of establishments is obtained when only the (ex-post) most able entrepreneurs are selected. Rather than postulating a functional form for μ, the following functional form for $A(.)$ will be assumed:

$$A(\nu) = \nu^{\varphi} \tag{2.2}$$

where $0 \leq \varphi \leq 1$.

Notice that when $\varphi = 1$ all agents are exactly the same in terms of their abilities to create new establishments (ξ is equal to one for every agent). On the contrary, when $\varphi = 0$ the creation of establishments is independent of the number of agents allocated to the entrepreneurial activity (that is, new establishments arrive exogenously).[7]

Output can be either consumed or invested. There is a standard linear technology to accumulate capital given by

$$K_{t+1} = (1-\delta) K_t + I_t$$

where K_t is capital, I_t is investment and δ is the depreciation rate.

To determine the feasibility of an allocation, we must keep track of the number of establishments at each productivity level. Letting ν_t be the number of agents that become entrepreneurs at date t, the measure of establishments across productivity levels x_t satisfies the following law of motion:

$$x_{t+1}(S) = \int Q(s,S)x_t(ds) + A(\nu_t)\psi(S) \tag{2.3}$$

[7] Allowing for heterogeneous entrepreneurial ability may play an important role for off-steady-state dynamics, since $A(\nu)$ will act as an adjustment cost function for creating new establishments.

for all S. This equation states that the next period's measure of establishments with shocks in the set S is given by the number of establishments that transit from their current productivity shocks to a shock in S, and the number of establishments created next period with a shock in S.

Aggregate employment is then given by

$$\eta_t = \int n_t(s) x_t(ds) \tag{2.4}$$

and aggregate capital by

$$K_t = \int k_t(s) x_t(ds). \tag{2.5}$$

These expressions are obtained by adding the labor inputs $n_t(s)$ and capital inputs $k_t(s)$ across all establishments in the economy.

Aggregate consumption feasibility is then given by

$$c_t + K_{t+1} - (1-\delta) K_t \leq \int f_t \left[s, k_t(s), n_t(s) \right] x_t(ds) \tag{2.6}$$

In words, aggregate consumption plus aggregate investment cannot exceed the sum of output levels across all establishments in the economy.

Given some initial conditions x_0 and K_0, an allocation is feasible if it satisfies equations (2.3), (2.4), (2.5), and (2.6) at all dates. From these feasibility conditions and the production function (2.1) it is straightforward to verify that along any steady state growth path: 1) aggregate consumption c_t, aggregate capital K_t, and the capital input at each type of establishment $k_t(s)$ grow at the technological growth rate g, and 2) aggregate employment η, the total number of entrepreneurs ν, the measure of establishments across productivity levels x, and the labor input at each type of establishment $n(s)$ are constant over time.[8] Notice that even though individual establishments are continuously expanding, contracting, dying and

[8] Existence of a steady state growth path requires that the fixed entry cost grow at the rate g (the rate of technological progress). Modeling the entry cost as being an entrepreneurial input is a natural choice, since the theory implies that wages will grow exactly at this rate along a balanced growth path. An alternative

being created, the employment size distribution of establishments remains constant along a steady state growth path. This is consistent with an important observation regarding the U.S. economy: average establishment size (in terms of employment) shows no tendency to increase or decrease over long periods of time.[9]

It is possible to transform the economy (by redefining preferences and technology appropriately) so that its steady state growth path exhibits zero growth. Since this is a standard procedure in the growth literature, the details are left to the reader. In what follows, it is assumed that the economy has already been transformed in this manner. In particular, the establishments' production function will become

$$f(s,k,n) = s\left[\theta k^{\rho} + \gamma n^{\rho}\right]^{\frac{\theta+\gamma}{\rho}}$$

hereon.

3. Competitive equilibrium with firing taxes

This section considers a competitive equilibrium where establishments are taxed for reducing their employment levels. Following Hopenhayn and Rogerson (1993), it is assumed that the proceeds of the firing taxes are rebated as lump sum transfers to households by the government. In the presence of firing costs, the firms' maximization problem becomes dynamic because current employment decisions affect future tax liabilities. For simplicity, we describe steady state competitive equilibria only. A discussion of the transitionary dynamics will be provided later on.

The individual state of an establishment is given by its current productivity shock s and its previous employment level e. Establishments seek to maximize expected discounted

modeling strategy would be to impose an entry cost in the form of a fixed amount of goods. A problem with this formulation is that steady state growth would require this fixed input requirement of goods to exogenously grow at the rate g. Clearly, there would be no theoretical justification for such an assumption.

[9] This observation comes from Census of Manufacturers data between 1947 to 1982.

profits net of firing taxes. The steady state profit maximization problem of an establishment of type (e, s) is described by the following dynamic programming problem:

$$V(e,s) = \max\left\{ f(s,k,n) - wn - rk - \tau w \max(0, e-n) + \frac{1+g}{1+i}\int V(n,s')Q(s,ds')\right\} \tag{3.1}$$

where w is the wage rate, r is the rental price of capital, and i is the interest rate. Note that whenever current employment n is lower than the previous period's employment e, the establishment must pay a factor τ of the wage rate per unit reduction in employment.[10]

Every period, households purchase consumption, capital, and new establishments, and receive income from the rental of capital, the supply of labor and entrepreneurial services, the profits of the establishments that they own, and the lump sum transfers from the government. Following Hansen (1985) and Rogerson (1988), households are assumed to trade lotteries. Trading is assumed to occur before the realizations of entrepreneurial abilities. The lotteries traded are contracts that specify probabilities (conditional on the realization of the entrepreneurial ability) of working or becoming an entrepreneur, and allow agents to perfectly diversify the risk that they face.

The steady state problem of a household with capital K and establishment ownership given by a measure x over establishment types, is described by the following functional equation:

$$H(K,x) = \max\left\{\ln c - \alpha(\eta + \nu) + \beta H(K', x')\right\} \tag{3.2}$$

subject to

$$c + (1+g)K' - (1-\delta)K \leq w\eta + rK + T + \int \pi(e,s)\, x(de \times ds) \tag{3.3}$$

$$x'(E \times S) = \int_{\{(e,s):\ n(e,s)\in E\}} Q(s,S)x(de\times ds) + A(\nu)\psi(S)\varkappa_E(0) \tag{3.4}$$

[10] Observe that establishment must pay the tax on employment reduction when they shut down. This corresponds with actual practice (see Lazear 1990, p. 708).

where η is the probability of becoming a worker, ν is the probability of becoming an entrepreneur, $\pi(e,s)$ are the one-period profits of an establishment of type (e,s), and T are the lump sum transfers from the government. Observe that households' preferences become linear with respect to the probability of working η and becoming an entrepreneur ν due to the trading in lotteries.[11] Equation (3.3) represents the budget constraint. Equation (3.4) gives the next period ownership of establishments x' as a function of the current period ownership x and the probability of becoming an entrepreneur ν. The second term in this expression takes into account that agents trade the entrepreneurship lotteries at actuarially fair prices. The expression $\varkappa_E(0)$ is an indicator function that is equal to one if $0 \in E$, and is equal to zero otherwise (note that new establishments arrive with zero employment from the previous period).

At steady state, the aggregate state of the economy (K^*, x^*) and equilibrium prices $\{i^*, r^*, w^*\}$ are constant over time. Establishments solve equation (3.1) taking equilibrium prices as given, and generate decision rules $n^*(e,s)$ and $k^*(e,s)$ for employment and capital, and one-period profits $\pi^*(e,s)$. Households solve equation (3.2) taking establishments' decisions, equilibrium prices, and equilibrium lump-sum transfers as given. At steady state, the representative household with individual state (K^*, x^*) chooses $K' = K^*$ and $x' = x^*$ for the following period. Associated with these decisions are (constant) choices of consumption c^*, labor η^*, and entrepreneurship ν^*. At equilibrium, the markets for capital, labor, and consumption clear. In particular,

$$K^* = \int k^*(e,s)x^*(de \times ds)$$

$$\eta^* = \int n^*(e,s)x^*(de \times ds)$$

$$c^* + (g + \delta)\,K^* = \int f[s, k^*(e,s), n^*(e,s)]x^*(de \times ds).$$

[11] In particular, α is given by $v(\omega) - v(\omega - 1)$.

