Discount Rate Selection and Efficiency in Allocating a Nonrenewable Resource

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I. INTRODUCTION

The discount rate is critically important for determining the efficient allocation of a nonrenewable resource. Recognition of this importance has lead in past to much work on the size of the social discount rate (SDR) and the distortion to the depletion path caused by using a discount rate higher than the SDR, the presumption being that private markets utilize discount rates exceeding the SDR. However, little effort has been devoted to measuring the efficiency losses induced by using a discount rate different from the SDR. The question of the size of the losses arises implicitly whenever a nonrenewable resource model is solved because the SDR can never be known with certainty and an estimated social rate must always be used in applied work.

This question has been addressed recently by ROWSE (1990a, 1990b). ROWSE (1990a) employs what is arguably the simplest possible continuous-time model for measuring the losses: a highly aggregated model of the world oil market featuring a single stationary linear willingness-to-pay function, an exogenously specified resource stock, and constant marginal costs of production. By contrast, ROWSE (1990b) utilizes a discrete-time model of natural gas allocation for the Canadian province of British Columbia exhibiting a much lower level of aggregation and incorporating several important complexities. Each study has similar findings: defining social welfare conventionally as the sum of consumer surplus and producer surplus, the percentage welfare losses are small when the wrong discount rate is used, even when the improper rate diverges widely from the SDR. Other performance measures also vary much more from their optimal values than social welfare as the improper rate diverges from the SDR.

The question is addressed again in this paper, but with a multiperiod, multiregional, multitechnology optimization model for allocating Canadian natural gas to domestic and export markets. This model has many elements of the most complex nonrenewable resource model that might be used to address the question. Moreover, the scenarios

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implemented are taken from ENERGY MODELING FORUM (1988, 1989a, 1989b) — henceforth EMF 9 — and have had considerable public exposure. Previewing the results, the major findings strongly complement those found earlier and support the argument that they reflect a general tendency of partial equilibrium nonrenewable resource models. This tendency has important theoretical and practical implications.

This paper is organized as follows. The computational model is described in the next section and its similarities to and differences from that of ROWSE (1990b) are highlighted. Salient empirical results are then presented and interpreted. The generality and implications of the findings are subsequently considered, then concluding remarks are offered in the final section.

II. THE MODEL

The theoretical structure of the model follows closely the formulation of perfect foresight surplus maximizing models utilized widely in the natural resource economics literature; see HARTWICK and OLEWILER (1986) for an overview. In such partial equilibrium models economic agents are assumed to possess perfect knowledge of the future and collectively to maximize the present value sum of consumer plus producer surplus. In each period (or instant of time) this sum is computed as the area under the willingness-to-pay curve less the area under the (inverse) supply curve. Frequently it is postulated that there exists a price for which demand shrinks to zero, reflecting demand shifting completely to an alternate source of supply. Such a price is referred to as a choke price, and places a ceiling on how high the resource price can rise. In most such theoretical models the principal constraint is that aggregate consumption must not exceed the known stock. Special assumptions may be made about the nature of the cost function for extraction, and how this function is affected by cumulative extraction. Endogenous to the allocation problem are the efficient prices, efficient allocations and the date of exhaustion of the stock if depletion occurs, or the date of shifting away from utilizing the resource if rising marginal production cost chokes off consumption of the resource instead of physical exhaustion of the stock. Variants of such models have been used since their first introduction by HOTELLING (1931) and subsequent important theoretical extensions by HEAL (1976) and LEVHARI and LIVIATAN (1977).

In this paper analysis is performed using a nonlinear programming model of domestic and export allocation of Canadian natural gas which captures all of these elements and many more. The model has a long time frame (1986-2060), represented by twenty-five 3-year periods, which ensures endogenous transition to backstop supplies of gas.

Exhibiting perfect foresight, the model determines equilibrium Canadian consumption levels, Canadian supplies and exports to the US by solving for equilibrium gas prices. Space limitations preclude explicit representation of the model here and thus it is described instead. It is a multiperiod, multiregion nonlinear programming model with multiple supply technologies. An earlier version of the model is detailed in ROWSE

(1986a) and a slightly modified version is utilized in ROWSE (1987b) to examine the social desirability of Canadian gas exports to the US. An updated version of the model is used in ROWSE (1988b) for participating in EMF 9 and this version is used here.

Figure 1 provides many details of the natural gas network represented in the model. All three producing provinces of Western Canada have existing and prospective conventional supplies of gas, while nonconventional or Deep Basin supplies are confined to Alberta. The latter are assumed available only by the mid-1990's at the earliest because they have not previously been produced commercially. Prospective supplies are also assumed available from the Mackenzie Delta/Beaufort Sea — henceforth simply Delta — area of the far north, but no sooner than the mid-1990's due to the lead time necessary for pipeline construction. Delta gas is depicted as an Alberta supply alternative because, if developed, it will be pipelined south to connect with the transportation infrastructure in Alberta. Although most conventional gas in Alberta is cheaper than gas from these alternatives, it can only be introduced gradually over time owing to constraints on gas finding rates and expansion of the domestic drilling rig fleet. Backstop gas is a residual category of gas, assumed available in Alberta in unlimited amounts for $8.00 per gigajoule (GJ) in 1986 Canadian dollars[1]. The nature of this gas is not specified; it may be high cost nonconventional gas, gasified coal, gas from the Arctic Islands or some combination of these sources.

The other sources of gas indicated in Figure 1 are suppressed for EMF 9, namely gas from the West Coast offshore, the Arctic and East Coast offshore. The first and second of these are implicitly represented in the backstop gas category, while the third is eliminated because of much uncertainty attaching to its development.

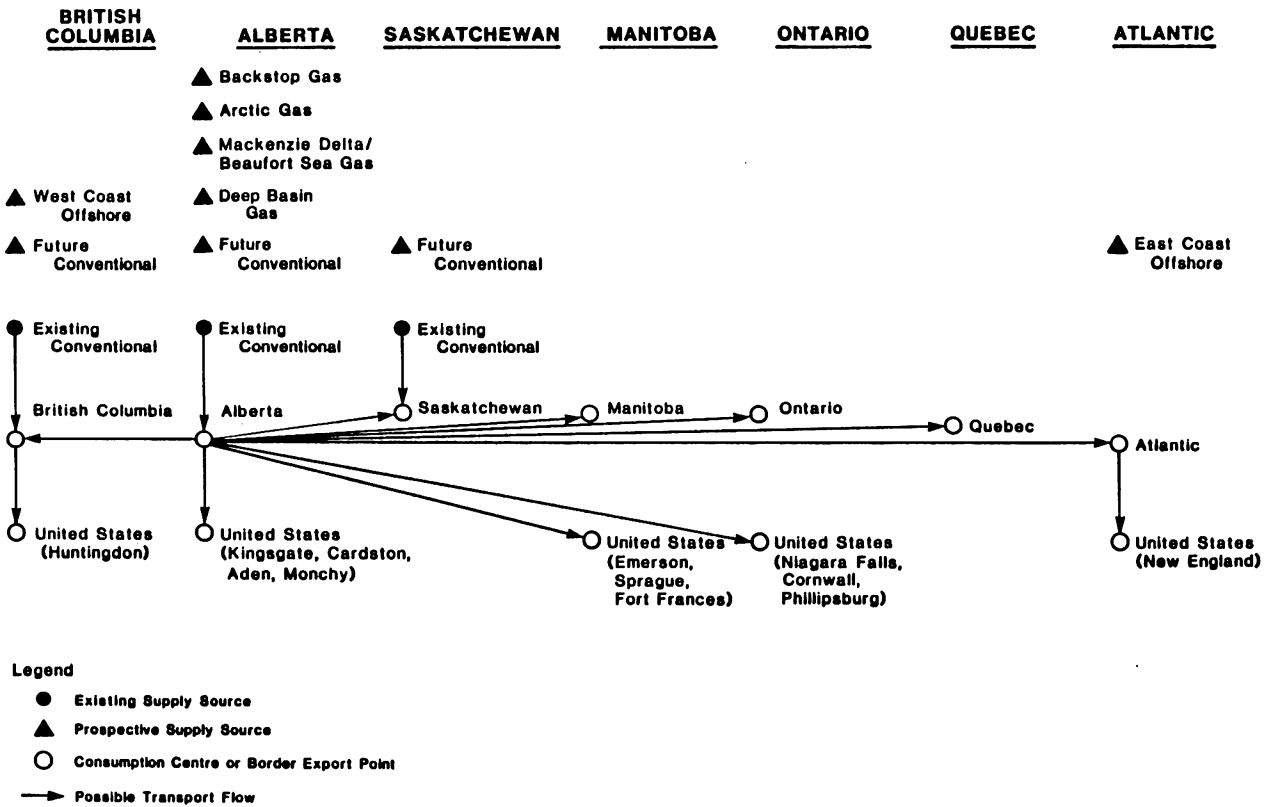
For conventional gas the model distinguishes between existing and prospective supply sources because, by assumption, new capital expenditures must be incurred to provide supplies from the latter but not the former. Furthermore, a credit of $0.30/GJ is provided for all conventional gas to account for the value of natural gas liquids extracted in gas processing plants. Rising costs of conventional supply due to resource base degradation are represented by insisting that unit supply costs rise by 1.33 cents/GJ per petajoule of cumulative production, both for existing and prospective supplies. A maximum of 75 exajoules (EJ) of new reserves of conventional gas is assumed producible from Western Canada beyond end-1985 established reserves.

