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I. Introduction

The relative performance of different state economies has been a matter of much interest to both policymakers and the public in general. In a neoclassical world where factors are free to move across political boundaries, one would not expect to observe the existence of persistent product price or factor income differentials. Such differentials would disappear either through the trading of goods or factor migration. Yet in seeming violation of neoclassical economic theory, apparent persistent differences in factor incomes have been repeatedly observed among states or regions in the U.S.[1] The intent of this paper is to develop and empirically examine a neoclassical model which explicitly incorporates both state and federal fiscal policies in order to explain persistent differences in the levels of market income of the states' economies.[2]

In section II, a simple neoclassical model of an integrated economy is developed. Within this framework, we show that trade in market goods and migration of the mobile factor may result in factor price equalization across states on a before tax basis. Our model differs from others [6; 16] in that the assumption of factor price equalization does not necessarily imply equality in per capita market income across states. This result may be traced to our assumption that each factor has the choice of working in either the market or household sector. Consequently, although *full* incomes may be equated, *market* incomes

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1. For an excellent summary of the earlier studies see Due [11]. The observation of seemingly persistent differences in *nominal* factor income across states, of course, ignores the possibility—pointed out by Coelho and Ghali [10]—that such differences may merely reflect differences in price levels across states. More recent attempts to explain observed price and income differentials across political boundaries have emphasized difference in technologies [3]. The popular press has distinguished between the "sunbelt" and the "snowbelt" in the past and more recently between states along the eastern coast and California versus the interior.

2. Earlier empirical studies [5] failed to find any association between state fiscal policies and relative economic performance. However, these studies failed to examine state expenditure and tax policies *relative* to those of other states. This model misspecification error may lead to biased results and explain the absence of relationship between state fiscal policies and relative economic performance reported by these studies.

need not be. In our model, divergences in *market* incomes across states is attributable, in part to the impact of state government fiscal policies on the supply of services of the immobile factor of production across states.

The model's comparative statics are discussed in section III. It is shown that if prices are equalized across states, a change in relative prices will tend to have the same proportionate effect in all states. Thus, part of the change in economic activity attributable to the relative price change will generate a component common to all states and, to a large extent, this component will be exogenous to individual state governments. However, to the extent that state and local governments can influence the full income and the net-of-tax factor reward of the fixed factor, the utilization rate, and thus, the total services supplied by the fixed factor can be influenced by state spending and tax policies. As a result, output per unit of factor of production may differ across states.

In section IV, data on federal and (contiguous, i.e., continental 48) state spending, transfer payments, and taxes covering the period 1957–77 are employed to examine the influence of relative spending or tax rate policies on individual state economic performance as measured by personal income. The empirical results reported in section III of this paper can be used to make inferences about a number of important issues. With few exceptions, the empirical results suggest that state and local spending policies may have grown too large. Further, the results suggest that state and local taxes have a negative and significant effect on the level of state income. However, the magnitude of estimated coefficients does not necessarily support the hypothesis that a reduction in a state's tax burden will elicit an increase in the state's tax revenues.

II. The Model

The Basic Model is characterized by the following equations:

$$H_{Mi} = H_M\,[(\Omega_{Mi}/N_{Mi}),\ R_M(1-t_{Mi})] \qquad \text{(Mobile Factor Demand for Time)} \quad (1)$$

$$H_{Ii} = H_I\,[(\Omega_{Ii}/N_{Ii}),\ R_I(1-t_{Ii})] \qquad \text{(Immobile Factor Demand for Time)} \quad (2)$$

$$Y_i = F(N_{Mi}S_{Mi},\ N_{Ii}S_{Ii}) \qquad \text{(Aggregate Production Function)} \quad (3)$$

$$\Omega_{Mi} = (N_{Mi}R_{Mi} + \alpha\,[\gamma_f G_f + \Psi_f TR_f] + a_i\,[\gamma_{Si} G_{Si} + \Psi_{Si} TR_{Si} - T_{Si}]) \qquad \text{(Mobile Factor Full Income)} \quad (4)$$

$$\Omega_{Ii} = (N_{Ii}R_{Ii} + (1-\alpha)\,[\gamma_f(-1)G_f + (\Psi_f-1)TR_f] + (1-a_i)\,[(\gamma_{Si-1})G_{Si} + (\Psi_{Si} - 1)TR_{Si}]) \qquad \text{(Immobile Factor Full Income)} \quad (5)$$

where:

Y_i = the ith state production of market goods;
N_{Mi} = the number of units of the mobile factor within the ith state;
N_{Ii} = the number of units of the immobile factor within the ith state;
S_{Mi} = the ith state utilization rate of the mobile factor;
S_{Ni} = the ith state utilization rate of the immobile factor;
H_{Mi} = the amount of time spent on household production by the mobile factors in the ith state;

H_{Ii} = the amount of time spent on household production by the immobile factors in the ith state;
R_M = the before-tax return to the mobile factor;
R_I = the before-tax return to the immobile factors;
t_{Mi} = the tax rate faced by the mobile factor in the ith state;
t_{Ii} = the tax rate faced by the immobile factor in the ith state;
α = the share of federal government services accruing to the mobile factors;
G_f = federal government purchases of goods and services;
γ_f = market value of the services provided by federal government purchases;
TR_f = federal transfer payments;
Ψ_f = the value of transfer payments;
T_f = federal tax revenues;
a_i = the share of state and local services accruing to mobile factors located within the state;
γ_S = the value of services provided by the state and local government;
G_S = state and local government purchases of goods and services;
TR_S = state and local transfer payments;
Ψ_S = the value of state and local transfer payments;
T_S = state and local tax revenues.

