Distortionary Taxation, Debt, and Immigration

Michael Ben-Gad
Department of Economics, University of Haifa, Mt. Carmel, Haifa 31905, Israel.*

Very Preliminary and Incomplete
February 13, 2004

Abstract

In this paper we investigate the behavior of an overlapping dynasties growth model with factor taxation to determine how much the natives of a country absorbing a flow of immigrants can use shifts in factor taxation or deficit finance to redistribute immigrant income to themselves. In an economy in which government expenditure is a fixed share of net national product, policy-makers can minimize the deadweight loss from factor taxation by equalizing the long-run tax rates on capital and work. However when the native population of a country expect immigrants to arrive in the future they can choose to shift some of the tax burden away from their own sources of income and on to the income of future immigrants without explicitly imposing discriminatory taxes. Instead, because natives are capital owners but immigrants are not they may choose to shift the burden of taxation from capital to labor. Alternatively, by temporarily lowering taxes they can shift the burden of present day government consumption to immigrants that have not yet arrived. Our results suggest that because of the steep dead weight loss incurred when factor taxes deviate from equality the scope for redistribution through intratemporal shifts from capital to labor is very small—the optimal tax on capital drops by approximately a percentage point for each percent inflow of immigrants. Much greater benefits are achieved by shifting taxes across time.

JEL Classification: E62, J61, H60, O41.

Key Words: Immigration, Fiscal Policy, Redistribution, Overlapping Dynasties.

*Tel.: +972 4 8249590, Fax.: +972 4 8240059, e-mail: mbengad@econ.haifa.ac.il.
1 Introduction

Immigration to the United States has risen sharply during the past two decades, prompting both public and academic debate about its many implications. In this paper, we extend Ben-Gad (2004) analysis of immigration—built upon Weil's optimal growth model with overlapping dynasties—by including distortionary taxation and public debt.

In this paper we investigate the behavior of an overlapping dynasties growth model with factor taxation to determine how much the natives of a country absorbing a flow of immigrants can use shifts in factor taxation or deficit finance to redistribute immigrant income to themselves. In an economy in which government expenditure is a fixed share of net national product, policy-makers can minimize the deadweight loss from factor taxation by equalizing the long-run tax rates on capital and work. However when the native population of a country expect immigrants to arrive in the future they can choose to shift some of the tax burden away from their own sources of income and on to the income of future immigrants without explicitly imposing discriminatory taxes. Instead, because natives are capital owners but immigrants are not they may choose to shift the burden of taxation from capital to labor. Alternatively, by temporarily lowering taxes they can shift the burden of present day government consumption to immigrants that have not yet arrived. Our results suggest that because of the steep dead weight loss incurred when factor taxes deviate from equality the scope for redistribution through intratemporal shifts from capital to labor is very small—the optimal tax on capital drops by approximately a percentage point for each percent inflow of immigrants. Much greater benefits are achieved by shifting taxes across time.

We make no effort to model the migration decision itself. Because migration from the developing world to the developed world is highly regulated, we treat changes in the rate of immigration as perturbations to an exogenous underlying flow. For the case of the United States, the marginal supply of potential immigrants from impoverished foreign countries is both very large and not very elastic. The number of legal immigrants is regulated by the rationing of visas, and illegal immigration is also controlled, by either the resources invested in its prevention, or by the costs and dangers imposed by the authorities on those attempting to cross the border.

\[\text{1See also Proposition 2 in Ben-Gad (2003).}\]
Figure 1: The Sources of Population Growth in OECD countries, decade averages for 1991-2000.
Consider an economy that is closed in every way but one: new people—adult immigrants—are arriving from abroad at a continuous rate of $m(t)$. These new immigrants are founding members of new infinite lived dynasties, each indexed by a value $s$, the date at which the dynasties’ founding member disembarked from an ocean steamer or crossed an international frontier, to instantaneously join the economy as a worker, consumer, and saver. In the absence of uncertainty, the behavior of each new immigrant and all of his or her descendants can be characterized as the maximization of a dynasties’ infinite horizon discounted utility function beginning at time $s$:

$$\max_{c,h} \int_s^\infty e^{(\rho-n)(s-t)} (\theta \ln c(s,t) + (1-\theta) \ln (1-h(s,t))) \, dt \quad (1)$$

subject to a time $t$ budget constraint:

$$a(s,t) = (1-\tau_h(t)) w(t) h(s,t) + ((1-\tau_k(t)) r(t) - n) a(s,t) - c(s,t) \forall s,t \quad (2)$$

where $c(s,t)$, $h(s,t)$, and $a(s,t)$ are consumption, hours worked and holdings of assets for the members of dynasty $s$ at time $t$, and $w(t)$ and $r(t)$ are wages and returns on capital at time $t$.