Natural gas production from a reservoir takes place over time; it cannot occur all at once. New conventional gas is assumed producible only according to a thirty-year production profile exhibiting constant production for eight years followed by 22 years of decline at 8.22% annually. ROWSE (1986a, p. 421) graphs this production profile. By contrast, shut in gas from existing gas reservoirs (gas not produced from a reservoir which could be produced) is assumed producible at an annual rate of 20% of remaining reserves.

1. Natural gas is measured in metric heat units. These units have the following approximations to standard volumetric units: 1 gigajoule (GJ) ≈ 1 thousand cubic feet (MCF); 1 petajoule (PJ) ≈ 1 billion cubic feet (BCF); and 1 exajoule (EJ) ≈ 1 trillion cubic feet (TCF).

FIGURE 1

Natural Gas Network



A different thirty-year recovery profile, featuring production which declines slowly after the first period, is represented for nonconventional gas. A flat production profile is assumed for Delta gas, based upon maximum pipeline deliverability. A conservative 8 EJ is assumed available from this region.

Exogenous bounds are imposed on how rapidly new conventional gas can be found and produced through 2005, with none beyond. Such bounds prevent unrealistically rapid gas finding rates and doubtful expansions of the Canadian drilling rig fleet. They also embody inertia that is characteristically observed in response to gas price increases. Bounds are absent beyond 2005 to allow economic factors alone to dictate future conventional gas supplies. These constraints may obviously bear strongly on model outcomes. In the numerical results presented below, sometimes these bounds are constraining but at other times they are not. Whether they bind depends on the strength of demands for Canadian gas, the discount rate employed, and the scenario examined.

Transport costs for gas are based on full pipeline tariffs. Full transport costs within Canada can be large; for example, a unit of backstop gas costing $8.00/GJ in Alberta and delivered to Toronto costs $10.14/GJ taking account of the Alberta supply cost, shipping costs and gas used in pipeline compressors to move gas through the Trans Canada Pipe Line system. Finally, taxes and royalties are excluded. Although of great importance to private producers for stimulating or inhibiting supplies, these elements are eliminated to focus on the socially desirable allocation of gas.

The model has six Canadian demand regions, with the Atlantic region suppressed for EMF 9. In each period each region has a single demand function representing demands of all classes of consumers. Each demand function consists of a fixed demand, which shrinks exogenously with the passage of time as the gas- using capital stock is retired, and a price-responsive component, which exhibits constant (unit) price elasticity of demand. The latter portion of the demand function becomes increasingly important with economic growth. Further details of this demand adjustment mechanism are provided in ROWSE (1990b). Each domestic demand function is anchored at a reference price-quantity combination, each of which is based upon EMF 9 scenario results provided by EMR/NEB, where NEB is an abbreviation for the National Energy Board of Canada. For measuring the social welfare of gas consumption a choke price is needed for each demand function and this choke price is the delivered price of backstop gas in each region.

For EMF 9 the pipeline links to US export markets are altered from Figure 1. To attain compatability with the AGAS model of the Alberta Research Council, only three US regions are modelled: CA, representing the Pacific Northwest and California; and WN and EN, representing West North Central and East North Central, respectively. The link between British Columbia/Alberta and CA is modelled via Huntingdon-Kingsgate, the link to WN is via Monchy and the link to EN is via Emerson. The other two links of Figure 1 are suppressed. To capture in primitive form the existing gas pipeline network in the US, the model also includes a link between WN and EN. No links are included between CA and the other two US regions. In addition, upper bounds are imposed on gas flows over all links.

The potential of US gas markets to absorb Canadian gas is represented in each period by a set of linear import demand functions based on regional market equilibrium prices and quantities found by AGAS. Each import demand function is the difference between US demands and supplies. In collaboration with another EMF 9 analyst, it is assumed that in each US region modelled and in each period the linear import demand function is specified by the AGAS equilibrium price-quantity combination and a price elasticity of 2.0 at that combination on the demand function. This representation permits export prices to rise sufficiently to choke off all gas exports to the US.

This national model has several similarities to the one used by ROWSE (1990b) for the single Canadian province of British Columbia — henceforth the BC model. The BC model has only one supply region, whereas this model has three regions, each with different existing conventional reserves and prospective conventional reserves. Each region, moreover, allows shutting in existing reserves to help tailor supplies to domestic and export gas demands. Both models allow for backstop production, but this model also allows for developing nonconventional gas in Alberta and gas from the Delta. Except for the backstop source, all prospective supply sources have supply costs which depend upon the discount rate because their capital costs precede natural gas production. In the BC model only the costs of the single future conventional supply source depend upon the discount rate. The backstop cost does not depend on the discount rate because it is assumed to be determined by competitive international energy markets, not by a discount rate employed by Canada.

This model also has six Canadian demand regions whereas the BC model only has one. These six regions have demand functions benchmarked at different price- quantity combinations, and all differ from those used in the BC model. Transportation costs also play a significant roie in gas allocation in the national model, whereas the role of transport costs in the BC model is minimal. With regard to gas export markets, this model has pipeline links to three US regions, each of which has demands which vary linearly with price, bounds on gas deliveries through each of these links, and a single bounded link between two of the US regions. The BC model has a highly simplified representation of its single US export market: for each period there is an exogenously specified price and ceiling on BC gas deliveries to the US. Hence the ability of US demands to bid up Canadian gas prices and divert gas from Canadian markets is largely absent from the BC model.

Consequently, all of the complexities and significant economic influences which are captured in the BC model when the discount rate changes are captured in this national model[2]. But the larger number of Canadian supply regions, demand regions, supply technologies and the roles played by several US gas export markets and transport costs mean that far more complications are captured in the national model. Indeed the range of

2. The principal influences captured in the BC model are detailed in ROWSE (1990b) prior to discussion of his computational results.

phenomena represented in this model approximates that of the most complex models of gas allocation used in EMF 9. The contrast with the model utilized by ROWSE (1990a) to first investigate the question of efficiency losses when the wrong discount rate is used is thus enormous.

III. COMPUTATIONAL RESULTS

3.1 The Control Case

EMF 9 provides many of the underlying assumptions used by each modeller for all cases examined. Two of the more important assumptions are a 10% real discount rate and an exchange rate of Cdn $1.00 = US $0.75. In addition, the model used here requires certain benchmarking inputs from the EMR/NEB and AGAS scenario results. For the control case, Canadian demand functions are anchored at reference price-quantity combinations taken from the EMR/NEB submission for this case. Foreseen demand growth is moderate in all Canadian regions and prices rise relatively smoothly over time. From the AGAS model, the export potential of US gas markets is considerable, with the CA market predominating.