In order to abstract from issues of capital accumulation or population growth, the total supply of each factor of production is assumed to be exogenously determined. The absence of capital accumulation suggests that factors of production may be viewed as different types of labor.

The services of the factors of production can be employed either in the production of market goods or in the production of a household commodity. The decision to work to produce market goods and/or the household commodity (Equations (1) and (2)) is based in part on the opportunity cost of the factor's services.[3] In this paper we adopt as the operational measure of the opportunities the full-income concept developed by Becker [4].[4] In addition to the value of the total endowment of services, factors of production will also include in their full-income measure the actions of the federal government.[5]

For the purpose of this paper, we assume that each state produces a single market good using similar technology. The market good production process (Equation (3)) is assumed to be linear, homogeneous, twice differentiable with two indispensable inputs.

In order to capture as wide a spectrum of factor mobility as possible, factors of production are divided into those which are mobile (factor M) and those which are not (factor I).[6]

3. The household commodity is assumed to be produced by the following linear homogenous, twice differentiable production function, $Z = f(H,X)$ where H denotes the amount of household time (i.e., leisure) and X the amount of market goods used in the production process.

4. Since by assumption there is no unemployment of either factor of production (i.e., they are always engaged in either market or nonmarket activity), the market reward to each factor of production represents the appropriate measure to value the factor services—both market and nonmarket.

5. Conventional accounting techniques value government services at factor costs. However, there is no reason why the value of these services should equal their costs, as pointed out by Bailey [2]. Thus, in any analysis of fiscal policy, a provision should be made for this possibility.

6. For simplicity of exposition, factors are classified as either mobile or fixed. In principle, the analysis could also be extended to allow for differing degrees of factor mobility (i.e., adjustment costs). For a two-sector model with adjustment costs, see Mussa [18]. However, if factor prices are equalized irrespective of the degree of factor mobility

With respect to the mobile factor, it is assumed that all forms of barriers, both natural and man-made, among the different states are absent. The mobile factor, therefore, is presumed to incur no cost when moving across state boundaries. Neither factor faces any moving costs within a state. The immobile factor, on the other hand, faces a prohibitive cost if it were to move across state boundaries. Immobile factors of production must therefore be employed within the state where they are located.

For convenience of exposition, it is assumed that neither the mobile nor the fixed factor can move across national boundaries (i.e., both factors are immobile across countries). In addition, Federal taxes and government services are assumed to be distributed between the two factors according to their proportion in the economy. In any state, the full-income measure of the mobile factor can be expressed as in equations (4) and (5).[7]

In the absence of natural barriers to trade (e.g., transportation costs), arbitrage will ensure that the price of market goods will be the same in every state. Furthermore, through migration, the mobile factor equalizes its income across states.[8] The assumption of a common technology across states, combined with the assumption that both the price of market goods and mobile factor income are equated respectively across states ensures that factor returns of the immobile factor will be equalized across states on a before-tax basis as well.[9] However, the *after-tax* factor return and/or income of the *immobile* factor need not be equalized across states. Therefore, within this scenario, state and local fiscal policy can influence the income and after-tax return of the immobile factor across states. Thus, insofar as state and local fiscal policies influence the amount of work of the fixed factor, the relative economic performance of the state will also be affected.

III. State Equilibrium: Comparative Statics

The equalization of factor prices combined with the assumption of a similar linear homogeneous technology implies that the proportion of factor services used in the production of market goods in any state will be the same as that of the rest of the economy. That is:

$$(N_{Mi} S_{Mi} / N_{Ii} S_{Ii}) = (N_{Mj} S_{Mj} / N_{Ij} S_{Ij}) V_{ij} \ldots \tag{6}$$

Thus, the ratio of output produced in a state to that of the U.S. economy will be equal

(e.g., through trade in goods), the degree of factor mobility will have no qualitative effect on the basic premise of this paper that the incidence of state and local fiscal policy will fall the most on the immobile factor. The major effect of the degree of mobility will be on the migration pattern. An issue that we *do not* explicitly focus on in this paper.

7. The mobile factor full-income measure may be expressed as

$$\Omega_{Mi} = \{N_{Mi} R_{Mi} + \alpha] \gamma_f G_f + \Psi_f TR_f - T_f]$$
$$+ a_i [\gamma_{Si} G_{Si} + \Psi_{Si} TR_{Si} - T_{Si}]\}$$

substituting the federal, state and local governments budget constraint yields the full-income measure shown in equation (4).

8. For ease of exposition, we assume that equality of the mobile factor income ($\Omega Mi/NMi$) across states implies the equality of factor rewards RMi. A sufficient condition for this to be the case is that the mobile factor, because of its mobility, is able to avoid the state taxes. However, also because of its mobility, neither is it able to benefit from the state and local services.

9. The general conditions under which trade is sufficient to equalize factor returns are well known in the economic literature [20]. The effects of factor migration on factor price equalization are also well known [17; 21].

to the ratio of the immobile factor services supplied in the state relative to that of total services supplied by the factor in the U.S. economy that is:

$$Yi = (N_{Ii} S_{Ii} / N_{IUS} S_{IUS}) Y_{US} \tag{7}$$

Substituting equations (1), (2), (3), (4), (5), and (6), into equation (7) and differentiating totally, yields:

$$\begin{aligned} E(Yi) = {} & \phi \eta_{I\Omega} (\gamma - 1)\, d(G_{Si}/N_{Ii} - G_S/N_{IUS}) \\ & + (\Psi - 1)\, d(TR_{Si}/N_{Ii} - TR_s/N_{IUS}) - \phi \eta_{BR} [dt_{Ii}/(1-t_I) - dt_{IUS}/(1-t_{IUS})] \\ & + E(Y_{US}) \end{aligned} \tag{8}$$

where E is the change in the log operator, G_S and TR_S denote the sum of all state purchases of goods and services, and transfer payments respectively. N_{IUS} denotes the U.S. endowment of the immobile factor.[10]

A simple interpretation can be provided in equation (8). Within an integrated economy framework, two separate types of equilibria are of interest. The first is state-specific equilibrium, that is, the equation of the demand and supply of goods and services and for factors of production within a given state. This may be achieved through a redistribution of goods and/or the mobile factor of production among states. The second is overall equilibrium, that is the equation of total demand and supply of goods and factors of production within the U.S.