By Walras Law, it can be verified that the lump sum transfers T^* equal the tax revenues of the government.

The only transitionary dynamics that this paper will analyze correspond to the economy with no firing taxes. Under no interventions, the welfare theorems hold and the competitive equilibrium allocation can be obtained as the solution to a social planner's problem with equal weights. The Appendix describes how to compute this social planner's problem as well as steady state equilibria.

4. Calibration

Parameter values are selected so that the steady state of the model economy reproduces several important features of U.S. data. Since U.S. labor markets are flexible compared to most European counterparts, firing restrictions are set to zero when calibrating to the U.S. economy.

The first issue to address is what actual measure of capital will the model capital correspond to. Since we are interested in establishment level dynamics, we abstract from capital components such as land, residential structures, and consumer durables. In particular, the empirical counterpart for capital is identified with plant and equipment, and is associated in the National Income and Product Accounts with non-residential investment. On the other hand, the empirical counterpart for consumption is identified with personal consumption expenditures in non-durable goods and services. Output is then defined to be the sum of these investment and consumption measures. The quarterly capital-output and investment-output ratios that correspond to these measures are 6.8 and 0.15 respectively.[12]

At steady state, investment is just enough to replenish capital from growth-adjusted

[12]Empirical measures for plant and equipment were obtained from Diaz-Gimenez, et al. (1992) for the years 1959, 1975 and 1986. The numbers reported in the text are the quarterly equivalent capital-output and investment-output ratios that correspond to averages over these three years.

depreciation. In particular:

$$\frac{I}{Y} = (g + \delta) \frac{K}{Y}.$$

Setting $g = 0.0039$ (the average quarterly growth rate in GNP per capita between 1954 and 1992) the above capital-output and investment-output ratios imply a depreciation rate δ equal to 0.01816.

Mehra and Prescott (1985) report that between 1889 and 1978 the average annual real return on equity was 7 percent, while the average annual real return on short-term debt was about 1 percent. As a compromise, an annual interest rate of 4 percent is chosen here.[13] At steady state

$$1 + i = \frac{1 + g}{\beta}.$$

The discount factor β is then selected to be 0.994 to reproduce this annual interest rate.

For the benchmark economy, the elasticity of substitution between capital and labor is set to one. Under this Cobb-Douglas specification, the share of labor in National Income is given by the technology parameter γ, which is consequently set at 0.64, the value implicit in the U.S. National Income and Product Accounts.

The capital share θ is related to the interest rate i, the depreciation rate δ and the capital-output ratio as follows:

$$\theta = (i + \delta) \frac{K}{Y}.$$

Using the above values for the interest rate, the depreciation rate of capital, and the capital-output ratio, leads to a θ equal to 0.19. The share of National Income going to owners of establishments is then $1 - \theta - \gamma = 0.17$.

The preference parameter α is selected so that 80 percent of the population is employed, roughly the fraction of the working age population that is employed in the U.S. economy. The curvature parameter φ is selected small enough so that the number of entrepreneurs in

[13] Also, this is the value commonly used in the real business cycles literature.

the economy is 1/100 the number of workers. Even though there is no data on the number of entrepreneurs in the U.S. economy, it seems reasonable to impose a small number relative to the number of workers.[14] Nevertheless, we will report results under different curvature parameters φ.

The remaining parameters pertain to the distribution function over initial productivity shocks, and the transition function Q. The transition probabilities are restricted to be of the following form:

$$\begin{aligned} Q\left(0,\{0\}\right) &= 1 \\ Q\left(s,[1,\widetilde{s}]\right) &= \frac{1}{\mu}\Pr\left\{(a+\phi\ln s+\varepsilon')\in[1,\widetilde{s}]\right\},\text{ for } s,\widetilde{s}\geq 1 \end{aligned}$$

where a, ϕ, and μ are constants, and ε' is an i.i.d. normally distributed variable with mean 0 and standard deviation σ. This is basically an AR(1) process truncated at the value of 0.

In computations the idiosyncratic productivity shocks must take a finite number of values. This means that we must decide the number of points and values for s to include in the finite grid. The number of parameters to determine in ψ will clearly depend on the number of points in the finite grid. On the other hand, there are four parameters that characterize the transition function Q: a, ϕ, μ, and σ. The actual transition matrix used in computations will be a finite approximation of Q over the grid points. Since all these parameters are important determinants of the establishment dynamics of the model, their values are selected to reproduce several features of U.S. establishment dynamics.

One such feature is the distribution of establishments by employment size. The Census of Manufacturers is a rich source of information, providing the number of establishments across several employment ranges in the U.S. manufacturing sector. Since the census reports data for nine employment ranges, a grid of nine positive values for the productivity shocks is chosen. The values are selected so that the (corresponding nine types of) establishments

[14] In a stochastic version of this economy, a small curvature parameter φ is also crucial for obtaining empirically reasonable cyclical behavior of job-creation and job-destruction rates (see Veracierto 1996).

in the model economy display employment levels in the middle of each of the employment ranges reported by the Census of Manufacturers. The distribution over initial productivity shocks ψ is then selected so that the invariant distribution x in the model economy mimics the average size distribution of manufacturing establishments across the census years of 1967, 1972, 1977, and 1982, which is reproduced in the upper portion of Table 2.

Another set of observations on (manufacturing) establishment dynamics concerns "job-creation" and "job-destruction" data. Davis and Haltiwanger (1990) defined "job-creation (destruction) between periods t and $t+1$" to be the sum of employment increases (decreases) across all establishments that expand (contract) between periods t and $t+1$, divided by the average employment level in the manufacturing sector between periods t and $t+1$. Job-creation (JC) was further split into employment increases due to births of establishments (JCB), and employment increases due to continuing establishments (JCC). Similarly, job-destruction (JD) was split into employment decreases due to deaths of establishments (JDD), and employment decreases due to continuing establishments (JDC). Davis and Haltiwanger reported quarterly values for job-creation and job-destruction corresponding to data from the Longitudinal Research Datafile. Their mean values for the period between 1972:2 and 1988:4 are reported in the upper portion of Table 2.

A last observation used is the five-years exit rate of manufacturing establishments. Dunne, Roberts and Samuelson (1989) performed an empirical study of establishment turnover using data on plants that first began operating in the 1967, 1972, or 1977 Census of Manufacturers. The five-year exit rate among these plants was found to be 36.2 percent. The parameters characterizing the transition function Q (mainly, a, ϕ, μ and σ) are chosen to reproduce this five years exit rate together with the quarterly "job-creation" and "job-destruction" rates reported in Table 2.

The time period of the model economy is selected to be one quarter. Parameters corresponding to this choice of time period are listed in Table 1. The lower portion of Table 2 displays steady state values. Table 2 shows that the model economy does a reasonable job in mimicking U.S. establishment dynamics.

5. Results

Table 3 reports how the steady-state of the benchmark economy is affected by the introduction of firing taxes equivalent to one quarter ($\tau = 1$) and one year of wages ($\tau = 4$).[15] Before moving to the results, it should be noted that the equilibrium without interventions is Pareto optimal. As a consequence, introducing firing penalties will only decrease welfare levels.[16]

Table 3 shows that both steady state allocations and prices are substantially affected by the introduction of firing restrictions: firing taxes equal to one year of wages reduce steady state consumption, output, capital, and wages by 7.84 percent, the number of workers by 6.62 percent, and the number of entrepreneurs by 2.77 percent.[17] These are exactly the type of effects which opponents of firing restrictions are concerned about, and we find them to be quantitatively very important.

Also reported are summary statistics on how the employment creation and destruction process is affected by the introduction of firing taxes. The average employment size of establishments decreases from 61.72 to 57.74 when τ goes from 0 to 4, while the variances of employment and capital levels across establishments increase from 1.36 to 1.46 and 1.37, respectively. For continuing establishments, the serial correlations of employment and capital

[15] Preference and technology parameters are those selected in the previous section.

[16] Even though workers are employed or not, depending on the outcome of the lotteries that they trade, these same contracts allow them to perfectly diversify this risk. In particular, the introduction of lotteries precludes the possibility that firing penalties reduce any uninsurable mobility costs incurred by workers.