Brief discussion of the results for the control case appears in ROWSE (1988b, pp. 410-411) and is not repeated here. For this work the control case is solved for six different discount rates using the nonlinear optimizer of MURTAGH and SAUNDERS (1983). The first and smallest rate is 3%. The second, 5%, is the pre-1985 NEB lower bound estimate of the SDR used for sensitivity analysis in cost-beneift studies of energy exports. This rate has also been used by ROWSE (1986a), DANIEL and GOLDBERG (1981) and others for nonrenewable resource allocation, and is just below the current NEB lower bound estimate of 6% for the SDR. The third, 8%, is the current NEB estimate of the SDR, and the fourth, 10%, is the current NEB upper bound estimate of the SDR and also the old NEB estimate of the SDR. It has also been widely used in previous studies of nonrenewable resources; see, for instance, NORDHAUS (1973) and MANNE (1976). The fifth, 12%, is an intermediate discount rate, and the sixth, 15%, is the old NEB upper bound estimate of the SDR[3].

The solutions corresponding to the six discount rates delineate quite different paths for exploiting the Canadian natural gas resource base and all capture the user costs of

3. A 12% discount rate is used to allow readier comparison of the results set forth here with those of ROWSE (1990a), which range from 3% through 12% in unit percentage increments.

nonrenewable resource consumption. (See ROWSE (1986b).[4]) In general, low discount rates conserve gas and high discount rates lead to faster introduction of gas supplies, a downward near term tilt to Canadian gas prices and greater near term gas exports to the US. Some of these effects are reversed later in time for high-discount-rate solutions as prices rise to the costs of delivered backstop gas. All of these outcomes incorporate the impacts of higher discount rates raising the supply costs of non-backstop gas (see GORDON (1966), WATKINS (1978) and FARZIN (1984)) and simultaneously raising the opportunity costs of deferring production (see ROWSE (1987a)). Hence a multitude of tradeoffs are made across Canadian regions, across supply technologies, across US export markets and across time in determining each solution. As mentioned earlier, some solutions exhibit bounds on introducing conventional gas over time which are constraining while others do not.

Salient results for the control case appear in Table 1. If the entries are viewed as forming a block square matrix, then each block of numbers along the principal diagonal is generated when the SDR is known and used. For instance, for a 3% SDR, the efficient allocation generates $646.96 billion (B) of social welfare (SW), which consists of $205.60 B consumer surplus (CS) and $441.36 B producer surplus (PS). These measures are in 1986 Canadian dollars discounted to 1987 and embody contributions from both domestic and export markets.

The influence of a higher discount rate depressing near term prices and advantaging near term consumers can be seen from comparing the ratio CS/SW from entries along the principal diagonal: 3% — $205.60 B/$646.96 B = 0.32; 5% — 0.40; 8% — 0.47; 10% — 0.51; 12% — 0.53; and 15% — 0.57. This behaviour is similar to that for the BC model, where the variation of this ratio over the range of 3% through 15% is from 0.53 to 0.72. The underlying adjustments are readily explained. Raising the discount rate reduces near term user costs, thus lowering efficient near term prices, in turn reducing near term PS and increasing near term CS. With the higher discount rate prices rise faster later in time, in some periods at the expense of CS, but in present value terms the distant term adjustments do not offset the near term adjustments. Thus surplus is transferred from producers to consumers.

What are the efficiency consequences of using the wrong discount rate? Each of the six model solutions is optimal for a particular SDR and suboptimal for all others. The off-diagonal elements of Table 1 provide answers to this question. Suppose that the SDR is known to be 3% but 5% is used instead. Then the 5% allocation trajectory is feasible and when substituted into the objective function for an SDR of 3% yields SW of $643.18 B, as indicated in the block forming the second entry in the first "row" of the table. As

4. For benchmarking purposes only the EMR/NEB and AGAS EMF 9 submissions for a 10% discount rate were available for the control case and these were used for all of the discount rates employed. Thus there may be some bias in the numerical results because the EMR/NEB and AGAS scenario results might have varied with the discount rate, had such analyses been undertaken. Any such bias is ignored. This point also applies to the two scenarios below.

TABLE 1

Performance Measures for the Control Case

SW: Social Welfare CS: Consumer Surplus PS: Producer Surplus

Social Discount Rate	Consumption Trajectory Optimal for Discount Rate Specified: 3%	5%	8%	10%	12%	15%
3%	SW = 646.96 CS = 205.60 PS = 441.36	SW = 643.18 (-0.58) CS = 238.78 (+16.14) PS = 404.40 (-8.37)	SW = 638.64 (-1.29) CS = 251.66 (+22.40) PS = 386.98 (-12.32)	SW = 637.66 (-1.44) CS = 251.38 (+22.27) PS = 386.28 (-12.48)	SW = 637.14 (-1.52) CS = 247.25 (+20.26) PS = 389.89 (-11.66)	SW = 637.10 (-1.52) CS = 242.86 (+18.12) PS = 394.24 (-10.68)
5%	SW = 475.01 (-0.68) CS = 161.08 (-15.77) PS = 313.93 (+9.37)	SW = 478.28 CS = 191.24 PS = 287.04	SW = 477.11 (-0.24) CS = 204.01 (+6.68) PS = 273.10 (-4.86)	SW = 476.48 (-0.38) CS = 204.87 (+7.13) PS = 271.61 (-5.38)	SW = 475.86 (-0.51) CS = 202.17 (+5.72) PS = 273.69 (-4.65)	SW = 475.51 (-0.58) CS = 198.99 (+4.05) PS = 276.52 (-3.66)
8%	SW = 330.34 (-2.44) CS = 122.09 (-24.03) PS = 208.25 (+17.07)	SW = 337.46 (-0.33) CS = 148.39 (-7.67) PS = 189.07 (+6.28)	SW = 338.60 CS = 160.71 PS = 177.89	SW = 338.47 (-0.04) CS = 162.60 (+1.18) PS = 175.87 (-1.14)	SW = 338.14 (-0.14) CS = 161.43 (+0.45) PS = 176.71 (-0.66)	SW = 337.86 (-0.22) CS = 159.66 (-0.65) PS = 178.20 (+0.17)
10%	SW = 272.81 (-3.46) CS = 105.54 (-26.70) PS = 167.27 (+20.69)	SW = 280.67 (-0.68) CS = 129.72 (-9.91) PS = 150.95 (+8.92)	SW = 282.46 (-0.04) CS = 141.69 (-1.60) PS = 140.77 (+1.57)	SW = 282.58 CS = 143.99 PS = 138.59	SW = 282.49 (-0.03) CS = 143.53 (-0.32) PS = 138.96 (+0.27)	SW = 282.32 (-0.09) CS = 142.43 (-1.08) PS = 139.89 (+0.94)
12%	SW = 232.40 (-4.34) CS = 93.29 (-28.21) PS = 139.11 (+23.10)	SW = 240.42 (-1.04) CS = 115.68 (-10.97) PS = 124.74 (+10.38)	SW = 242.54 (-0.17) CS = 127.29 (-2.04) PS = 115.25 (+1.98)	SW = 242.85 (-0.04) CS = 129.88 (-0.05) PS = 112.97 (-0.04)	SW = 242.95 CS = 129.94 PS = 113.01	SW = 242.90 (-0.02) CS = 129.34 (-0.46) PS = 113.56 (+0.49)
15%	SW = 191.12 (-5.46) CS = 80.03 (-30.24) PS = 111.09 (+27.05)	SW = 198.96 (-1.58) CS = 100.24 (-12.62) PS = 98.72 (+12.90)	SW = 201.25 (-0.45) CS = 111.33 (-2.96) PS = 89.92 (+2.84)	SW = 201.75 (-0.20) CS = 114.17 (-0.48) PS = 87.58 (+0.16)	SW = 202.07 (-0.04) CS = 114.78 (+0.05) PS = 87.29 (-0.17)	SW = 202.16 CS = 114.72 PS = 87.44

NOTE: All performance measures are in billions of 1986 Canadian dollars discounted to 1987. Furthermore, figures in parentheses are percentage changes relative to the optimal solution for the social discount rate indicated.

indicated in parentheses, the percentage decline from the SW maximum is only 0.58%. This SW consists of $238.78 B CS (16.14% above that of the SW maximum) and $404.40 B PS (8.37% below that of the SW maximum). Consequently, a sizeable surplus transfer occurs: consumers gain $33.18 B and producers lose $36.96 B, for a net loss of only $3.78 B. Similarly, if 8% is used when the SDR is 3%, SW declines by 1.29%; if 10% is used, SW declines by 1.44%; if 12% is used, SW declines by 1.52%; and if 15% is used SW also declines by 1.52% (a greater percentage loss occurs than for the 12% case, but there is no difference to two decimal digits). As intuition might predict, the larger the divergence between the improper rate and the SDR the larger the percentage SW loss. Large surplus transfers from producers to consumers also occur, but the percentage changes do not vary monotonically with the divergence.