The important point is simply that if prices are equalized across states, a change in relative prices will tend to have the same proportionate effect in all states. Thus, part of the change in economic activity attributable to the relative price change will generate a component common to all states (i.e., the $E(Y_{US})$ term in equation (8) and, to a large extent, this component will be exogenous to individual state governments. However, to the extent that state and local governments can influence the full income and the net-of-tax factor reward of the fixed factor, the utilization rate, and thus, the total services supplied by the fixed factor can be influenced by state spending and tax policies. As a result, output per unit factor of production may differ across states.

The change in state economic activity attributable to the state's economic policies will differ from that of the "average" performance in the other states to the extent that the state's spending and tax rate policies differ from those of the average of the other states. The three terms in the brackets in equation (8) summarize the basic hypotheses of the model. First, if factor prices are equalized across states on a before-tax basis then the coefficient for the percent change in the U.S. real income will be unity. Second, the effect of government purchases and transfer payments on state personal income depends crucially on the private sector's valuation of these services. Third, increases in a state's relative tax burden will reduce that state's personal income level.

The simplicity of the model developed in this paper can be largely attributed to a couple of sets of assumptions. The first one being the assumption that the value of government services are the same across states and the federal government. This assumption allows us to aggregate the government spending variables into the two spending variables (govern-

10. A formal derivation of this equation is available from the authors upon request as Appendix B.

ment purchases and transfer payments). We would like to point out, however, that these potential aggregation problems are not unique to our paper.

The second set of assumptions that play a key role are those leading to the factor price equalization result. Notice that the equalization of factor prices across states could have been achieved in a variety of ways, such as: the number of traded goods equaling the number of factors of production. This suggests that factor price equalization and not migration is more critical in our model.

Recently, Alam [1] has extended the framework developed in this paper to analyze the effects of fiscal policy on the trade balance. In his analysis he investigates the effects of relaxing the factor price equalization assumption and finds that as this assumption is relaxed the basic equation used in the empirical analysis (Equation (8)) does not change qualitatively. However, the coefficient of the percent change in Equation (8) will no longer equal unity. Thus, whether the coefficient for the percent change in national personal income is unity or not may be interpreted as an indirect test of the validity of the factor price equalization assumption.

The factor price equalization result on a before-tax basis suggests that the incidence of the state and local fiscal policy will fall on the factors of production that cannot move across state boundaries. Therefore, our analysis implies that when state and local fiscal policies result in a state experiencing above average performance, the state's fixed factors will earn local rents.

IV. Empirical Evidence: The State's Performance

A stochastic version of equation (8) was estimated for each state with per capita personal income—deflated by the CPI—used to measure state economic activity. Personal income was used due to constraints on the availability of data on other measures of state economic activity. One of the explanatory variables in our model is state real expenditures (i.e., deflated by the CPI). For purposes of estimation, this variable was subdivided into state government purchases and state transfer payments. A third explanatory variable used in our analysis is the differential tax burden among the various states.[11]

Single equations were first estimated for each state. Unfortunately, the single equation estimates are predicated upon the assumption that each state's explanatory variables are predetermined. This may be a reasonable assumption for the U.S. growth rate variable if the state is small relative to the union. It may also be a reasonable assumption for the local government purchases of goods and services variable. However, it is clearly not a reasonable assumption for the state transfer payments and tax rate variables. This becomes apparent when one considers that the automatic stabilizer feature of modern fiscal policy ensures that part of the spending variable is related to the level of economic activity.[12] Thus, by construction, the transfer payment and tax rate variables used in this study will be endogenously

11. The data employed in the tests below come from a variety of sources; a detailed explanation of the sources appears in Appendix A.

12. For these programs the government may be thought of as setting the criteria governing eligibility for transfer payments rather than total expenditures. That is, the government sets the benefit package. In this sense, the eligibility criteria are analogous to a tax rate schedule and total transfer payments to tax revenues. In which case, transfer payments per person as well as the effective marginal tax rates, are endogenously determined [7].

determined and, as a result, the ordinary least squares estimates may suffer from simultaneous equation bias. In order to allow for this, equation (8) was re-estimated using two-stage least squares.

The instrumental variables technique is likely to produce better estimates only if the instruments are reasonably highly correlated with the explanatory variables that they replace and largely uncorrelated with the error term. Since the errors are unobservable the determination of the appropriateness of an instrumental variable can only be made on a priori grounds. The two-stage results are consistent with those of the single equation estimates. This can be interpreted in one of two ways. Either the single equation estimates are consistent or both approaches have the same degree of inconsistency. Furthermore, the structure of the theoretical model advanced above might lead one to expect correlation of the disturbances across equations. Zellner [22] has suggested the use of seemingly unrelated regression analysis to obtain more efficient estimates in such cases. We estimated a variant of equation (8) using the seemingly unrelated regression technique to measure state economic performance relative to its region and economic performance relative to the national economy. As it turns out, the seemingly unrelated results are consistent with the single and simultaneous equation estimates. Thus, in what follows, only the single equation estimates will be discussed.[13] Finally, although controversial, tests of econometric exogeneity are possible [23]. However, due to the sample size limitations imposed by the availability of state and local data variable, we did not perform Granger-Sims "causality" or econometric exogeneity tests.