[17] Firing taxes equal to one year of wages are about the same magnitude as the largest severance payments observed in actual countries (see Lazear 1990).

increase from 0.974 to about 0.991, and the variances of employment and capital growth rates decrease from 0.072 to about 0.027.

Figure 1 displays the employment decision rules of establishments subject to a same productivity shock, before and after the introduction of the firing taxes. Without firing penalties, current employment decisions are independent of previous employment levels. With firing penalties, employment decisions are characterized by a lower and an upper bound. If previous employment is smaller (greater) than the lower (upper) bound, current employment is adjusted to the lower (upper) bound. If previous employment is between these lower and upper bounds, current employment does not change. Current employment is increasing with previous period employment because establishments try to postpone the tax payment on employment reduction.

These decision rules provide some intuition on the reported changes in the statistics summarizing the employment creation and destruction process. The increase in the variance of employment across establishments is due to the fact that establishments with identical current productivity shocks chose different employment levels in the presence of firing taxes, whereas they would choose identical employment levels in the absence of such taxes.[18] The increase in the serial correlation of employment and the decrease in the variance of employment growth rates are due to the fact that establishments do not adjust their employment levels as much as without firing taxes: there is a wide range of previous employment levels in which establishments make no adjustment, and outside this range the adjustment is much smaller than it would otherwise be. Since, under the assumed functional forms, (log) capital is a linear function of (log) productivity and (log) current employment, capital inherits the same properties as employment.

[18] That is, the variance of employment levels within establishment groups with identical productivity shocks becomes positive with the introduction of firing taxes. An offsetting effect is that the variance of average employment levels across establishment groups with different productivity shocks decreases. For $\tau = 4$ this last effect is not large enough, but for $\tau = 1$ it dominates the first effect, and the variance actually decreases.

Figure 2 shows capital-labor ratios as a function of previous employment. We see that for the range where establishments do not adjust their employment levels, the capital-labor ratio is a decreasing function of previous employment. Even though capital increases together with employment in this range, there is a substitution from capital to labor in order to avoid the tax on employment reduction.

A priori, it is not clear whether the welfare gains of removing these firing penalties will be large or not: agents are able to consume substantially more at the steady state without taxes, but they also have to work substantially more. Table 3 reports the percentage consumption increase, uniform across all dates, needed to give agents in the steady state of the economy with $\tau = 4$ the same welfare level as agents in the steady state of the economy with $\tau = 0$. Using this welfare measure, the gain from removing the tax on employment reduction is computed to be 3.22 percent.

Welfare conclusions reached from steady state comparisons can easily be misleading since they ignore the consequences of transitional dynamics. For the economy considered here, capital and the number of establishments are larger in the steady state with $\tau = 0$. In order to build this extra capital and create establishments, some consumption and leisure must be sacrificed along the transition to the steady state without taxes. This means that the welfare gain obtained above actually overstates the gain of removing the tax on employment reduction. To explore the magnitude of this effect it is necessary to compute the transition path between steady states. Figure 3 reports the transition paths for capital, consumption, output, entry of new establishments, entrepreneurs, and workers from the steady state with firing taxes to the one without.[19] Once this transitionary dynamics is considered, the welfare gain from removing the tax on employment reduction drops to 2.82 percent. Even though

[19] The choice of going from the steady state with firing restrictions to the steady state without was done for computational reasons: computing the transitionary dynamics in this direction only requires solving the Social Planner's problem described in the Appendix.

this welfare estimate is lower than the one obtained in the steady state comparison, it is still a large number. The transitionary dynamics are fast enough that they do not overturn the welfare results quite substantially.

The rest of the section explores how sensitive our results are to different specifications about the degree of heterogeneity in entrepreneurial skills, the substitutability of capital for labor, and the share of capital. The objective is to analyze how the interactions between capital, labor, and the creation of new establishments affect our results.

5.1. Capital-labor substitution

The benchmark economy has assumed a Cobb-Douglas production function, which is the specification commonly used in the macroeconomic literature. However, a unit elasticity of substitution is larger than what empirical estimates suggest: based on time series evidence for fourteen manufacturing industries, Lucas (1969) found elasticities of substitution that typically range between 0.3 and 0.5. In line with this evidence, we select an elasticity of substitution equal to 0.40 ($\rho = -1.5$) and recalibrate other parameters to match the same observations as the benchmark economy.[20] For sake of comparison we also consider an economy with an unrealistic elasticity of substitution equal to 2.5 ($\rho = 0.60$).[21] The effects in these economies of a firing tax equal to one year of wages are reported under the columns "Low substitution" and "High substitution" in Table 4. To ease comparisons, the columns "No Policy" and "Benchmark Economy" reproduce the corresponding results of Table 3.[22]

We see from Table 4 that the long run effects on allocations are virtually independent of

[20] This requires setting $\gamma = 0.0012$ and $\theta = 0.8288$ to match the observed labor share in national income and the capital-output ratio. All other parameters, including the idiosyncratic shocks process, are left unchanged.

[21] Recalibrating this economy requires setting $\gamma = 0.7426$ and $\theta = 0.0874$.

[22] Note that the laissez-faire equilibria of all these economies are exactly the same, since they were calibrated to identical observations.

the degree of substitution between capital and labor. This is a surprising result: intuition suggests that a high elasticity of substitution could offset the negative effects of firing restrictions by allowing establishments to use capital more intensively in the process of adjusting to their idiosyncratic productivity shocks. In that setting, removing firing restrictions would lead to smaller productivity gains.

Table 4 shows that the variance of capital growth rates is larger in the economy with high elasticity of substitution and that the persistence of capital is smaller. This indicates that establishments indeed use capital more intensively to adjust to changes in their idiosyncratic shocks when the elasticity of substitution is high. However, the efficiency gains of this process are quantitatively small.

To be precise, let $Y(\eta, K, x)$ be the maximum amount of aggregate output that can be obtained (absent firing restrictions) with an aggregate number of workers η, an aggregate stock of capital K, and a vector x describing the measure of establishments across idiosyncratic productivity shocks.[23] Letting $*$-variables denote steady state values corresponding to an equilibrium with firing restrictions, the ratio $Y(\eta^*, K^*, x^*)/Y^*$ describes the initial static gains in output that can be obtained from removing the firing restrictions while leaving the supply of factors of production unchanged. Table 4 shows that in the economy with high elasticity of substitution the static efficiency gain is 2.17 percent, while in the economy with low elasticity of substitution the gain is 2.25 percent. Thus, a high elasticity of substitution does allow the economy to operate closer to its production possibility frontier, but the difference is small.[24]

[23] This function is described by equation $(A.8)$ in the Appendix.

[24] Recalibrating parameter values is important for obtaining this result. In particular, increasing the elasticity of substitution while leaving all other parameters at their benchmark values leads to substantially smaller effects of firing taxes. The reason is that the capital-output ratio becomes four times larger than in the benchmark economy (and the data) while employment becomes four times smaller. In this almost "pure capital" economy, firing taxes generate a static inefficiency of only 0.18 percent. In recalibrating the

While these small static efficiency differences lead to small differences in long run allocations, the short run dynamics of these economies critically depend on the elasticity of substitution. Figures 4 and 5 display the transitionary dynamics of both economies. We observe that when the elasticity of substitution is small, employment does not increase on impact as much. The reason is that with a fixed initial stock of capital (and a low elasticity of substitution), a large increase in employment does not produce a substantial increase in output. This induces a weak employment response which in turn leads to a weak response in aggregate output. Observe that in the economy with low substitution output undershoots its new steady state level, while in the economy with high elasticity of substitution output overshoots it.

With a low elasticity of substitution, capital must increase together with labor in order to attain the efficiency gains of removing the firing restrictions. This requires a sharp increase in investment and a consequent sacrifice in consumption. In fact, Figure 4 shows that consumption stays well below its new steady state level for a long period of time compared to the economy with a high elasticity of substitution. As a counterpart, the stock of capital converges much more rapidly.

In both economies, the creation of new establishments increases by a small amount. The reason is that the benchmark value for the curvature parameter φ generates a sharp degree of heterogeneity in entrepreneurial skills. As a consequence, increasing the number of entrepreneurs cannot substantially increase the creation of new establishments. The next section analyzes the role of this parameter.