The results for a 5% SDR are listed in the second "row." Using 3% reduces SW by 0.68%, more than the 0.58% erosion induced by using a 15% rate. Using a rate below the 5% SDR transfers surplus from consumers to producers, while using a rate exceeding this SDR transfers surplus in the opposite direction. But again, the percentage adjustments to CS and PS do not vary monotonically with the divergence.

The results for higher discount rates are similar and need not be detailed. In general, the percentage welfare losses are all small and satisfy a regularity property: they increase with the divergence from the SDR. The largest percentage loss is 5.46% when the SDR is 15% but a 3% discount rate is used instead. Moreover, a second regularity property is satisfied: the percentage welfare loss increases as the SDR diverges from the discount rate used to generate that solution. This property is consistent with intuition but does not necessarily follow from the previous property. Finally, the result that the largest percentage welfare loss occurs when the SDR is high but a low rate is used may not correspond with intuition. But in fact intuition is not strong enough to predict which percentage loss ought to be largest. Using a high discount rate when the SDR is low and using a low discount rate when the SDR is high both are suboptimal; which is worse cannot be predicted by intuition alone[5].

The finding of small percentage welfare losses is consistent with previous findings of ROWSE (1990a, 1990b). Moreover, it is surprising that using a discount rate of 15% when the SDR is 3% generates welfare losses of only 1.52%, a finding likely at variance with what the emphasis upon efficiency in the economic literature would implicitly suggest.

3.2 The Lower Oil Price Case

The first of three alternative scenarios examined in EMF 9, this case assumes a lower world oil price path than the control case. The major implications for gas markets are two:

5. See the base case and sensitivity results of ROWSE (1990a), where the worse percentage SW loss of the two errors differs with the assumed demand and supply circumstances.

a more buoyant macroeconomy which expands demands for gas, particularly in the US, and a lower-priced range of refined oil substitutes for gas, which undercut certain gas markets. For Canada, domestic and export demands are influenced considerably by lower oil prices. Although the EMR/NEB submission finds gas demand growth uneven across Canada due to uneven regional economic impacts, the overall demand growth exceeds that of the control case. Export markets become much less lucrative for producers because of more competition from oil. AGAS finds both lower equilibrium prices and lower export levels, and these findings are used to benchmark the US import demand functions.

Details of the solution for this scenario are provided in ROWSE (1988b, pp. 412-413). On balance gas markets are much weaker than in the control case, prices are lower and domestic consumption and exports grow less rapidly. Salient results for solutions utilizing different discount rates appear in Table 2. Entries in this table are directly comparable with the corresponding entries of Table 1. Utilizing a 3% SDR leads to an optimal solution with SW of $522.69 B, down $124.27 B or 19.21% from the control case. But this reduction is more than borne by PS, which falls by $124.85 B or 28.29%. CS actually rises. This pattern is repeated for corresponding solutions along the principal diagonal: SW falls, CS rises and PS falls. The greatest percentage reduction in PS occurs for the solution where the SDR is 15%: PS falls from $87.44 B to $43.61 B, or by 50.13%. In any event, the solutions are markedly different from the control case.

Examination of Table 2 reveals that the patterns of Table 1 are repeated, but with minor differences. For a 3% SDR the percentage SW losses are approximately double the previous losses. But for a 15% SDR the losses are only slightly higher when using discount rates of 3% and 5% and slightly lower for other rates. Nevertheless, the percentage SW losses are all relatively small and the losses from using a 15% rate when the SDR is 3% are 3.11%. The percentage adjustments to PS and CS are all much greater than the corresponding percentage changes to SW. Moreover, the two regularity properties identified above are also satisfied.

3.3 The Low Resources Case

The second of three alternative scenarios assumes a world oil price path of the control case but a lower natural gas resource base in the US. Canadian demand functions are again those of the control case but the US import demand functions reflect more lucrative markets for Canadian gas because of the smaller US resource base.

Details of the solution for this case are provided in ROWSE (1988b, pp. 413-414); on balance exports are higher than for the control case, domestic prices are higher and Canadian consumption is lower, reflecting the diversion of gas from Canadian markets. Salient results for solutions utilizing different discount rates appear in Table 3. Again, tabular entries are directly comparable with the corresponding entries of Table 1. Utilizing a 3% SDR leads to an optimal solution with SW of $716.56 B, up $69.60 B or 10.76% from the control case. But again the percentage adjustment to SW is exceeded by that to

TABLE 2

Performance Measures for the Lower Oil Price Case

SW: Social Welfare CS: Consumer Surplus PS: Producer Surplus

Social Discount Rate	Consumption Trajectory Optimal for Discount Rate Specified: 3%	5%	8%	10%	12%	15%
3%	SW = 522.69 CS = 206.18 PS = 316.51	SW = 517.55 (-0.98) CS = 241.86 (+17.31) PS = 275.69 (-12.90)	SW = 509.93 (-2.44) CS = 260.21 (+26.21) PS = 249.72 (-21.10)	SW = 507.55 (-2.90) CS = 263.83 (+27.96) PS = 243.72 (-23.00)	SW = 506.85 (-3.03) CS = 263.37 (+27.74) PS = 243.48 (-23.07)	SW = 506.42 (-3.11) CS = 261.33 (+26.75) PS = 245.09 (-22.56)
5%	SW = 378.59 (-1.17) CS = 164.72 (-16.07) PS = 213.87 (+14.48)	SW = 383.09 CS = 196.27 PS = 186.82	SW = 381.33 (-0.46) CS = 213.98 (+9.02) PS = 167.35 (-10.42)	SW = 380.33 (-0.72) CS = 217.88 (+11.01) PS = 162.45 (-13.04)	SW = 379.85 (-0.85) CS = 218.19 (+11.17) PS = 161.66 (-13.47)	SW = 379.28 (-0.99) CS = 217.20 (+10.66) PS = 162.08 (-13.24)
8%	SW = 261.10 (-3.68) CS = 125.70 (-25.22) PS = 135.40 (+31.49)	SW = 269.66 (-0.52) CS = 152.01 (-9.58) PS = 117.65 (+14.26)	SW = 271.08 CS = 168.11 PS = 102.97	SW = 270.96 (-0.04) CS = 172.06 (+2.35) PS = 98.90 (-3.95)	SW = 270.78 (-0.11) CS = 173.04 (+2.93) PS = 97.74 (-5.08)	SW = 270.43 (-0.23) CS = 173.23 (+3.05) PS = 97.20 (-5.60)
10%	SW = 215.77 (-4.91) CS = 108.73 (-28.05) PS = 107.04 (+41.23)	SW = 224.70 (-0.97) CS = 132.26 (-12.48) PS = 92.44 (+21.97)	SW = 226.78 (-0.06) CS = 147.24 (-2.57) PS = 79.54 (+4.95)	SW = 226.91 CS = 151.12 PS = 75.79	SW = 226.85 (-0.03) CS = 152.34 (+0.81) PS = 74.51 (-1.69)	SW = 226.67 (-0.11) CS = 153.05 (+1.28) PS = 73.62 (-2.86)
12%	SW = 184.45 (-5.80) CS = 96.15 (-29.56) PS = 88.30 (+48.90)	SW = 193.18 (-1.34) CS = 117.40 (-13.99) PS = 75.78 (+27.79)	SW = 195.51 (-0.15) CS = 131.36 (-3.77) PS = 64.15 (+8.18)	SW = 195.75 (-0.03) CS = 135.11 (-1.02) PS = 60.64 (+2.26)	SW = 195.80 CS = 136.50 PS = 59.30	SW = 195.73 (-0.04) CS = 137.56 (+0.78) PS = 58.17 (-1.91)
15%	SW = 152.85 (-6.74) CS = 82.60 (-31.33) PS = 70.25 (+61.09)	SW = 161.00 (-1.76) CS = 101.18 (-15.88) PS = 59.82 (+37.17)	SW = 163.37 (-0.32) CS = 113.81 (-5.38) PS = 49.56 (+13.64)	SW = 163.71 (-0.11) CS = 117.38 (-2.41) PS = 46.33 (+6.24)	SW = 163.85 (-0.02) CS = 118.90 (-1.15) PS = 44.95 (+3.07)	SW = 163.89 CS = 120.28 PS = 43.61

NOTE: All performance measures are in billions of 1986 Canadian dollars discounted to 1987. Furthermore, figures in parentheses are percentage changes relative to the optimal solution for the social discount rate indicated.