Table I reports the single equation estimates for each of the states. The empirical results reported in Table I are consistent with the implications of the model developed in this paper. The significance level of the intercept term of each of the estimated equations can be used to draw inferences about two competing views regarding the relationship between factor rewards across states. One view argues that trade in goods and factor migration will equalize the before-tax factor return in all states at all times, (for simplicity in what follows, we will refer to this view as the factor price equalization hypothesis), thus holding state fiscal policy constant; all states will tend to grow at the same rate, in which case, if the model is properly specified, the intercept term will be insignificant.

The other view, which we shall call the adjustment cost hypothesis, argues that although trade in goods and factor migration mitigate regional differences in income, differences in factor returns and income will remain for long periods of time due to some market imperfections, such as movement costs. This view suggests that if all else is constant over time, low-income states will catch up with the national average. In order to do so, these states will experience above-average growth rates. Furthermore, if the model is properly specified, the catching-up effect will be picked up by the constant term. Thus, according to the adjustment costs hypothesis, after accounting for the potential effects of fiscal policy, states with income below the national average should have a positive and significant intercept term, while states with income above the national average should have a negative intercept.

In the majority of estimated equations the intercept term was not found to be statistically significantly different from zero. There are, however, seven states for which the inter-

13. The results for the simultaneous equation estimates are available from the authors upon request as Appendix D. Similarly, the seemingly unrelated results are available as Appendix C.

cept was significantly different from zero. Interestingly, the states with negative intercepts (i.e., a below-average growth rate after controlling for state fiscal policy)—Connecticut, Michigan and Ohio—are located in the snow belt or older industrial area of the country, whereas—Kentucky, North Carolina, Texas and Wyoming—the states with a positive intercept (i.e., above-average growth rate after controlling for the effects of fiscal policy) are southern states. These results lend support to the adjustment costs hypothesis.

An alternative explanation of the significant coefficients may be due to changes in the composition of output of the various states and the existence of industry specific factors of production.[14] It is worthwhile to point out that two of the states with negative intercepts—Michigan and Ohio—have basic industries (automobile and steel respectively), which have been declining during recent years. Similarly, two of the states with high positive intercepts—Wyoming and Texas—have fossil fuel deposits which have significantly increased in value during the last few years. However, these states appear to be the exception rather than the rule. Thus, the results overwhelmingly favor the hypotheses of factor price equalization over the adjustment cost hypothesis.

Upon inspection of Table I, it is apparent that the estimated coefficient for the percent changes in the U.S. real per capita income is not statistically significant in only five states—Delaware, Nevada, North Dakota, South Dakota and Wyoming—the U.S. coefficient is positive and significant in the remaining forty-three states. Three states—Indiana, Michigan, and Ohio—have a coefficient more than two standard errors above unity. And two states—California and Texas—have a coefficient more than two standard errors below unity. Notice that in the case of Michigan, Ohio and Texas the coefficient of the intercept is also statistically significant, and that the states with above unity coefficients tend to have a negative intercept. In the remaining thirty-eight states the coefficient is within two standard errors of unity. Thus, for these states we cannot reject the unit coefficient predicted by the factor price equalization hypothesis.

The pattern of estimated coefficients for the intercept term and the percent change in U.S. real personal income [$E(Y_{US})$] provides additional support for the factor price equalization hypothesis. This is important for several reasons. First, it suggests that the degree of mobility for the most mobile factors of production in a state plays an important role in the incidence of state and local fiscal policy. To the extent that there is perfect mobility for one of the factors of production, the short and long run incidence of state and local fiscal policy will be the same. Alternatively stated, state fiscal policy will have a contemporaneous effect on state real personal income. In contrast, the view that movement costs lead to imperfect factor mobility implicitly assumes a partial adjustment of income over time. Lagged values of fiscal policy will have a significant effect on current levels of expenditures and taxes. To summarize, the estimated coefficients for the intercept and $E(Y_{US})$ terms favor the factor price equalization hypothesis.

Another feature in the empirical results reported in Table I is the insignificance of the states' relative spending and transfer payment variables. Only in six states—Louisiana, New Jersey, New Mexico, Ohio, Oregon, and South Dakota—was the spending variable positive and significant. In no state was the variable both negative and significant. The transfer payment variable was negative and significant in three states—Massachusetts, Mis-

14. This interpretation was suggested to us by a referee.

Table I. State Performance Relative to the National Economy Single Equation Estimates*[a]