Integrating the first order conditions of the individual maximization problem and the time $t$ budget constraint over time, we obtain the consumption rule for dynasty $s$ at time $t$:

$$c(s,t) = \theta (\rho-n) (\omega(t) + a(s,t)) \forall s,t. \quad (3)$$

where $\omega(t) = \int_t^\infty e^{-\int_s^v ((1-\tau_k(v)) r(v) - n) dv} \left[ (1-\tau_h(u)) w(u) \right] du$ is the present discounted value of all potential income from time $t$ forward, for dynasty $s$. The intratemporal equilibrium condition is:

$$h(s,t) = \begin{cases} 
1 - \frac{1-\theta}{\theta (1-\tau_h(t)) w(t)}, & \text{if } c(s,t) < \frac{\theta}{1-\theta} (1-\tau_h(t)) w(t) \\
0, & \text{if } c(s,t) \geq \frac{\theta}{1-\theta} (1-\tau_h(t)) w(t). 
\end{cases} \quad (4)$$

See Galor (1986), Djajic (1989), Borjas (1994), and Zak et. al. (2002) for models with endogenously determined levels of immigration.

We assume complete intergenerational altruism, but otherwise this is most similar to Canova and Ravn’s (2000) framework for analyzing the impact of German reunification. By contrast in Zak et. al. (2002) agents live only two periods and in Storesletten (2000) agents enjoy long but finite-lives.

2 See Galor (1986), Djajic (1989), Borjas (1994), and Zak et. al. (2002) for models with endogenously determined levels of immigration.

3 We assume complete intergenerational altruism, but otherwise this is most similar to Canova and Ravn’s (2000) framework for analyzing the impact of German reunification. By contrast in Zak et. al. (2002) agents live only two periods and in Storesletten (2000) agents enjoy long but finite-lives.
Aggregating (3) over all dynasties and differentiating with respect to $t$, aggregate consumption evolves over time according to:

$$
\dot{c} (t) = \theta (\rho - n) \left[ m (t) \Omega (t) + (1 - \tau_k (t)) r (t) (\Omega (t) + A (t)) + e^{n(t-h)} m (t) M (t) a (t, t) - C (t) / \theta \right]
$$

(5)

where $C (t) = e^{n(t)} \int_0^t M (s) m (s) c (s, t) d s + e^{nt} c (0, t)$, $A (t) = e^{nt} \int_0^t N (s) m (s) a (s, t) d s + e^{nt} a (0, t)$, and $\Omega (t) = e^{nt} \int_0^t N (s) m (s) \omega (s, t) d s + e^{nt} \omega (0, t)$, are aggregate consumption, aggregate assets, and the aggregate present value of future earnings at time $t$, and $M (s) = e^{\int_0^s m (v) d v}$, is the number of dynasties that have accumulated by time $s$. The initial size of the population is normalized to one, and $c (0, t)$, $a (0, t)$, and $\omega (0, t)$, are the time $t$ consumption, asset, and discounted earnings of those dynasties resident in the country at time zero. We write equation (5) in terms of per-capita variables:

$$
\dot{c} (t) = (1 - \tau_k) r (t) c (t) - \rho c (t) - \theta (\rho - n) m (t) a (t)
$$

(6)

where $c (t) = \frac{C (t)}{N (t)}$, $a (t) = \frac{A (t)}{N (t)}$, $\alpha (t) = \frac{a (t) - a (t, t)}{a (t)}$ is the percentage difference between per-capita capital and the capital imported by immigrants, and $\zeta (t) = \frac{\omega (t) - \omega (t, t)}{\omega (t)}$ is the analogous term for labor earnings.