PS: PS rises by \$50.24 B or 11.38%. CS also rises. For all discount rates except 15%, all performance measures rise. For 15%, the percentage rise to PS is 12.71%, while CS declines very slightly. Although the departures of the performance measures from those of the control case are less dramatic than for the lower oil price case, nonetheless the outcomes are noticeably different from those of the control case.

Examination of Table 3 shows that the patterns of Table 1 are repeated. For a 3% SDR the percentage SW losses are all below their counterparts for the control case. With a few exceptions this is also true for other SDRs. All percentage SW losses are small and the largest percentage loss continues to occur when the SDR is 15% but a 3% discount rate is used instead. With a few exceptions, the percentage adjustments to PS and CS also dominate the percentage changes to SW. Again, the two regularity properties are satisfied.

3.4 Reviewing the Major Findings

The fourth EMF 9 scenario is a higher demand case. Because the model results for this case are nearly identical to those of the third scenario, it is not considered here. The results are discussed in ROWSE (1988b, p. 414).

Much interest in the discount rate for nonrenewable resource allocation stems from a belief that the SDR is below discount rates used by private markets. Figure 2 shows from Tables 1, 2 and 3 how social welfare erodes when the SDR is low (namely 3%) and a higher discount rate is employed. The results depict the largest changes observed; if the SDR is 5% or 8%, then the erosion of welfare is even less pronounced. In no case is the erosion of welfare much greater than 3% when the discount rate exceeds the SDR. For two cases the maximum loss is about 1.5%. The separation of the different trajectories also reflects the substantial differences among the scenarios.

Figure 3 shows how CS and PS vary with the discount rate. As the discount rate rises, surplus is transferred from producers to consumers but the transfer is not monotonic. Finally, the percentage changes to CS and PS dwarf the percentage losses to SW.

IV. ON THE GENERALITY AND IMPLICATIONS OF THE FINDINGS

Are the findings robust over a broad range of assumptions and parameter estimates which underly and frame the model, or are they highly dependent on specific model inputs? The consistency of the findings set forth here with those of ROWSE (1990a, 1990b) suggests strongly that they reflect a general tendency and are not tied only to particular model inputs. These and earlier findings together should be regarded as ranging across a spectrum of models and a breadth of alternative scenarios about the future. Indeed, the findings suggest that perhaps a different question ought to be asked, namely under what circumstances might the percentage welfare losses be large when an improper discount rate is used? One possibility is when the supply circumstances are stringent relative to demands and mistakes are apt to prove costly. However, the sensitivity analysis of ROWSE

TABLE 3

Performance Measures for the Low Resources Case

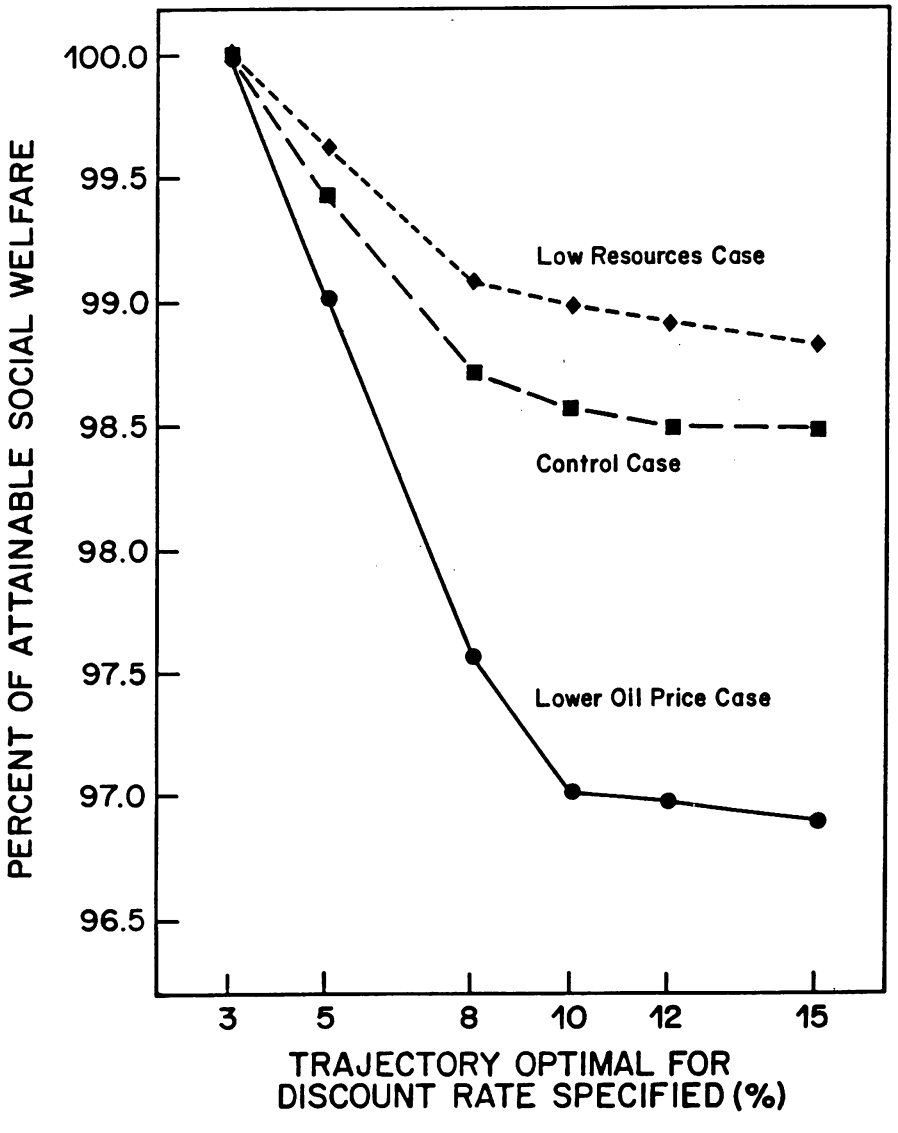
SW: Social Welfare CS: Consumer Surplus PS: Producer Surplus