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economy we increased the need for labor by increasing the parameter γ. This shifted the burden back into labor, increasing the inefficiency of firing taxes.

5.2. Heterogeneity in entrepreneurial skills

We now consider an economy with low heterogeneity in entrepreneurial skills. In particular, we set the curvature parameter, φ, in equation (2.2) to 0.60, ten times larger than its benchmark value. This leads to a large steady state ratio of entrepreneurs to workers: roughly one entrepreneur for every 10 workers, instead of one entrepreneur for every 100 workers in the benchmark case. Other parameters are recalibrated to match the same observations as the benchmark economy. Table 4 shows the results under the column "Low Heterogeneity".

We see that with the higher value of φ firing taxes decrease the number of establishments by a much larger amount: 1.65 percent versus 0.17 percent in the benchmark case.[25] As a consequence, the effects on consumption, output, capital, and wages are larger, but not by an important amount: these variables decrease by 8.13 percent compared to 7.84 percent in the benchmark case. The reason why the large effect in the number of establishments created does not translate into a large effect in output, is that the returns to scale at the establishments level are close to constant ($\gamma + \theta = 0.83$).

Figure 6 shows the transitionary dynamics corresponding to the economy with low entrepreneurial heterogeneity (high φ). We observe that a big difference with the benchmark case is that the number of establishments created increases quite sharply on impact. However, the initial response of output and labor are almost identical to the benchmark economy. The sharp increase in the number of establishments created does not lead to a noticeable effect in the initial response of output or employment because the initial productivity of the new establishments is quite low. It takes time for these establishments to transit to large productivity levels and affect aggregate output.

From these experiment we conclude that the degree of heterogeneity in entrepreneurial

[25] This larger response in the number of establishments created can be generated with a smaller response in the number of entrepreneurs (2.73 percent, versus 2.77 percent in the benchmark economy) because entrepreneurial skills are more similar than in the benchmark case.

abilities is not important either for the long run or the short run effects of firing taxes.

5.3. An economy without capital

To analyze how important the presence of physical capital is for the results, this section considers an economy without capital, one where the capital share θ is set to zero.[26] Since Hopenhayn and Rogerson (1993) analyzed a similar case, this economy is referred to as H-R hereon.[27] The column "H-R" in Table 4 reports results for this economy.

We see that the long-run effects of firing restrictions are quite similar in the H-R and benchmark economies. A firing tax equal to one year of wages reduces steady state consumption, output and wages by 7.47 percent in the H-R economy, while it decreases them by 7.84 percent in the benchmark economy. The effects on establishment creation are also similar: 0.08 percent in the H-R economy versus 0.17 percent in the benchmark economy. The main difference is with employment: in the H-R economy firing taxes reduce the number of workers by 8.14 percent, while in the benchmark economy the corresponding number is 6.62 percent.

Since consumption in the H-R economy decreases by less than it does in the benchmark economy and employment decreases by more, the welfare cost is smaller: 2.56 percent in the H-R economy versus 3.22 percent in the benchmark case. Considering transitional dynamics leaves the welfare cost unchanged at 2.56 percent in the H-R economy, while decreases it to

[26] Values for the idiosyncratic shocks s were modified so establishments chose exactly the same employment levels as in the benchmark economy. The initial distribution ψ and the transition matrix Q were left unchanged since they gave rise to exactly the same job-creation and job-destruction rates and size distribution as in the benchmark economy. The leisure parameter α was also altered to replicate the labor force participation.

[27] The H-R economy is not exactly the same as Hopenhayn and Rogerson's. In the H-R economy: exit is exogenously determined, the technology to create establishments requires work effort instead of a fixed input of goods, there is technological growth, and the time period is one quarter instead of 5 years

2.82 percent in the benchmark economy.[28]

Observe that when firing restrictions are introduced in the H-R economy, establishments do not have an alternative factor of production that they can use to adjust to their shocks. As a consequence the static gains from removing the firing taxes are larger: 2.32 percent versus 2.23 percent in the benchmark economy. This larger static gain do not produce larger long run effects because of the dramatically different dynamic responses of both economies. As Figure 7 shows, the H-R economy displays no transitionary dynamics at all. Similar to the benchmark economy, the large amount of heterogeneity in entrepreneurial skills creates a substantial adjustment cost in the creation of new establishments. As a result, the creation of establishments does not change significantly when the firing restrictions are removed. Since the number of establishments across idiosyncratic shocks is the only state variable in the H-R economy, this gives rise to the lack of transitionary dynamics. All the adjustment is in a large permanent increase in the supply of labor which increases output far more than the initial 2.32 percent increase in productivity.

The response in the benchmark economy is substantially different. The initial increase in productivity is smaller (only 2.23 percent) but affects not only labor but capital productivity. As a consequence, the economy invests along the transition path to increase the stock of capital. Due both to the higher labor productivity and to the agents' desire to smooth consumption over time (given the higher investment undertaken), agents react on impact

[28] The welfare cost found in the H-R economy is about the same as that found by Hopenhayn and Rogerson (1993), though the effects on consumption and employment are much larger here. The main reason for this is that the H-R economy was calibrated to quarterly job creation and destruction rates, instead of the five years observations selected in Hopenhayn and Rogerson's paper. Davis and Haltiwanger (1990) report that annualized quarterly job-creation and job-destruction figures are much larger that the annual job-creation and job-destruction figures, suggesting that the H-R economy is capturing much larger employment flows than in Hopenhayn and Rogerson's paper. As a consequence, restricting labor mobility leads to larger effects in the H-R economy than in Hopenhayn and Rogerson's paper.

by substituting leisure intertemporally and increasing their supply of labor by a fairly large amount (actually by a larger amount than in the H-R economy, even though the productivity gain is smaller). As the stock of capital increases through time, agents do not need to work as hard and they decrease their labor supply. On the other hand, consumption increases along the transition path due to the increase in output and the decline in the rate of investment. Once capital approaches its new steady state value, the effect on labor is substantially smaller than in the H-R economy, while output and consumption increase by somewhat larger amounts.

6. Conclusions

This paper extends Hopenhayn and Rogerson´s (1993) analysis of firing taxes by introducing a flexible form of capital and considering transitional dynamics. These extensions allow the paper to study the short run consequences of firing taxes and to explore the importance of capital mobility on the effects of firing taxes. The welfare costs of firing taxes could also be recalculated taking into account transitionary dynamics.

The paper obtains five important results. First, considering transitional dynamics reduces the welfare cost of firing taxes, but by a small amount. The transition to the new steady state is fast enough that the welfare consequences of firing taxes are dominated by their long run effects. Second, capital is not important for understanding the long run effects of firing taxes: the long run effects are quite similar in an economy without capital. Third, capital is crucial for understanding the short run effects of firing taxes: it generates transitional dynamics which are absent when capital is not present. Fourth, the way that capital interacts with labor substantially affects the transitionary path. In particular, a lower elasticity of substitution dampens the initial response of labor, output, and consumption, but leads to a much faster rate of convergence. Fifth, capital accumulation substantially amplifies the initial productivity gains of removing the firing restrictions. In fact, the long run effects are somewhat larger in the economy with capital, despite the smaller distortions in the establishments' adjustment process.

The paper abstracts from potential benefits of firing restrictions by assuming perfect insurance markets and frictionless reallocation of workers across establishments. As a consequence, it leaves open the question of whether relaxing these assumptions could substantially decrease the welfare costs of firing restrictions. Alvarez and Veracierto (1998, 1999) analyze this particular issue.

A. Appendix

This Appendix describes the algorithms used to compute equilibria. Steady-states and transitionary dynamics are treated separately.

A.1. Steady state

First, the steady state interest rate is given by

$$1+i=\frac{1+g}{\beta}$$

and therefore, the steady state rental price of capital is

$$r=\frac{1+g}{\beta}-1+\delta.$$

Fixing the wage rate at an arbitrary value w, the value of the different types of establishments (as a function of w) can be obtained by solving the following equation:

$$V\left(e,s;w\right)=\max\left\{\ f(s,k,n)-wn-rk-\tau w\max\left(0,e-n\right)+\beta\int V(n,s';w)Q(s,ds')\right\}.$$

The solution to this problem is computed using standard recursive methods. Note that this solution gives decision rules $n(e,s;w)$ and $k(e,s;w)$ as a function of w.