The production function $F : \mathbb{R}^2_+ \rightarrow \mathbb{R}_+$ is homogeneous of degree one in aggregate capital and effective labor—the aggregate supply of hours worked $H (t)$, multiplied by the level of labor augmenting technology $z (t)$. We assume that $z (t)$ is growing at the fixed rate $x$, and rewrite (??) and the per-capita feasibility constraint, in terms of the stationary variables $\tilde{c} (t) = \frac{c (t)}{\tilde{z} (t)}$, $\tilde{k} (t) = \frac{k (t)}{\tilde{z} (t)}$ and $\tilde{w} (t) = \frac{w (t)}{\tilde{z} (t)}$.

$$
\dot{\tilde{c}} (t) = [(1 - \tau_k) r (t) - \rho - x] \tilde{c} (t) - \theta (\rho - n) m (t) \tilde{k} (t) \kappa (t) - \theta (\rho - n) m (t) \tilde{b} (t) \beta (t)
$$

(7)

$$
\dot{\tilde{k}} (t) = (1 - g (t)) \left( F \left( \tilde{k} (t), h (t) \right) - \delta k (t) \right) - \tilde{c} (t) - (x + n + m (t) \kappa (t) \tilde{k} (t)
$$

(8)

$$
\dot{\tilde{b}} (t) = g (t) \left( F \left( \tilde{k} (t), h (t) \right) - \delta k (t) \right) - \tau_h (t) \tilde{w} (t) h (t) - \tau_k r (t) \left( \tilde{b} (t) + \tilde{k} (t) \right) - (n + x + m (t) \beta (t)) \tilde{b} (t)
$$

where $\delta$ is the depreciation rate of capital and factors receive their marginal products:

$$
r (t) = F_K \left( \tilde{k} (t), h (t) \right) - \delta
$$

(9)

$$
\tilde{w} (t) = F_H \left( \tilde{k} (t), h (t) \right).
$$

(10)
We rewrite the interior value of (4) in terms of per-capita, stationary variables:

\[
\tilde{c}(t) = \frac{\theta}{1-\theta} (1 - \tau_h(t)) \tilde{w}(t) (1 - h(t)),
\]

(11)
differentiate with respect to time, substitute (7), (8), and (11) for the values \(\tilde{c}(t), \tilde{k}(t),\) and \(\tilde{c}(t),\) and solve for the evolution of work hours:

\[
\dot{h}(t) = -\frac{1 - \theta}{\theta (1 - \tau_h(t))} \left[ \frac{\tilde{c}(t)}{F_k(\tilde{k}(t), h(t))} - \tilde{c}(t) \right] - \frac{\theta}{1-\theta} (1 - \tau_h(t)) \tilde{w}(t) (1 - h(t)) - (x + n + m(t) \kappa(t)) \tilde{k}(t).
\]

We substitute (11) into (8):

\[
\tilde{k}(t) = (1 - g(t)) \left( F(\tilde{k}(t), h(t)) - \delta \tilde{k}(t) \right) - \frac{\theta}{1-\theta} (1 - \tau_h(t)) \tilde{w}(t) (1 - h(t)) - (x + n + m(t) \beta(t)) \tilde{k}(t).
\]

Finally the government’s budget must remain balanced over the long run:

\[
\tilde{b}(0) = \int_0^\infty \psi(t) \left[ g(t) \left( F(\tilde{k}(t), h(t)) - \delta \tilde{k}(t) \right) - \tilde{T}(t) - (n + x + m(t) \beta(t)) \tilde{b}(t) \right] dt
\]

where \(\psi(t) = e^{\int_0^t \left( (\rho - \delta - \gamma) / c(v) \right) dv}\) (See Judd 1987) and \(\dot{T}(t) = \tau_h(t) \tilde{w}(t) h(t) + \tau h r(t) \left( \tilde{b}(t) + \tilde{k}(t) \right)\)

represents time \(t\) tax revenue. Setting \(\theta = 1\) and \(h(t)\) to a constant \(h,\) the dynamic system (7) and (8) describes the dynamic behavior of the economy when labor is inelastically supplied. We assume the production function takes the constant elasticity of substitution form:

\[
F(K(t), z(t) H(t)) = (\lambda K(t)^\gamma + (1 - \lambda) (z(t) H(t))^\gamma)^{1/\gamma}
\]

The system (???) and (12) describes the behavior of the economy if \(\theta > 0\) and the supply of labor is elastic. In each case the product of \(m(t)\) and \(\kappa(t)\) regulates the impact of immigration on the economy. If \(\kappa(t)=0,\) new immigrants are identical to members of the already resident population, and changes in the rate of immigration have no effect on the economy.