Social Discount Rate \ Consumption Trajectory Optimal for Discount Rate Specified:	3%	5%	8%	10%	12%	15%
3%	SW = 716.56 CS = 224.96 PS = 491.60	SW = 713.79 (-0.39) CS = 254.92 (+13.32) PS = 458.87 (-6.66)	SW = 709.79 (-0.94) CS = 268.80 (+19.49) PS = 440.99 (-10.29)	SW = 709.17 (-1.03) CS = 266.75 (+18.58) PS = 442.42 (-10.00)	SW = 708.66 (-1.10) CS = 262.31 (+16.60) PS = 446.35 (-9.20)	SW = 708.00 (-1.19) CS = 252.94 (+12.44) PS = 455.06 (-7.43)
5%	SW = 519.53 (-0.59) CS = 172.03 (-13.71) PS = 347.50 (+7.50)	SW = 522.62 CS = 199.37 PS = 323.25	SW = 521.60 (-0.20) CS = 213.18 (+6.93) PS = 308.42 (-4.59)	SW = 521.15 (-0.28) CS = 212.93 (+6.80) PS = 308.22 (-4.65)	SW = 520.58 (-0.39) CS = 210.15 (+5.41) PS = 310.43 (-3.97)	SW = 519.46 (-0.60) CS = 202.62 (+1.63) PS = 316.84 (-1.98)
8%	SW = 356.88 (-2.08) CS = 127.86 (-22.63) PS = 229.02 (+14.97)	SW = 363.34 (-0.31) CS = 151.88 (-8.10) PS = 211.46 (+6.15)	SW = 364.46 CS = 165.26 PS = 199.20	SW = 364.36 (-0.03) CS = 166.45 (+0.72) PS = 197.91 (-0.65)	SW = 364.08 (-0.10) CS = 165.41 (+0.09) PS = 198.67 (-0.27)	SW = 363.28 (-0.32) CS = 160.33 (-2.98) PS = 202.95 (+1.88)
10%	SW = 292.90 (-2.99) CS = 109.66 (-25.21) PS = 183.24 (+17.98)	SW = 300.06 (-0.62) CS = 131.87 (-10.06) PS = 168.19 (+8.29)	SW = 301.85 (-0.03) CS = 144.88 (-1.19) PS = 156.97 (+1.06)	SW = 301.94 CS = 146.62 PS = 155.32	SW = 301.87 (-0.02) CS = 146.37 (-0.17) PS = 155.50 (+0.12)	SW = 301.39 (-0.18) CS = 142.56 (-2.77) PS = 158.83 (+2.26)
12%	SW = 248.18 (-3.81) CS = 96.36 (-27.04) PS = 151.82 (+20.57)	SW = 255.55 (-0.95) CS = 117.04 (-11.39) PS = 138.51 (+10.00)	SW = 257.69 (-0.12) CS = 129.65 (-1.84) PS = 128.04 (+1.68)	SW = 257.92 (-0.03) CS = 131.77 (-0.23) PS = 126.15 (+0.18)	SW = 258.00 CS = 132.08 PS = 125.92	SW = 257.84 (-0.06) CS = 129.29 (-2.11) PS = 128.55 (+2.09)
15%	SW = 202.69 (-4.92) CS = 82.10 (-28.38) PS = 120.59 (+22.36)	SW = 209.97 (-1.51) CS = 100.89 (-11.99) PS = 109.08 (+10.68)	SW = 212.40 (-0.37) CS = 112.94 (-1.47) PS = 99.46 (+0.92)	SW = 212.75 (-0.20) CS = 115.40 (-0.67) PS = 97.35 (-0.12)	SW = 212.99 (-0.09) CS = 116.29 (+1.45) PS = 96.70 (-1.88)	SW = 213.18 CS = 114.63 PS = 98.55

NOTE: All performance measures are in billions of 1986 Canadian dollars discounted to 1987. Furthermore, figures in parentheses are percentage changes relative to the optimal solution for the social discount rate indicated.

Figure 2

Erosion of Social Welfare as the Discount Rate Used Diverges from the Social Discount Rate of 3%



(1990a) suggests that even highly stringent supply circumstances may not yield large percentage welfare losses.

Can these findings be explained? ROWSE (1990a, 1990b) argues that they arise because there are many near-optimal depletion paths for a nonrenewable resource, the central hypothesis of ROWSE (1988a). His specific arguments are presented there, but the intuition is straightforward. If mistakes are made in allocating a nonrenewable resource over time and they are not too gross, the resulting efficiency loss is small because the primary effect of the mistakes is to transfer surplus from producers to consumers (or in the opposite direction), or across generations of consumers, or both, and only a secondary effect is to lower surplus from what it could otherwise have been.

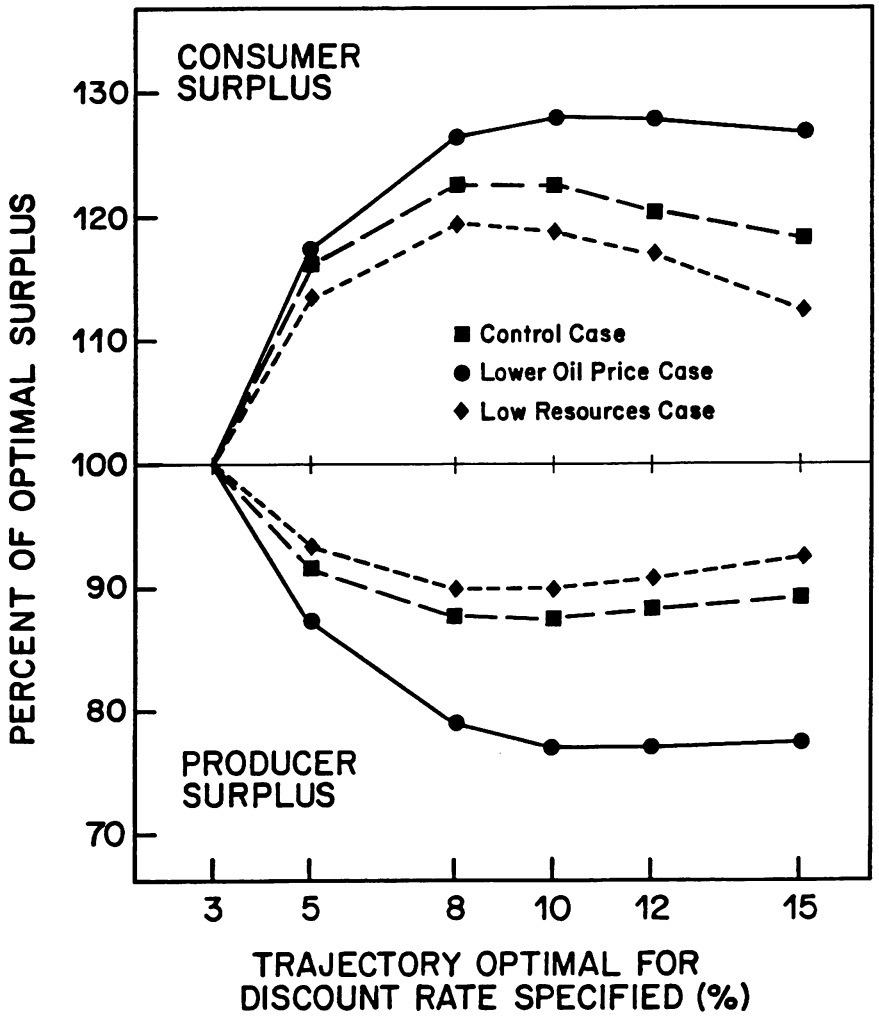
What are the implications of these findings, presuming that they do reflect a general tendency of partial equilibrium nonrenewable resource models? Much of the exhaustible resources literature focusses on efficiency issues and neglects nonefficiency issues. The findings here suggest that the adjustments to nonefficiency performance measures are likely to be far greater than the alterations to social welfare when the wrong discount rate is used. In particular, it is apparent that considerations such as income distribution, regional employment and environmental externalities warrant more attention when a discount rate is selected than they have heretofore received. The near- optimality of numerous depletion paths means that nonefficiency performance measures must rank higher in choosing a socially optimal depletion path than is commonly believed. Alternatively, the conventional social welfare function appears too narrow to act as a societal welfare function and needs to be modified or supplemented.

Where environmental externalities are considered important, the findings of this paper appear particularly relevant. Choosing the correct social discount rate is important for deciding which generations enjoy the benefits of consumption goods whose production gives rise to environmental emissions and which generations bear either the externalities or the costs of abatement. Stated differently, this work renders environmental externalities more important for selecting a social discount rate because lost social welfare from using the wrong rate may be small, but the intergenerational redistribution of the costs of the emissions may be considerable.

It is sometimes argued that, where there are uncertain long term adverse effects of environmental emissions not reflected in the costs of a commodity, a social policy to slow the use of that commodity may be welfare improving. The findings here for a nonrenewable resource offer some support for this view. Erring on the side of caution by slowing consumption of a nonrenewable resource with serious potential long term effects may not erode (conventionally defined) social welfare much if the error is reversed at a later date. Alternatively, stretching out the period of time over which the commodity is consumed to allow the biosphere time to adapt to the emissions may not reduce welfare much. Of course, the mechanism utilized to slow consumption could have serious efficiency consequences, so this view must be qualified.