A steady state is then characterized by a w^*, ν^*, x^*, c^* such that the following conditions are satisfied:

$$w=A'(\nu)\beta\int V\left(0,s;w\right)\psi(ds) \tag{A.1}$$

(A.2) $$c = \frac{w}{\alpha}$$

(A.3) $$c = \int \left[f(s, k(e,s;w), n(e,s;w)) - (g+\delta)k(e,s;w) \right] dx$$

(A.4) $$x(E \times S) = \int_{\{(e,s):\ n(e,s;w) \in E\}} Q(s,S)dx + A(\nu)\psi(S)\varkappa_E(0)$$

where (A.1) is the free entry condition, (A.2) is that the marginal rate of substitution of consumption for leisure be equal to the inverse of the wage rate, (A.3) is that consumption is equal to aggregate output minus investment, and (A.4) is the law of motion for x.

Note from (A.4) that x is proportionate to A. Then, we can fix A at an arbitrary value A^0 and w at some arbitrary value and solve (A.4) for $x^0\left(w, A^0\right)$. Substituting (A.2) in (A.3) we can solve for the scale factor $\varphi\left(w, A^0\right)$ that gives the following equality:

$$\frac{w}{\alpha} = \varphi \int \left[f(s, k(e,s;w), n(e,s;w)) - (g+\delta)k(e,s;w) \right] dx^0$$

Then, $A(w) = \varphi\left(w, A^0\right) A^0$ and $x(w) = \varphi\left(w, A^0\right) x^0$. We can then define the function $\nu(w) = A^{-1}\left[A(w)\right]$,where A^{-1} is the inverse function of A.

A wage rate w^* will constitute a steady state equilibrium if it satisfies:

$$w = A'(\nu(w))\beta \int V\left(0, s; w\right) \psi(ds)$$

Steady state values ν^*, x^*, c^* are then obtained from w^*as follows:

$$c^* = \frac{w^*}{\alpha}, \qquad \nu^* = \nu(w^*), \qquad \text{and } x^* = x(w^*)$$

A.2. Transitionary dynamics

The only transitionary dynamics that this paper analyzes correspond to the economy with no firing taxes. Under no interventions, the welfare theorems hold and the competitive equilibrium allocation is given by the solution to the social planner's problem with equal weights. The state of the economy is described by the aggregate stock of capital K and the aggregate measure over establishment types x (where this measure is now defined over idiosyncratic productivity shocks only). The planner's problem is given by the following Bellman equation:

$$V(K,x) = \max\left\{\log\left[Y(\eta,K,x) - I\right] - \alpha(\eta+\nu) + \beta V(K',x')\right\} \tag{A.5}$$

subject to

$$(1+g)\,K' = (1-\delta)\,K + I \tag{A.6}$$

$$x'(S) = \int Q(s,S)x(ds) + A(\nu)\psi(S) \tag{A.7}$$

where the function $Y(\eta,K,x)$ solves the following static optimization problem:

$$Y(\eta,K,x) = \max \int f[s,k(s),n(s)]x(ds) \tag{A.8}$$

subject to

$$\int k(s)x(ds) \leq K$$

$$\int n(s)x(ds) \leq \eta$$

that is, $Y(\eta,K,x)$ is the aggregate production function of the economy, giving the maximum aggregate output level that can be produced with η workers, K units of capital, and a measure x over establishment types.

Once the number of idiosyncratic shocks are restricted to lie in a finite grid, the state space in (A.5) becomes finite dimensional. The return function is then approximated about the deterministic steady state as a quadratic function. Given that the laws of motion (A.6) and (A.7) are linear, this leaves a linear-quadratic structure. Standard methods can then be used to solve it.

Note that this approximation is possible since all state variables are strictly positive at steady state. This would not be true if exit were endogenously determined.

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TABLE 1

Parameters:

Preferences				
$\beta = 0.994$	$\alpha = 0.95$			
Technology				
$\theta = 0.19$	$\gamma = 0.64$	$\delta = 0.01818$	$\varphi = 0.06$	$g = 0.00388$
Productivity Shocks				
$s_0 = 0.00$	$s_1 = 1.00$	$s_2 = 1.14$	$s_3 = 1.32$	$s_4 = 1.50$
$s_5 = 1.73$	$s_6 = 1.97$	$s_7 = 2.21$	$s_8 = 2.56$	$s_9 = 3.06$
Transition Probabilities Parameters				
$a = 0.062$	$\phi = 0.996$	$\mu = 1.005$	$\sigma = 0.0447$	
Distribution over Initial Productivity Shocks				
$\psi_0 = 9.995\text{e-}1$	$\psi_1 = 2.3\text{e-}4$	$\psi_2 = 6.8\text{e-}5$	$\psi_3 = 1.6\text{e-}4$	$\psi_4 = 0.0$
$\psi_5 = 0.0$	$\psi_6 = 0.0$	$\psi_7 = 0.0$	$\psi_8 = 0.0$	$\psi_9 = 0.0$

Transition Matrix:

1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.087	0.848	0.065	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.005	0.084	0.879	0.032	0.000	0.000	0.000	0.000	0.000	0.000
0.005	0.000	0.086	0.847	0.062	0.000	0.000	0.000	0.000	0.000
0.005	0.000	0.000	0.088	0.877	0.031	0.000	0.000	0.000	0.000
0.005	0.000	0.000	0.000	0.090	0.846	0.059	0.000	0.000	0.000
0.005	0.000	0.000	0.000	0.000	0.092	0.808	0.095	0.000	0.000
0.005	0.000	0.000	0.000	0.000	0.000	0.094	0.873	0.028	0.000
0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.096	0.896	0.004
0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.099	0.896

TABLE 2

U.S. Economy:

Average Size = 61.7		Exit Rate = 36.2%	
JCB = 0.62%		JDD = 0.83%	
JCC = 4.77%		JDC = 4.89%	
Employment	Shares	Employment	Shares
5 - 9	23.15%	250 - 499	3.86%
10 - 19	22.82%	500 - 999	1.68%
20 - 49	24.83%	1000 - 2499	0.73%
50 - 99	12.59%	> 2500	0.28%
100 - 249	10.05%		

Model Economy:

Average Size = 61.72		Exit Rate = 38.5%	
JCB = 0.72%		JDD = 0.72%	
JCC = 4.80%		JDC = 4.80%	
Employment	Shares	Employment	Shares
5 - 9	26.19%	250 - 499	2.25%
10 - 19	31.67%	500 - 999	2.13%
20 - 49	20.21%	1000 - 2499	0.59%
50 - 99	13.01%	> 2500	0.02%
100 - 249	3.92%		

TABLE 3
BENCHMARK ECONOMY

	No Policy	Firing Tax $\tau = 1$	Firing Tax $\tau = 4$
c	100.00	96.90	92.16
Y	100.00	96.90	92.16
K	100.00	96.90	92.16
w	100.00	96.90	92.16
η	100.00	97.21	93.38
v	100.00	99.23	97.23
A(v)	100.00	99.95	99.83
avg(n)	61.72	60.03	57.74
var(ln n)	1.36	1.25	1.46
corr(ln n′, ln n)	0.974	0.988	0.991
var(ln n′ - ln n)	0.072	0.031	0.027
var(ln k)	1.36	1.25	1.37
corr(ln k′, ln k)	0.974	0.986	0.990
var(ln k′ - ln k)	0.072	0.034	0.028
Static Ineff.	0.0%	0.74%	2.23%
S.S. Welfare	0.0%	1.05%	3.22%
Trans. Welfare	0.0%	0.90%	2.82%