3 Shifting the Tax Burden between Capital and Labor

In a series of papers on optimal factor taxation in optimal growth models published during the 1980’s Kenneth Judd and Christophe Chamley demonstrated that governments can minimize the welfare loss from distortionary taxation if the long run tax on capital income is zero and imposing the entire burden of funding a fixed level of government expenditure on labor income.
If however government expenditure is a fixed portion of the net product, the zero tax on capital income is no longer optimal and governments will optimize by setting the tax rate $\tau_k$ equal to the share of government expenditure $g$.

**Proposition 1:** In an economy without immigration and where government expenditure is a fixed portion of the net product, the welfare optimizing long-run policy is to equalize tax rates.

**Proof:** See appendix.

Proposition 1 is relevant when there is a representative agent whose welfare is maximized. When immigrants are arriving, policies that may minimize distortions may not serve the interests of the population already present and vice-versa. More specifically, the resident population already owns capital while future immigrants will rely solely on labor income. A decision to immediately and permanently shift some of the tax burden away from capital and towards labor will also redistribute some portion of the tax burden away from residents and towards those households that have not yet arrived from abroad. Of course these present-day residents or natives will also rely on labor income and will bear some welfare loss from the distortion any reduction in the capital tax will imply. How much these natives will choose to deviate from the policy in Proposition 1 will depend of course on the rate of immigration they anticipate, how much if any capital the immigrants import with them, and the elasticity of labor supply in the economy.

We start with a baseline economy on a balanced growth path. We set $\rho = .03$, $x = .02$, $\lambda = .65$, and $\nu = -0.1765$ so that the elasticity of substitution between capital and labor is .85. Government expenditure is set to be 35% of net national product and we assume that the government’s budget is always balanced. To consider the welfare effects of different tax schemes we assume that the rates of taxation on capital and income were initially each 35% but have now been changed. After calculating the corresponding impulse responses for each policy change we can then compare the welfare for members of the native dynasty that they derive from the new paths of consumption and hours worked $c(0, t)$, and $h(0, t)$, to that which would have obtained had the policy remained unchanged. The compensating differential $p$, is measured as a permanent percentage increase in consumption (see Ben-Gad (2004)):

$$p = 1 - e^{(n-\rho)\int_0^\infty e^{(n-\rho)t} \left( \theta \ln \frac{c(0, t)}{h(0, t)} + (1-\theta) \ln \frac{1-h(0, t)}{1-h(0, t)} \right) dt}.$$  

(13)
<table>
<thead>
<tr>
<th>Tax Rate on Capital $\tau_k$</th>
<th>Rate of Immigration</th>
</tr>
</thead>
<tbody>
<tr>
<td>$m = 0$</td>
<td>$m = .005$</td>
</tr>
<tr>
<td>.31</td>
<td>-0.00292</td>
</tr>
<tr>
<td>.315</td>
<td>-0.00224</td>
</tr>
<tr>
<td>.32</td>
<td>-0.00164</td>
</tr>
<tr>
<td>.325</td>
<td>-0.00114</td>
</tr>
<tr>
<td>.33</td>
<td>-0.00073</td>
</tr>
<tr>
<td>.335</td>
<td>-0.00041</td>
</tr>
<tr>
<td>.34</td>
<td>-0.00018</td>
</tr>
<tr>
<td>.345</td>
<td>-0.00005</td>
</tr>
<tr>
<td>.35</td>
<td>0</td>
</tr>
<tr>
<td>.355</td>
<td>-0.00005</td>
</tr>
<tr>
<td>.36</td>
<td>-0.00019</td>
</tr>
</tbody>
</table>

Table 1: Compensating differentials for members of native dynasties expressed as percentage increases in permanent consumption, following a change in the tax on capital from 35 percent. The elasticity of intertemporal labor supply is zero and the rate of natural population increase is 6.7 per thousand.

In Tables 1-3 we present the values of $p$ for different parameterizations of the model. The numbers designated with stars correspond to the welfare maximizing tax rates for a given flow of immigration. If labor supply is inelastic the tax rate on capital that maximizes native welfare changes only slightly—approximately one percent lower for each ten per thousand additional immigrants. When labor supply is elastic the decline in the optimal rate is much small. Furthermore the numbers in involved are not very large, even when the rate of immigration is very large. One important caveat: the compensating differential is calculated for all resident households, including capital poor newly arrived immigrants who are unlikely to enjoy the right to participate in elections. Therefore the numbers in Tables ??-?? should be seen as minima.