Figure 3

Variation of Surplus Measures as the Discount Rate Used Diverges from the Social Discount Rate of 3%



V. CONCLUDING REMARKS

What are the social welfare consequences of using the wrong discount rate to allocate a nonrenewable resource? This question is addressed in this paper and in two previous studies by ROWSE (1990a, 1990b). This work employs a complex optimization model for domestic and export allocation of Canadian natural gas and the findings are very similar to those found earlier. Accordingly, they lend strong support to the hypothesis that, for partial equilibrium nonrenewable resource models maximizing conventionally-defined social welfare, the efficiency losses from using the wrong discount rate are small, even for wide divergences from the social discount rate. Furthermore, consumer surplus and producer surplus generally vary much more than social welfare when the wrong discount rate is used.

In one respect the findings are the most persuasive of those yet advanced. If measuring efficiency in allocating a nonrenewable resource is to be seriously attempted, then it must be with a large-scale computational model which captures numerous real-world complexities. To avoid representing such complexities may simply mean solving the wrong problem. Unfortunately, large-scale models frequently lack transparency in behaviour due to the complexities they include. It is compelling that the gas model used here — which lacks transparency — yields major findings so similar to the simple continuous-time model of ROWSE (1990a) and the complex discrete-time model of ROWSE (1990b) — both of which are much more transparent. This result suggests that large-scale computational nonrenewable resource models incorporating numerous complexities and used by governments, regulatory agencies, research institutes and consulting firms are likely to behave in a similar way when the wrong discount rate is used.

The implications of the findings are important. Nonefficiency measures warrant more attention for selecting an optimal depletion path than they have heretofore received or, alternatively, the conventional social welfare function needs to be modified or supplemented. The findings have particular relevance for environmental issues. Using an improper discount rate may incur small efficiency losses in conventional partial equilibrium models but cause considerable intergenerational redistribution of the gains and losses from the consuming activities which generate the externalities. The near optimality of many depletion paths also suggests (but does not prove) that measures to reduce environmental emissions could have relatively small costs in terms of foregone social welfare.

Although the findings apply formally only to partial equilibrium modelling of nonrenewable resource allocation, they appear relevant for applied general equilibrium (AGE) modelling as well. First, it is highly likely that the circumstances of allocating a specific nonrenewable resource are so complex that to analyze this allocation solely within an AGE model will not suffice. The need to incorporate particular details of extraction, processing and distribution of a nonrenewable resource over time and space will likely render an AGE approach alone infeasible. Consequently, it may be appropriate to examine such resource allocation using both a partial equilibrium model and an AGE model, in

order to learn how the detailed analysis of the partial equilibrium model conforms with the general analysis of the AGE model. In other words, it may be desirable to utilize such models in a complementary fashion. In this case the findings reported here should prove useful.

By contrast, it may be desirable to utilize an aggregate measure or measures of social welfare in an intertemporal AGE model, and thus discounting may be necessary. In this circumstance the findings may have direct counterparts in an AGE framework.

More broadly, the apparent small loss of efficiency associated with pursuing objectives other than efficiency in a nonrenewable resource model may have some applicability to AGE models. For instance, imposing constraints to reduce environmental emissions or to alter the distribution of income may not have large impacts on overall efficiency, however efficiency is defined and measured in an AGE model. The same may also be true for performance measures other than efficiency. Of course, these statements are conjectural and subject to confirmation or refutation by analysis with an appropriately specified AGE model.

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SUMMARY

What are the social welfare consequences of using an improper discount rate to allocate a nonrenewable resource? In previous work, ROWSE addresses this question using a simple continuous-time model and a more complex discrete-time model. He finds small percentage social welfare losses from using the wrong discount rate , even for wide divergences from the social rate. In this paper the same question is addressed using a multiperiod, multiregional , multitechnology model of Canadian natural gas allocation. Numerical results strongly complement those found earlier, implying that ROWSE's findings reflect a general tendency. This tendency has important theoretical and practical implications.

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Heri, Erwin W.

Was Anleger eigentlich wissen sollten... Ein Querschnitt durch die Grundlagen moderner Finanz- und Anlagetheorien. Basel/Stuttgart 1991. Helbing & Lichtenhahn/Schäffer Verlag. 160 S.

Erwin W. Heri, Direktor beim Schweizerischen Bankverein und Extraordinarius an der Universität Basel, hat ein Buch veröffentlicht, das im Bereich der Finanzmarkttheorie in deutscher Sprache eine echte Lücke schliesst. Die Studie richtet sich an ein breites Publikum und auch an Studenten, die eine Kurzeinführung in die Grundlagen der Finanzmarkttheorie suchen. Ohne allzuviel Technik ist es dem Verfasser ausgezeichnet gelungen, in sieben Kapiteln die Grundlagen der Preisbildung sowie der Risikoanalyse bei Obligationen, Aktien und Wechselkursen darzustellen. Heri betont ausdrücklich, dass hier keine Hinweise darauf gegeben werden, wie man reich wird, sondern eher darauf, wie man auf volatilen Märkten die gröbsten Fehler vermeidet. Nicht behandelt werden in dieser Einführung neuere Portfolio-Strategien wie Insurance, Dedication und Indexing und auch derivative Instrumente. Dies alles soll im Rahmen einer späteren Veröffentlichung behandelt werden.

Im ersten einleitenden Kapitel werden einige strukturelle Faktoren diskutiert, die in den letzten Jahren zur vielgenannten Popularität der Finanzmärkte beigetragen haben. Es sind dies die Volatilität, die Deregulierung im Finanzbereich, die weltwirtschaftlichen Ungleichgewichte, die Schuldenkrise, die Gewichtsverschiebung von individuellem hin zu kollektivem oder institutionellem Sparen, die technologischen Fortschritte im Telekommunikations- und im Mikroelektronikbereich, sowie die Innovationskraft der Finanzmärkte, das heisst die Möglichkeiten, auf jeweilige Schuldner massgeschneiderte Finanzierungsinstrumente zu schaffen, die auch dem Anleger interessante Möglichkeiten bieten.

Im zweiten Kapitel "Obligationen" geht es dem Verfasser darum, das Verständnis für generelle Preisbildungsfragen im Bereich festverzinslicher Anlageinstrumente zu fördern. Zudem vermittelt es die Erkenntnis, dass Obligationen vielleicht doch nicht immer so risikolos sind, wofür sie in der Regel gehalten werden.

Im dritten Kapitel "Aktien" wird darauf hingewiesen, dass das Eingeben grosser firmenspezifischer Risiken im Durchschnitt nicht belohnt wird. In dem Sinne zahle sich eine vernünftige Portfolio-Diversifikation immer aus.

Im vierten Kapitel "Theorie flexibler Wechselkurse" geht Heri zuerst kurz auf die Geschichte flexibler Wechselkurse ein, um dann die Preisbildung am Devisenmarkt zu diskutieren und einige Konsequenzen für das Verhalten eines international investierenden Anlegers abzuleiten. Der Wechselkurs ist in internationalen Portefeuilles eine wichtige Ertragsdeterminante, oft ebenso wichtig wie der Ertrag der im Portefeuille enthaltenen Aktien oder Obligationen. Zudem unterliegt die Preisbildung am Devisenmarkt ähnlichen Grundprinzipien wie die Preisbildung an den Aktien- und Obligationenmärkten. Diese Tatsache wird insbesondere in der angelsächsischen Literatur nach wie vor eher stiefmütterlich behandelt, wohl deswegen, weil der Anteil ausländischer Aktiva in amerikanischen Portefeuilles noch immer relativ gering ist.