$\Delta \ln Y$	Constant	$\Delta \ln Y$	$\Delta[(G_i/POP_i) - (G_{US}/POP_{US})]$	$\Delta[(TR_i/POP_i) - (TR_{US}/POP_{US})]$	$\Delta(t_i - t_{US})$	R^2	F	DW	ρ	SE
1. Alabama	.00825	.969*	.000174	.000623	−4.39*	.699	8.70	1.86	—	.0147
	(.00557)	(.169)	(.000324)	(.000896)	(1.77)		(4,15)			
2. Arizona	.00787	.649*	−.0000389	−.00101	−4.32*	.716	8.83	—	−.272	.0176
	(.00708)	(.193)	(.000295)	(.00156)	(1.05)		(4,14)			
3. Arkansas	.00475	1.08*	.000492	.000578	−6.13*	.672	7.16	—	−.086	.0226
	(.00939)	(.270)	(.000299)	(.00166)	(1.71)		(4,14)			
4. California	.00405	.638*	.000110	.0000298	1.37	.699	8.11	—	−.506	.0122
	(.00366)	(.138)	(.000197)	(.000344)	(.908)		(4,14)			
5. Colorado	.0148	.567*	−.0000772	.00205	−2.34*	.441	2.76	—	.124	.0191
	(.00919)	(.238)	(.000362)	(.00145)	(1.22)		(4,14)			
6. Connecticut	−.0120*	1.11*	.0000557	−.00140	−.463	.692	8.42	1.73	—	.0175
	(.00626)	(.221)	(.000140)	(.00179)	(1.02)		(4,15)			
7. Delaware	.0186	−.222	.000280	−.00212	−3.45*	.475	3.16	—	−.569	.0377
	(.0122)	(.452)	(.000260)	(.00292)	(1.72)		(4,14)			
8. Florida	−.00400	1.14*	−.000353	.0000284	−2.95	.703	8.91	1.88	—	.0203
	(.00922)	(.255)	(.000376)	(.00238)	(2.22)		(4,15)			
9. Georgia	.00240	1.22*	.000341	.000760	−4.79*	.895	29.96	—	−.582	.0116
	(.00380)	(.114)	(.000266)	(.000760)	(1.19)		(4,14)			
10. Idaho	.0123	1.44*	.000844	.00733	−4.79*	.757	10.87	—	−.336	.0310
	(.0118)	(.368)	(.000483)	(.00204)	(.949)		(4,14)			
11. Illinois	.00144	0.816*	−.000239	.000412	−1.31*	.807	14.60	—	−.170	.0119
	(.00466)	(.156)	(.000220)	(.000556)	(.680)		(4,14)			
12. Indiana	−.00341	1.45*	.000466	.00459*	−1.76*	.915	37.50	—	−.525	.0116
	(.00426)	(.139)	(.000277)	(.00108)	(.602)		(4,14)			
13. Iowa	−.00315	1.03*	−.000114	.00139	−6.72*	.798	13.86	—	−.178	.0256
	(.000974)	(.383)	(.000469)	(.00128)	(2.11)		(4,14)			

14. Kansas	−.00331	1.22*	−.0000888	.00141	−2.40*	.785	12.75	—	−.376	.0192
	(.000639)	(.233)	(.000359)	(.000910)	(1.13)		(4,14)			
15. Kentucky	.00971*	.979*	.000169	−.000990	.546	.816	16.6	1.90	—	.0117
	(.00404)	(.127)	(.000163)	(.000821)	(.698)		(4,15)			
16. Louisiana	.00208	.915*	.000466*	−.00105	−1.62	.644	6.79	1.73	—	.0181
	(.00817)	(.199)	(.000245)	(.00142)	(1.08)		(4,15)			
17. Maine	−.00414	1.11*	.000337	.00288*	−2.54*	.801	14.11	—	−.931	.0207
	(.00527)	(.184)	(.000252)	(.00142)	(.974)		(4,14)			
18. Maryland	.00706	.775*	−.000137	.0000169	−1.02*	.611	5.89	2.26	—	.0165
	(.00619)	(.193)	(.000237)	(.00150)	(.581)		(4,15)			
19. Massachusetts	.00477	.891*	.00121	−.000507*	−1.98	.717	8.88	—	.234	.0135
	(.00604)	(.184)	(.000281)	(.000193)	(1.30)		(4,14)			
20. Michigan	−.0174*	1.71*	−.000408	−.000113	−2.22*	.860	22.99	1.75	—	.0182
	(.00652)	(.208)	(.000480)	(.00103)	(1.13)		(4,15)			
21. Minnesota	−.00659	1.39*	−.000384	.00574	−3.22*	.741	10.0	—	−.375	.0205
	(.00698)	(.232)	(.000411)	(.00110)	(1.21)		(4,14)			
22. Mississippi	.0120	1.11*	.000437	.000515	−1.61	.632	6.00	—	−.282	.0204
	(.00905)	(.253)	(.000362)	(.00135)	(1.54)		(4,14)			
23. Missouri	−.00432	.878*	.000769	−.00309*	−4.64*	.604	5.74	1.81	—	.0212
	(.00806)	(.236)	(.000666)	(.00179)	(1.90)		(4,15)			
24. Montana	−.00850	.841*	−.0000653	−.00311*	−5.42*	.884	26.59	—	−.738	.0223
	(.00565)	(.203)	(.000198)	(.00159)	(.762)		(4,14)			
25. Nebraska	−.00654	1.25*	.000166	−.000566	−4.41*	.893	29.08	—	−.585	.0170
	(.00552)	(.178)	(.000300)	(.00129)	(.758)		(4,14)			
26. Nevada	.00116	.548	−.00138	−.00126	−4.32*	.500	3.48	—	−.372	.0315
	(.0170)	(.337)	(.000282)	(.00182)	(1.30)		(4,14)			
27. New Hampshire	.00362	.853*	−.00140	−.000316	−5.16*	.822	17.34	2.18	—	.0176
	(.00664)	(.208)	(.000441)	(.00149)	(1.39)		(4,15)			
28. New Jersey	.00134	.768*	.00363*	.000644	−1.73*	.761	11.92	1.80	—	.0109
	(.00423)	(.130)	(.000213)	(.000740)	(.730)		(4,15)			

Table I. State Performance Relative to the National Economy Single Equation Estimates*[a] (Continued)