TABLE 4
SENSITIVITY ANALYSIS

	No Policy	Bnchmrk. Economy	Low Substitut.	High Substitut.	Low Heterog.	H-R Econ.
c	100.00	92.16	92.07	92.30	91.87	92.53
Y	100.00	92.16	92.14	92.39	91.87	92.53
K	100.00	92.16	92.58	92.85	91.87	n.a.
w	100.00	92.16	92.07	92.30	91.87	92.53
η	100.00	93.38	93.26	93.44	93.39	91.86
v	100.00	97.23	97.35	97.42	97.27	98.71
A(v)	100.00	99.83	99.84	99.84	98.35	99.92
avg(n)	61.72	57.74	57.67	57.76	58.58	54.12
var(ln n)	1.36	1.46	1.45	1.49	1.46	1.30
corr(ln n′, ln n)	0.974	0.991	0.991	0.991	0.991	0.990
var(ln n′ - ln n)	0.072	0.027	0.027	0.027	0.027	0.027
var(ln k)	1.36	1.37	1.41	1.31	1.37	n.a.
corr(ln k′, ln k)	0.974	0.990	0.991	0.986	0.990	n.a.
var(ln k′ - ln k)	0.072	0.028	0.027	0.035	0.028	n.a.
Static Ineff.	0.0%	2.23%	2.25%	2.17%	2.23%	2.32%
S.S. Welfare	0.0%	3.22%	3.22%	3.10%	3.35%	2.56%
Trans. Welfare	0.0%	2.82%	2.84%	2.74%	2.83%	2.56%