4 Deficit Spending and Immigration

Incomplete.
<table>
<thead>
<tr>
<th>Capital $\tau_k$</th>
<th>$m = 0$</th>
<th>$m = .005$</th>
<th>$m = .01$</th>
<th>$m = .015$</th>
</tr>
</thead>
<tbody>
<tr>
<td>.31</td>
<td>-0.00338</td>
<td>-0.00304</td>
<td>-0.00261</td>
<td>-0.00207</td>
</tr>
<tr>
<td>.315</td>
<td>-0.00259</td>
<td>-0.0023</td>
<td>-0.00193</td>
<td>-0.00146</td>
</tr>
<tr>
<td>.32</td>
<td>-0.0019</td>
<td>-0.00166</td>
<td>-0.00135</td>
<td>-0.00096</td>
</tr>
<tr>
<td>.325</td>
<td>-0.00132</td>
<td>-0.00113</td>
<td>-0.00087</td>
<td>-0.00055</td>
</tr>
<tr>
<td>.33</td>
<td>-0.00085</td>
<td>-0.0007</td>
<td>-0.00050</td>
<td>-0.00024</td>
</tr>
<tr>
<td>.335</td>
<td>-0.00048</td>
<td>-0.00037</td>
<td>-0.00022</td>
<td>-0.00003</td>
</tr>
<tr>
<td>.34</td>
<td>-0.00021</td>
<td>-0.00014</td>
<td>-0.00004</td>
<td>0.00008</td>
</tr>
<tr>
<td>.345</td>
<td>-0.00005</td>
<td>-0.00002</td>
<td>0.00003*</td>
<td>0.00009*</td>
</tr>
<tr>
<td>.35</td>
<td>0*</td>
<td>0*</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>.355</td>
<td>-0.00005</td>
<td>-0.00009</td>
<td>-0.00013</td>
<td>-0.00019</td>
</tr>
<tr>
<td>.36</td>
<td>-0.00021</td>
<td>-0.00028</td>
<td>-0.00037</td>
<td>-0.00048</td>
</tr>
</tbody>
</table>

Table 2: Compensating differentials for members of native dynasties expressed as percentage increases in permanent consumption, following a change in the tax on capital from 35 percent. The elasticity of intertemporal labor supply is one and the rate of natural population increase is 6.7 per thousand.

5 Conclusion

Incomplete.

6 Appendix

Proof of Proposition 1: Follow Chamley (1986) we define the second best Ramsey problem as a current value Hamiltonian in which the government chooses the after-tax wage $\bar{w} = (1 - \tau_k) \tilde{w}$ and rate of return to capital and government debt $\bar{r} = (1 - \tau_k) r$.

$$H = V(\bar{c}, h) + \xi (\rho - \bar{r}) \bar{c} + \lambda \left( (1 - g) \left( F\left(\tilde{k}, h\right) - \delta \tilde{k} \right) - \bar{c} - (n + x) \tilde{k} \right) + \mu \left( \bar{w} h + \bar{r} \left( \tilde{k} + \tilde{b} \right) - (n + x) \tilde{b} - (1 - g) \left( F\left(\tilde{k}, h\right) - \delta \tilde{k} \right) \right) + \nu (1 - \tau_k) \bar{r}$$

Differentiating with respect to $k$ and $b$. First order conditions are:

$$\lambda (1 - g) [F_k (k, h) - \delta] + \mu (1 - g) [F_k (k, h) - \delta] + \lambda (n + x) - \mu \bar{r} = (\rho - n) \lambda - \dot{\lambda}$$

$$(\bar{r} - n - x) \mu = (\rho - n) \mu - \dot{\mu}$$
Table 3: Compensating differentials for members of native dynasties expressed as percentage increases in permanent consumption, following a change in the tax on capital from 35 percent. The elasticity of intertemporal labor supply is zero and the rate of natural population increase is zero.

\[
\dot{\lambda} = \dot{\mu} = 0 \quad \text{and} \quad \bar{\tau} = \rho + x \quad \text{and} \quad r = F_k(k, h) - \delta. \quad \text{Combining:}
\]

\[
\lambda (1 - g) r + \mu (1 - g) r - \lambda \bar{\tau} - \mu \bar{\tau} = 0
\]

Therefore \(\bar{\tau} = (1 - g) r\). See also Ben-Gad (2003).

References