$\Delta \ln Y$	Constant	$\Delta \ln Y$	$\Delta[(G_i/POP_i) - (G_{US}/POP_{US})]$	$\Delta[(TR_i/POP_i) - (TR_{US}/POP_{US})]$	$\Delta(t_i - t_{US})$	R^2	F	DW	ρ	SE
29. New Mexico	.0110	.569*	.000543*	−.000545	−2.38*	.635	6.09	—	−.494	.0217
	(.00745)	(.227)	(.000246)	(.00137)	(1.22)		(4,14)			
30. New York	−.00419	.976*	.0000794	.000534	−2.59*	.765	11.43	—	−.274	.0131
	(.00442)	(.164)	(.000129)	(.000442)	(1.09)		(4,14)			
31. North Carolina	.0114*	.874*	−.000167	−.0000160	−4.37*	.805	15.47	1.65	—	.0128
	(.00462)	(.164)	(.000365)	(.00127)	(2.07)		(4,15)			
32. North Dakota	.00920	.290	.000166	−.000790	−8.77*	.944	59.17	—	−.68	.0404
	(.0119)	(.414)	(.000451)	(.00239)	(.799)		(4,14)			
33. Ohio	−.0139*	1.37*	.000411*	.000544	−4.18*	.908	37.40	1.97	—	.0144
	(.00391)	(.130)	(.000233)	(.000815)	(1.53)		(4,15)			
34. Oklahoma	.000914	.920*	.000233	−.000828	−1.75	.572	4.68	—	−.361	.0163
	(.00658)	(.192)	(.000224)	(.000710)	(1.23)		(4,14)			
35. Oregon	.000944	.843*	.000356*	−.000229	−1.78	.642	6.29	—	−.458	.0165
	(.00703)	(.256)	(.000208)	(.00108)	(1.14)		(4,14)			
36. Pennsylvania	−.00570	1.09*	.0000156	.000543	−1.17	.864	23.90	2.01	—	.0097
	(.00426)	(.124)	(.000247)	(.000696)	(.748)		(4,15)			
37. Rhode Island	.00820	.875*	.000223	−.00249	−3.11*	.728	9.38	—	−.559	.0204
	(.00612)	(.205)	(.000240)	(.00180)	(1.69)		(4,14)			
38. South Carolina	.00914	1.01*	.000436	−.00147	−3.04	.635	6.07	—	−.197	.0199
	(.00763)	(.263)	(.000393)	(.00158)	(1.99)		(4,14)			

39. South Dakota	.00309	.577	.00103*	.000256	−7.74*	.929	49.12	2.06	—	.0321
	(.0115)	(.400)	(.000564)	(.00266)	(.644)		(4,15)			
40. Tennessee	.00467	1.11*	−.000139	.00201	−4.54*	.860	22.97	2.02	—	.0116
	(.00456)	(.137)	(.000229)	(.00121)	(1.04)		(4,15)			
41. Texas	.0110*	.625*	.000451	−.00126	−3.90*	.832	17.30	—	.277	.0103
	(.00491)	(.136)	(.000352)	(.000996)	(.786)		(4,14)			
42. Utah	.00584	.629*	.000260	−.00134	−.907	.523	3.84	—	−.335	.0153
	(.00590)	(.181)	(.000328)	(.00239)	(1.33)		(4,14)			
43. Vermont	.00397	.913*	.000372	.00151	−4.54*	.823	17.50	2.19	—	.0281
	(.0100)	(.328)	(.000224)	(.00176)	(.749)		(4,15)			
44. Virginia	.00628	1.10*	.0000290	.000877	−1.94*	.674	7.73	1.91	—	.0155
	(.00644)	(.224)	(.000341)	(.00168)	(1.07)		(4,15)			
45. Washington	−.00203	1.10*	−.000359	.00147	−4.33*	.731	10.18	2.11	—	.0175
	(.00597)	(.195)	(.000230)	(.00115)	(1.61)		(4,15)			
46. West Virginia	.0134	.614*	−.000253	.000733	−3.77*	.459	3.18	1.88	—	.0249
	(.00873)	(.269)	(.000310)	(.00144)	(1.45)		(4,15)			
47. Wisconsin	−.00401	1.19*	−.000249	.0000744	−.907	.838	19.43	1.88	—	.0126
	(.00461)	(.114)	(.000210)	(.000604)	(.641)		(4,15)			
48. Wyoming	.0269*	.354	.000271	.00232	−4.61*	.458	3.16	1.85	—	.0446
	(.0156)	(.521)	(.000202)	(.00271)	(1.38)		(4,15)			

a. Standard errors in parentheses
*Significant at the 5% level

souri and Montana—and positive and significant in only one state—Maine. The insignificance of the estimated coefficients does not support the view that increases in relative spending lead to increases in the state output.

The regression coefficient of the change in relative government expenditures represents the effect that would result from a one-unit increase in such expenditures if the other right-hand-side variables in the regression, including the relative tax rates, were held constant. The insignificance of the coefficient implies either that the public views increases in expenditures as being perfect substitutes for private goods (i.e., $\gamma=1$) or that the demand for time is unresponsive to changes in income.

If the demand for household time is responsive to income at the margin, the empirical estimates suggest that on the margin the value of the government services equals their cost (i.e., $\gamma=1$), and as a result would have no impact. The fact that government expenditures do not appear to have an impact on economic activity does not imply that government expenditures are necessarily wasteful. On the contrary, these results are consistent with "optimal" behavior on the part of the government. Abstracting from the substitution effects that nonneutral taxation may generate, a government policy that maximizes the economy's total wealth (inclusive of government services) is one that makes the value of government services equal to their costs (i.e., $\gamma=1$). Thus, if anything, the evidence suggests that state governments have pursued an optimal spending policy, as defined above. A note of caution is in order however, since, as we mentioned, this optimum neglects the substitution effects generated by tax rates which may reduce the level of income. Once the distortionary effects of *nonneutral* tax rates on the economy are taken into account, it becomes apparent that an "optimal" government spending policy requires that the value of the services provided be sufficiently large to cover the factor costs of the services provided as well as the costs generated by the non-neutral tax rate (i.e., $\gamma>1$). In which case, the reduced form coefficient for the public spending variable will be unambiguously negative. Interpreted in this light, the empirical results suggest that in the case of Louisiana, New Jersey, New Mexico, Ohio, Oregon, and South Dakota and possibly for most of the other states—state expenditures are beyond their optimal level. A similar argument applies to the expenditures on social programs in Indiana and Maine.