Figure 1 -- Employment Decision Rules

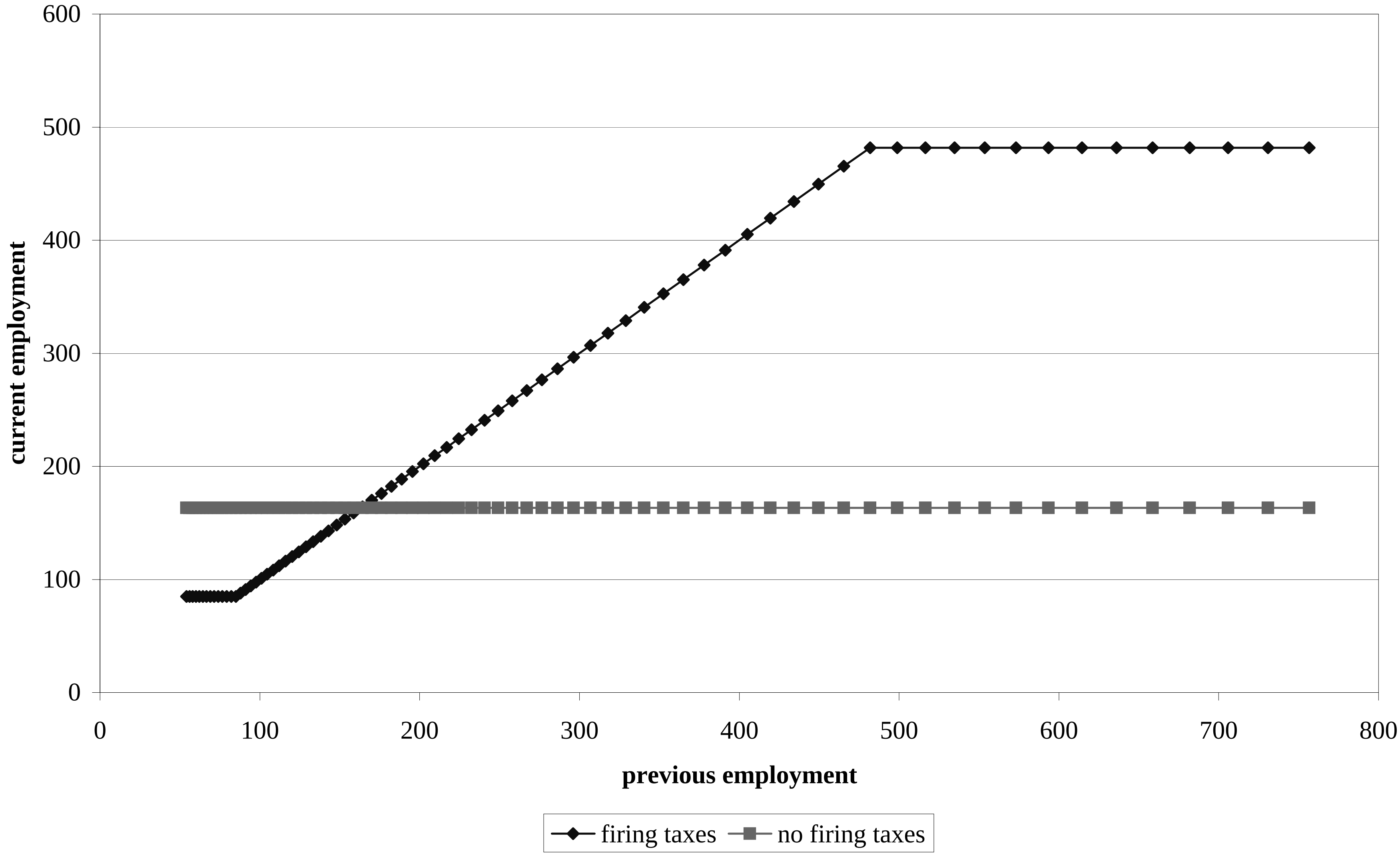

Figure 2 -- Capital-Labor Ratios

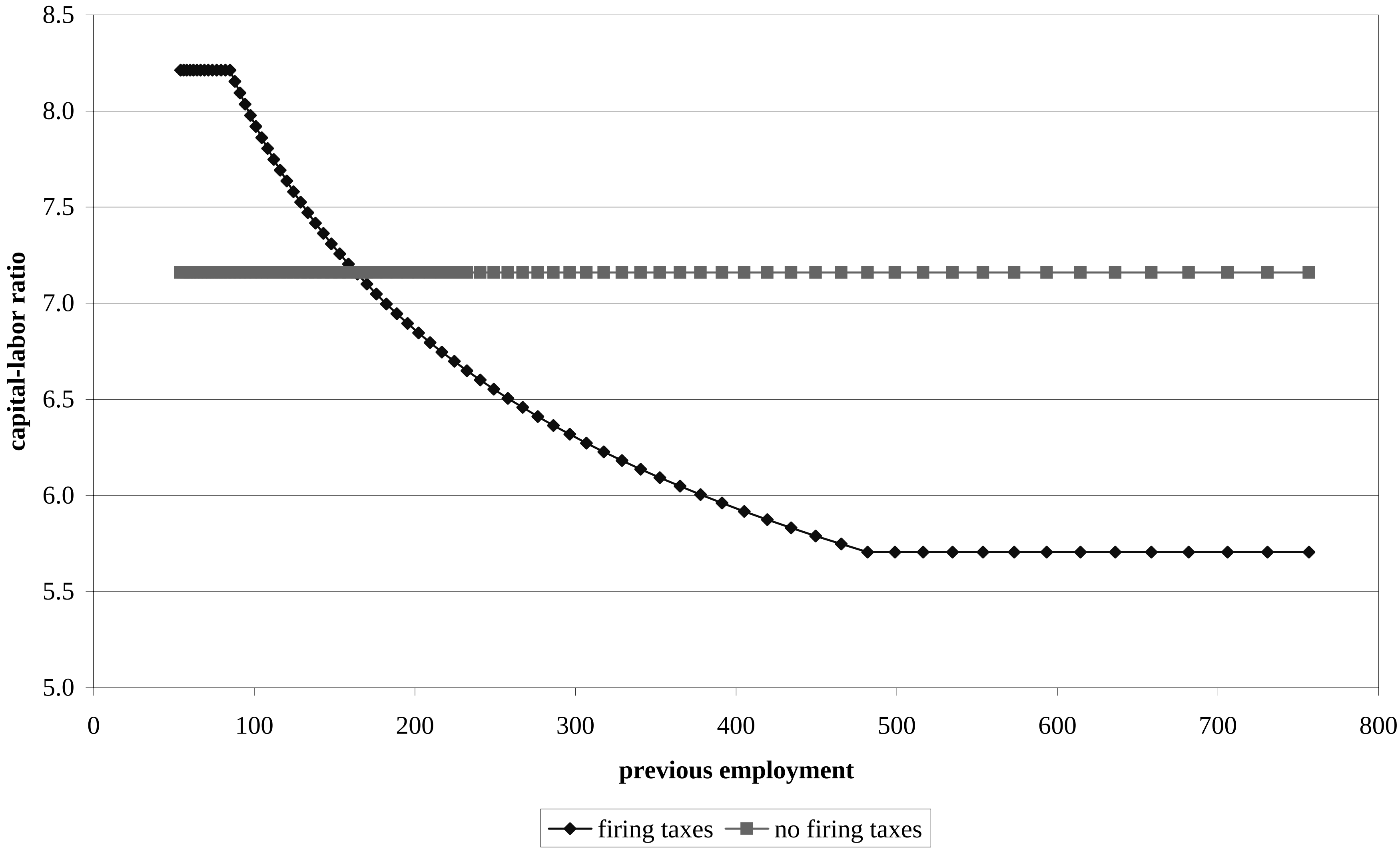

Figure 3 -- Benchmark Economy

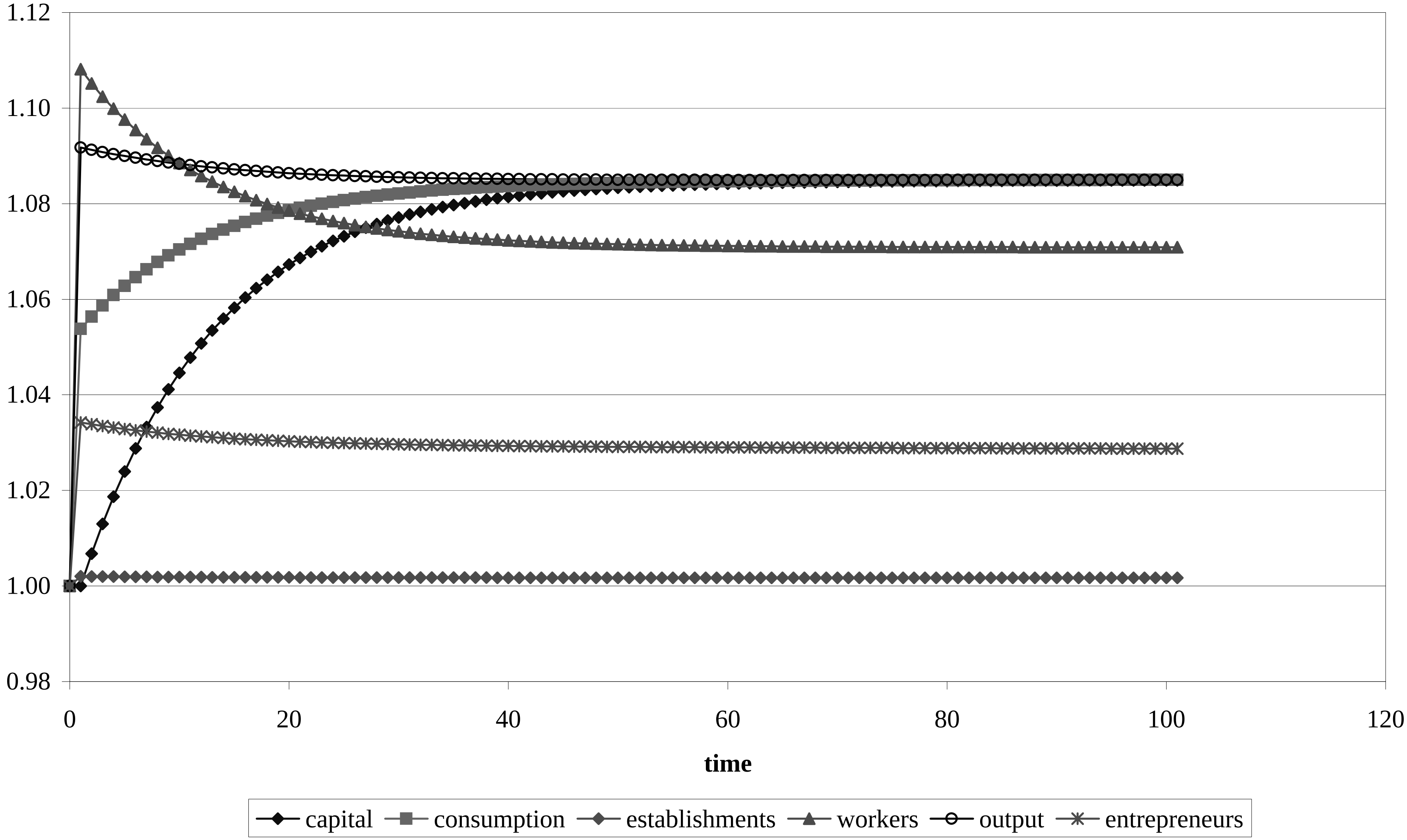

Figure 4 -- Low Elasticity of Substitution