The results reported in the previous paragraphs strongly suggest the possibility of homogeneity of coefficients across states, in which case the data could be pooled into a single time series-cross section regression and the effects of the different variables on personal income reported in a more compact manner. However, this hypothesis is rejected by the data. Therefore, a separate equation for each of the states must be estimated.[15]

15. Chow [9] and Fisher [12] have suggested the following F test for homogeneity of coefficients across equations using the sum of square residuals was employed: Because the estimated value of the F statistic, 12.8, exceeds the critical $F(235,768)$ value at the 1% level, one can reject the null hypothesis of homogeneous coefficients across states. Rejection of the homogeneity of coefficients across equations precludes the possibility of pooling the data and reporting the empirical analysis in a more compact manner. An alternative way to present the joint significance of the coefficients of one of the fiscal variables across all 48 equations may be obtained by using the binomial distribution. This, of course, assumes that the coefficients are independent of each other (which in the absence of any prior to the contrary may be a reasonable assumption). The binomial distribution yields the probability density function for a given number of successful outcomes (i.e., significant coefficients), X. Or,

$$\lambda = [n!/(s!(n-s)!)]\ 1-q^{n-s}q^{s}$$

where n is the number of observations (48) and q the probability of a success (5%). The null hypothesis is that the fiscal variable has no effect on economic activity. One would expect to find nq significant coefficients by chance. The mode or

The homogeneity of the intercept, the percent change in U.S. per capita income and state and local expenditure across equations imply that the rejection of the homogeneity of coefficients across equations is due to the variability of the coefficient of the relative tax burden. This differential response of state personal income changes, to changes in the relative tax burden is not totally unexpected since states, in general, use a different mix, or structure of various taxes (i.e., property, sales, income, corporate, etc.). In addition, the level of tax rates and the degree of progressivity may also vary across states. Thus, since the mode of taxation is likely to differ across states, and since the different taxes have different degrees of incidence on the various factors of production, they will have different distortionary effects on the work-leisure choice. As a result, one would not expect to find the coefficient for the tax variable to be equal across states, although the model suggests the tax coefficient to be both negative and significant.

The results reported in Table I indicate that the coefficient of the relative tax burden is positive and insignificant in only one state—California; negative and insignificant in nine states—Connecticut, Florida, Kentucky, Oklahoma, Oregon, Pennsylvania, South Carolina, Utah and Wisconsin; and negative and significant in the remaining thirty-eight states.

It should be noted that the data employed for the tax rate variable are highly aggregated and represent *effective average* (i.e., the states' tax burden) tax rates and, as such, do not account for progressivity in the tax system.[16] Clearly, the use of effective average tax rates as a proxy for state marginal tax rates will result in less precise estimates. Further, given the level of aggregation, one cannot tell which types of taxes are important, merely that a disincentive effect appears to exist.

A natural question that arises in the empirical estimation of equation (8) concerns possible multicollinearity among the state explanatory variables. The state government budget constraint can be viewed as the sum of purchases and transfer payments, or equivalently, taxes, borrowing, and revenue sharing. To the extent that borrowing and revenue sharing differ from zero, then this would tend to reduce the correlation between spending and the effective tax rates. In addition, it must be noted that the explanatory variables are expressed as changes in the deviation from the mean which also tends to reduce any correlation between spending and tax revenues.[17]

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most likely outcome is 2.48 successes with a probability of .215. Upon inspection of Table I it is apparent that the number of successful outcomes for the government purchases, transfer payments, and tax rate variables are 6, 4, and 38, respectively, with a corresponding probability of .220, .127, 2.3×10^{-40}.

Although the assumption of independent outcomes may not be entirely correct, the probability for each outcome implied by the binomial distribution is highly suggestive. The probability of outcomes for the government purchases and transfer payments variables is of the same order of magnitude as that of the null hypothesis while the probability of the tax rate outcome is several orders of magnitude smaller than that expected by the null hypothesis.

16. Under a progressive tax system, an exogenous increase in a state growth rate will increase tax revenues more than proportionately. Therefore, the effective tax rates utilized in this study will unambiguously underestimate the true marginal tax rate. Thus, the degree of progression will induce a positive correlation between tax rates and economic growth thus biasing the estimated coefficient against the hypothesis that tax rates discourage market sector production.

17. We estimated the correlation among the different explanatory variables and found that, in most cases, the correlation between state explanatory variables was less than .25. In some cases, however, the correlation was in excess of .5. There was high correlation between state tax and transfer payment variables for North Carolina, Rhode Island, Virginia, Louisiana, Colorado, and Delaware. There was also high correlation between state government spending and taxes for Oregon, Missouri, California, and Colorado. Finally, there was high correlation between state transfer payments and government expenditures for North Carolina, South Carolina, Tennessee, Utah, Virginia, Washington, Missouri, Colorado, and Nebraska. In most cases, the multicollinearity issue does not present a problem. However, the above variables may be collinear and the equations for those states should be viewed with caution.

The results suggest that increases in local taxes have a contemporaneous effect on state incomes. Before discussing the magnitude of the coefficient, a word of caution is in order: for reasons previously explained the coefficient differs substantially across states. Upon inspection of Table I it is apparent that the range of significant coefficients varies from low values in the neighborhood of one, to high values in the neighborhood of eight, with values between three and four being the most frequent, although the coefficients suggest that the effects of state and local taxes on states may be quite sizable indeed. However, in no states are the coefficients sufficiently large such that a reduction in state tax rates would generate an increase in tax revenues [15].[18]

Our results differ from those of other studies in this area, such as Genetski and Chin [13] and Kadlec and Laffer [15]. Our analysis, which encompasses the time period of the Genetski and Chin study, suggests that the pooling of the data across states (and thus cross-sectional analysis) is inappropriate since one may not reject the hypothesis of homogeneity of coefficients.

V. Conclusions

Data on percent changes in state real personal income, real per capita state spending, and the state tax burden were examined to ascertain the effect of state fiscal policies on relative economic performances. A stochastic version of equation (8) which included a constant term was estimated. The empirical results indicate that the model is quite robust and the results are fairly consistent across the techniques employed. In particular, the constant term was rarely significant. Furthermore, in the majority of the states one could not reject the hypothesis that the coefficient for the percent change in U.S. real per capital personal income was different from unity. These results are contrary to the implications of theories that explain income differentials as temporary phenomena which are eliminated over time as factor prices are equilibriated across regions [6; 19]. The results reported in this paper favor the hypothesis that through trade in goods and factor migration, *before-tax* factor incomes, and *full* incomes are equalized across state lines. This is important, for it implies that the effects of state fiscal policies on state personal income will be contemporaneous.

The empirical results indicate that there may be several states for which the factor price equalization hypothesis may be violated. However, for most of these states the coefficient for $E(Y_{US})$ is significantly different from unity; it tends to be higher than unity for the states with a negative intercept and smaller than unity for the states with positive intercept terms.

The empirical results indicate that, with few exceptions, the government purchases and

18. Assuming that the state tax base is equal to a state personal income, the critical value of the tax burden coefficient must be larger than ten for a tax rate reduction to generate an increase in tax revenues. This can be shown as follows: In 1977, the last year in our sample, total state and local revenue per $1,000 of personal income was $110.5, that is the average tax burden was 11.05%. Thus, holding income constant, a ten percent across the board reduction of state tax rates would lower the state relative tax burden from 11.00% to approximately 10%. Alternatively stated, the 10% reduction in tax rates reduces the tax burden by approximately 1 percentage point. Furthermore, in order to collect the same amount of revenue the tax base has to expand by 10%. Therefore, abstracting from the state's progressive taxation and tax deductions and exceptions and factor migrations, it then follows that the only way the tax base will increase by this much is if the personal income in the state increases by 10%. That is, if the magnitude coefficient of the relative tax burden is larger than 10. The critical value of the coefficient depends on the initial conditions. However, none of the calculations performed suggested that for any of the states a tax rate reduction would result in higher revenue.

transfer payment variables were not statistically significant. One explanation for this result is that states are pursuing "optimal" spending policies. However, where substitution effects are important (and our analysis indicates that the relative tax burden appears to have a consistent negative and significant effect across states,) then a policy of equating γ to unity may indicate excessive spending. Interpreted in this way the empirical results indicate that the optimal amount of public programs should exceed unity in order to cover the program costs and the "excess burden" generated by the taxes levied to finance the program. Therefore, our results suggest that in most states the expenditure and transfer payment programs are larger than their optimal size. Of course, our analysis does not take into account distributional effects which may result in different spending optima.

Although the empirical results lead one to reject the homogeneity of coefficients across states, that does not necessarily imply that the functional form (equation (8)) should differ across states. It should be noted that the empirical analysis presented in this paper is capable of explaining differences in real per capita income across states without specific references to such regional exogenous factors such as climatic conditions and/or mineral wealth.

In thirty-eight of the states examined the relative tax burden was negative and significant. These results suggest that relative tax burdens distort the factors of production, work-leisure choice, as well as, such other factors as location. Alternatively stated, the results indicate that state tax policy influences the states' income level. Furthermore, the results indicate that the relationship is a contemporaneous one. The magnitude of the tax burden coefficient does not necessarily imply that a reduction in tax rates will bring about an increase in tax revenues (i.e. the states' tax revenues appear to be in the upward sloping segment of the Laffer curve as opposed to the downward sloping segment). These results are in marked contrast with other studies that have examined the relationship between tax burden and state personal incomes.

The results presented in this paper also have implications for the success of predatory tax policies. It should be emphasized that there is an effect on the U.S. economy resulting from the average state tax rate. Consequently, if all states engage in predatory or "beggar thy neighbor" tax policies, there may be no *relative* gain, but there would be an *absolute* gain due to the reduced average marginal tax rates.

Although our results indicate support for the integrated economy approach, regional differences still exist. The empirical analysis of this paper suggests the conclusion that individual state fiscal policies can and do influence relative state real per capita income levels. In contrast, federal fiscal policy mainly influences absolute or national economic performance.[19] As a result, the empirical analysis suggests that both state and federal fiscal policies matter in the determination of the overall economic performance of a state or region.

Appendix A. Data Sources

The data used in this study came from a variety of sources reporting on aggregate U.S. annual time series from 1957 to 1977. Data for federal government purchases of goods and services, federal transfer payments, federal tax revenues, and personal income at constant prices are taken directly from the *National Income Accounts*. Population figures were obtained from the *U.S. Department of*

19. For a discussion of the impact of recent Federal tax policies on the U.S. economy and tax revenues, see Canto, Joines and Webb [8].

Commerce Bureau of Census Current Population Reports. Tax revenues and state expenditures and transfer payments were obtained from *U.S. Department of Commerce States' Government Finances.* Finally, the states' personal income figures were taken directly from *U.S. Department of Commerce Bureau of Economic Analysis.*

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