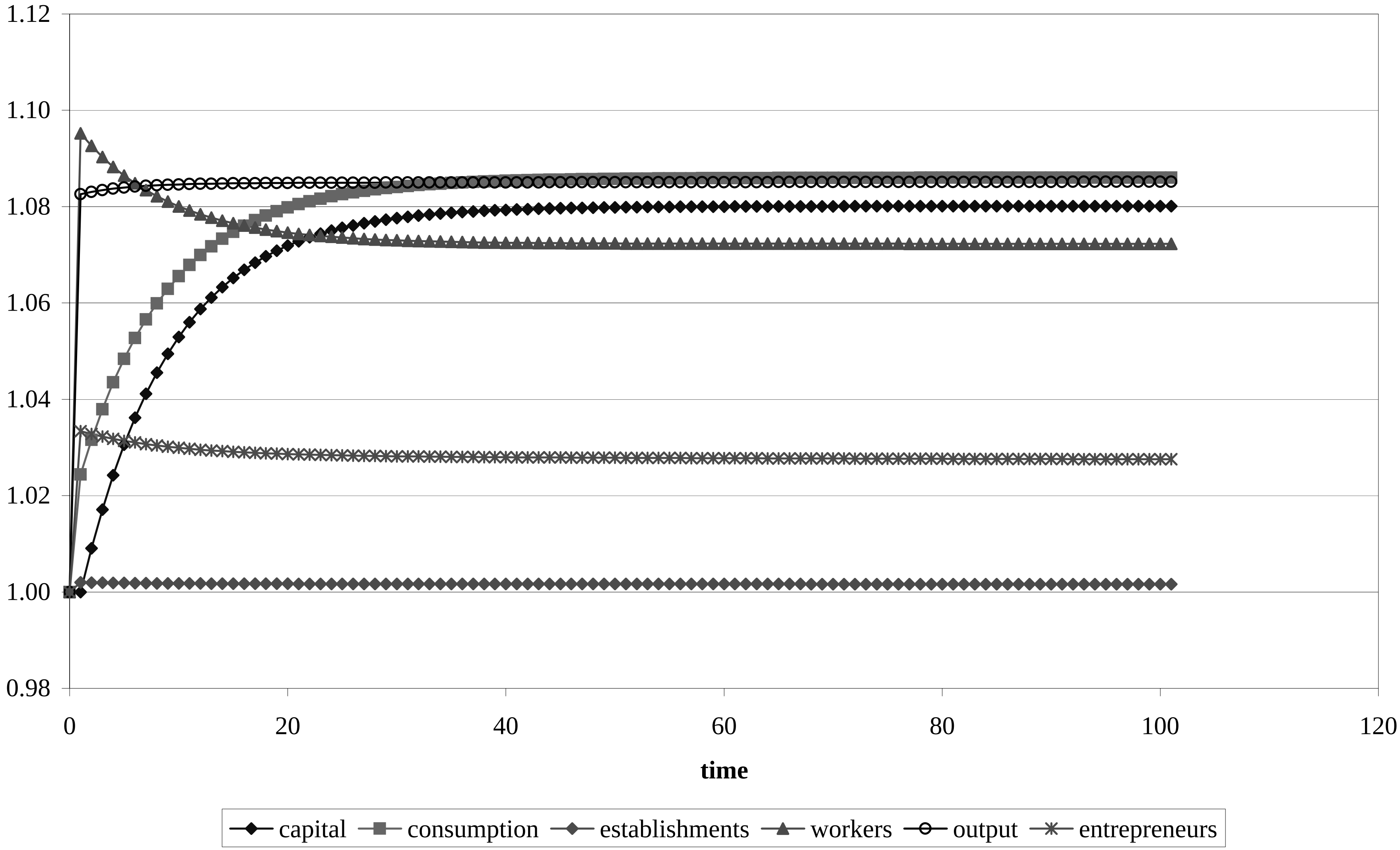

Figure 5 -- High Elasticity of Substitution

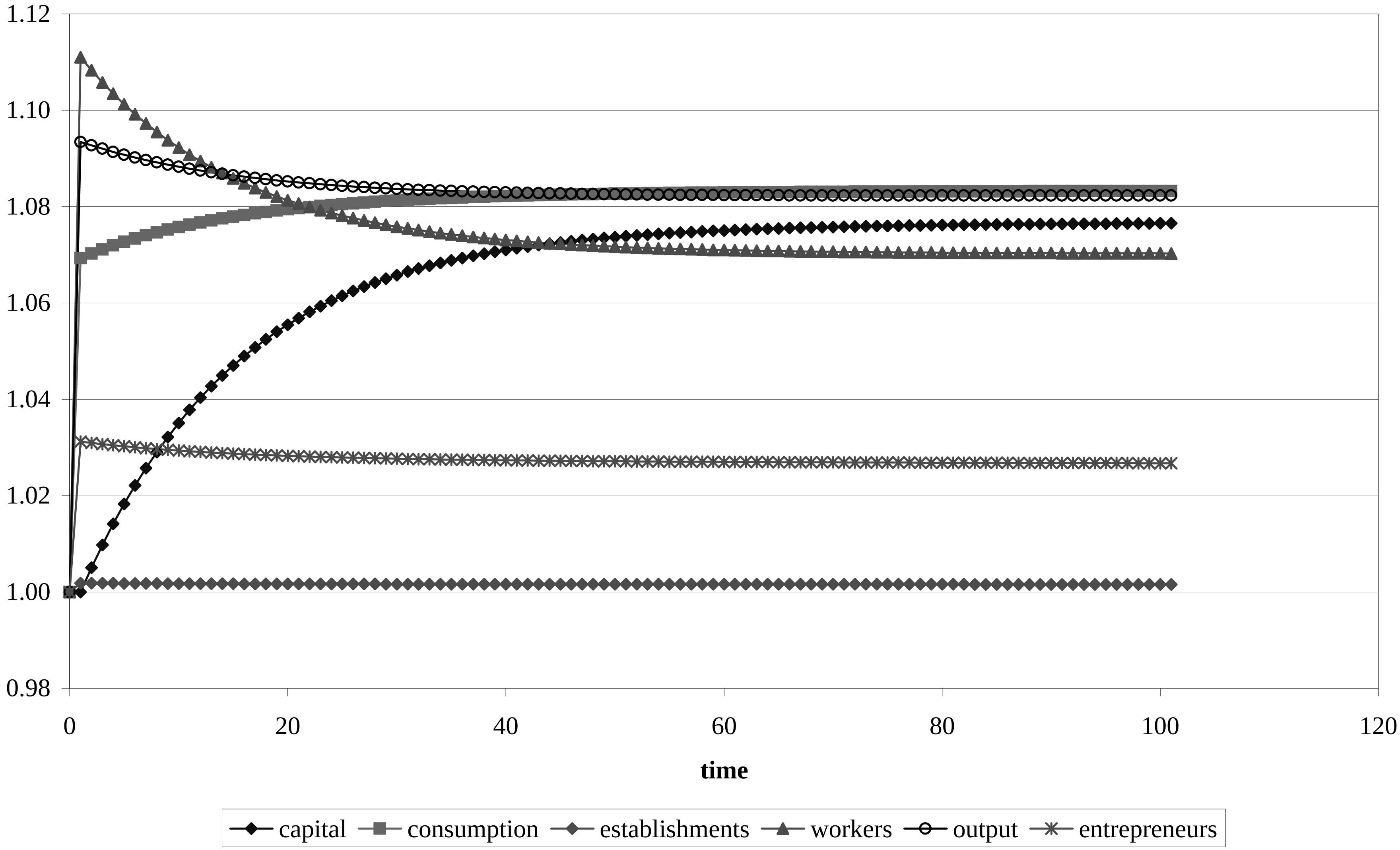

Figure 6 -- Low Heterogeneity in Entrepreneurial Skills

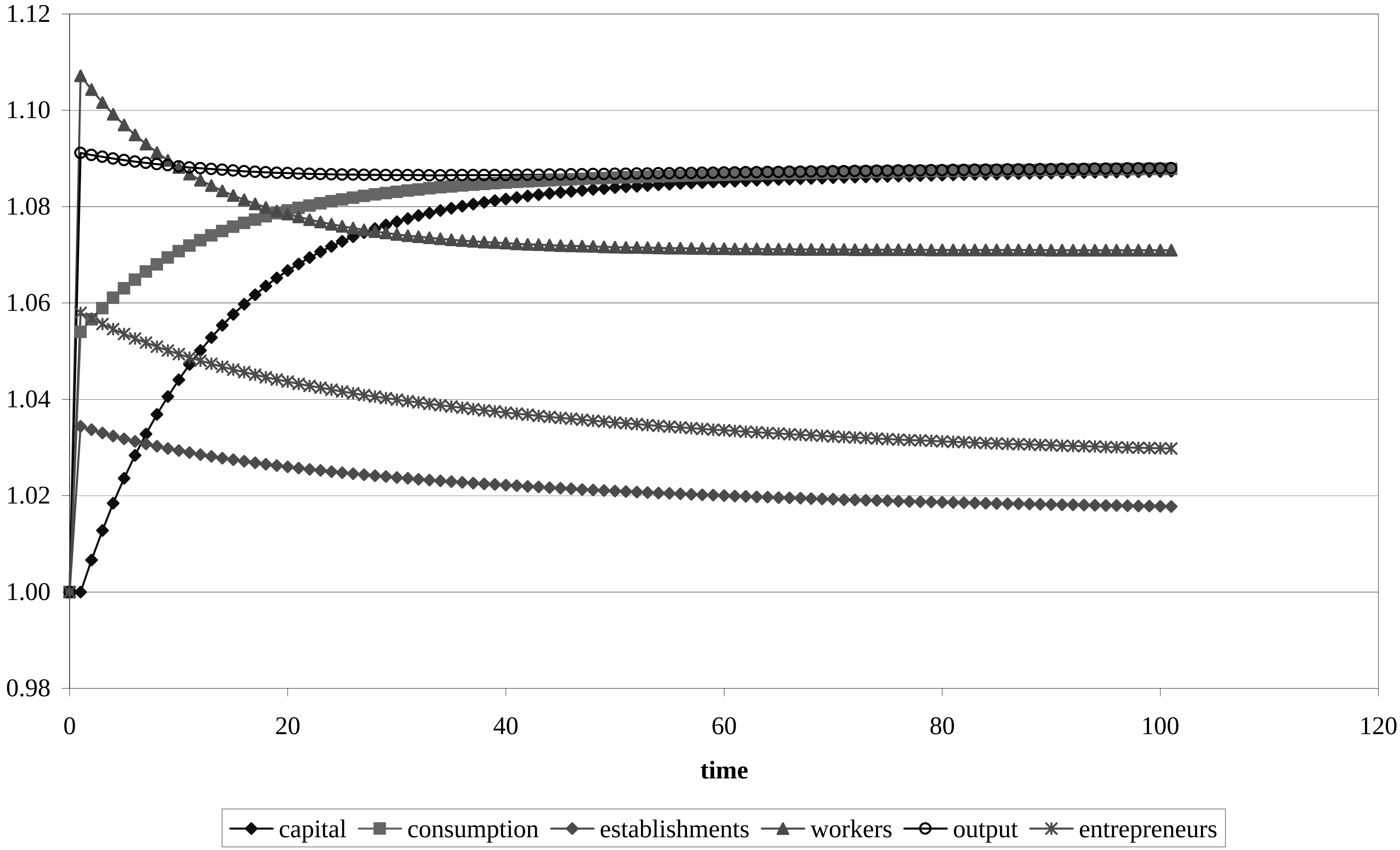

Figure 7 -- H-R Economy