Im fünften Kapitel "Theorie effizienter Märkte" geht es um die Frage, welche Information die Marktteilnehmer in welcher Art und Weise für die Preisbildung verarbeiten. Die Theorie effizienter Märkte beruht auf der Annahme, dass alle Marktteilnehmer in jedem Moment alle preisrelevanten Informationen besitzen und auf neue Meldungen derart reagieren, dass die Preise permanent die entsprechenden Informationen erhalten. Mit der Theorie effizienter Märkte wird eine Art Informations- und Verhaltenstheorie unterstellt, die in ihrer Konsequenz die in die Zukunft gerichteten Preisbildungsmodelle implizieren. Die Theorie effizienter Märkte lehrt, dass die meisten Finanzmarktpreise annähernd Zufallpfad-Charakter aufweisen und ausserordentlich schwer zu prognostizieren sind. Effizienz heisst auch, dass man sich nicht durch Erfolge irgendwelcher Gurus dazu verleiten lassen sollte, übermässige Risiken einzugehen.

Im sechsten Kapitel "Grundlagen der Modernen Portfolio-Theorie" werden die quantitative Risikomessung und neuere Verfahren der Risikominderung wie Portfolio-Bildung, Absicherungsstrategien, Portfolio Insurance u.a. diskutiert. Bei der Bestimmung des Gesamtrisikos eines Portefeuilles müssen statistische Konzepte eingeführt werden, die uns einen Hinweis geben, inwiefern Aktienerträge korreliert sind. Im Prinzip wird es möglich, dass jeder Anleger, basierend auf seiner individuellen Risikotoleranz, seinen individuell optimalen Anlagemix errechnet.

Im abschliessenden siebten Kapitel "Der anlagepolitische Entscheidungsprozess: Versuch einer Synthese" werden die Grundlagen der Finanztheorie zur Formulierung einer konkreten Anlagestrategie verwendet. Dabei versteht der Verfasser den Ansatz als Synthese zweier Anlagephilosophien, "Bottom Up"- und "Top Down"-Ansatz, die in der traditionellen Literatur oft als Widersprüche hingestellt werden. Sie sind aber nicht sich widersprechende Substitute. "Bottom Up" und "Top Down" müssen vielmehr in einem disziplinierten anlagepolitischen Entscheidungsprozess komplementär eingesetzt werden.

Anton Föllmi, Basel

Jöhr, Walter Adolf

Der Auftrag der Nationalökonomie. Ausgewählte Schriften. Herausgegeben von Hans Ch. Binswanger, J.-P. Jetzer, F. Kneschaurek und G. Schwarz. Tübingen 1990. J.C.B. Mohr (Paul Siebeck). XXXIII, 521 S., Geb. DM 148.00.

Diese Besprechung der posthum neu veröffentlichen Auswahl aus dem Schaffen von W.A. JÖHR (1910 - 1987) ist keine gewöhnliche; denn alle Aufsätze bzw. Auszüge aus früheren Büchern habe ich vor fast dreissig Jahren als Student zum erstenmal - und seither einzeln immer wieder - gelesen. W.A. Jöhr war im Verlaufe eines Vierteljahrhunderts vom Lehrer zum Mentor und schliesslich zum Kollegen und Freund geworden, bis sich dann 1978 unsere Wege teilweise wieder trennten.

Wie würde ich jetzt nach all diesen Jahren auf die Lektüre von fast 300 Seiten Texten aus W.A. Jöhrs Feder reagieren?

"Die Entwicklung der Volkswirtschaftslehre in der Schweiz nach dem Zweiten Weltkrieg wurde durch W.A. Jöhr wesentlich mitbestimmt", so beginnt die Einleitung zum dreiteiligen Sammelband (S. VII) und bereitet damit auch gleich die Bühne für die einzelnen Akte vor. Der erste und meines Erachtens wichtigste Teil ist mit "ausgewählten Fragen der allgemeinen und speziellen Wirtschaftspolitik" vielleicht nicht ganz zutreffend überschrieben; denn hier finden wir gleich mehrere absolut grundlegende Aufsätze zu Grundfragen der Ökonomie im Spannungsfeld zwischen reiner Theorie und politischen Anwendungen. Denn Jöhr ging es in der Tat nie "nur um die Wissenschaft als solche" (S. VII), sondern sie war für ihn ganz selbstverständlich "Dienst an der Gemeinschaft". Biographien von anderen Grossen jener Generation zeigen immer wieder, wie die "Krise" der 30er Jahre die besten Talente aus anderen Disziplinen überhaupt erst zur Ökonomie brachte: Um, wie Jöhr es selber sagte, "die Ursache eines ebenso erstaunlichen wie verheerenden Prozesses...blosszulegen." Nicht um der Erkenntnis per se willen, sondern um etwas dagegen zu unternehmen. Dieses Engagement für die politische Lösung drängender, gesellschaftlicher Probleme ist der rote Faden durch das inhaltlich reichhaltige Werk von Jöhr. Aus dem Jahre 1947 stammt der Grundbeitrag "Die Beurteilung konkreter wirtschafts-politischer Probleme", der die JÖHRschen Konstanten - Praxisorientierung, Kompromissorientierung und Weltorientierung - klar und deutlich zum Ausdruck bringt. Ebenso programmatisch wie aufschlussreich sind die Aufsätze "Der Auftrag der Nationalökonomie in unserer Zeit", "Kompromiss als Problem der Gesellschafts-, Wirtschafts und Staatsethik", die Ausführungen zu den Gegensatzpaaren "Schätzungsurteil und Werturteil" oder "Wissenschaft und Werte". Parallel zum Sammelband habe ich G. DEBREU's "Presidential Address" in der "American Economic Review" zum Thema der Mathematisierung der Ökonomie gelesen. Welche selbstbewusste, ja fast überhebliche Einschätzung des Erfolgs der mathematischen Wirtschaftstheorie im Lichte rein wissenschaftsinterner Kriterien und Massstäbe! Und damit ein Kontrast zum interdisziplinären und anwendungsorientierten W.A. Jöhr, der 1947 die folgenden Sätze festhielt: "Die Grundlagenforschung hat sich in den letzten zwanzig Jahren stark entwickelt. Hat die

Beurteilung konkreter, wirtschaftlicher Probleme mit ihr Schritt gehalten? Die Frage stellen, heisst, sie verneinen." (S. 6).

Es scheint, dass diejenigen, die diese Divergenz der Forschungswege von Theorie und Applikation als stossend empfinden, am Aussterben sind. Der erste Teil der Jöhrschen ausgewählten Schriften sollte deshalb zur Plichtlektüre aller Doktoranden erklärt werden, denn Praxisorientierung stand für Jöhr nie im Gegensatz zu Abstraktion oder Systematik, die formale Analyse nie im Kontrast zur Notwendigkeit von Schätz- und Werturteilen. Fachliche Interdisziplinarität ist bei Jöhr kein Abgleiten in intellektuelle Undiszipliniertheit. Im Gegenteil, sein breiter sozialwissenschaftlicher Ansatz bringt die verschiedenen Dimensionen des Problems in eine Perspektive, die verschiedene Aspekte wirkungsvoll integriert und nicht bloss nebeneinander stellt. Sein "Kompromiss" ist nicht der fauler maroder Politiker, sondern die logische Folge des Umstands, dass Jöhr ideologische und dogmatische Positionen mit Leichtigkeit durchschaut und schonungslos entlarvt. Dies gilt selbst für die marktwirtschaftliche Theorie bzw. Ordnung. Jöhr steht fest auf dem Boden des Marktes und erkennt früh die Unvereinbarkeit von Freiheit und Sozialismus. Trotzdem sieht er auch die Grenzen und Fehlleistungen der 'ungelenkten Marktwirtschaft'. Den traditionellen Sozialismus hat Jöhr von Anbeginn unmissverständlich abgelehnt wie später dann auch den "neuen" der 60er Jahre. Aber er hat die marxistische und neo-marxistische Kritik am marktwirtschaftlichen System stets ernst genommen und ist nie davor zurückgeschreckt, Vorschläge für Ordnungs- und Prozesskorrekturen des Marktes vorzuschlagen und zu verteidigen. Im Momente haben die "Mises" und "Hayeks" Hochkonjunktur, doch mir scheint, dass auch Jöhr in einigen Jahren eine Renaissance erleben wird, nämlich dann, wenn klar wird, dass weder mit ideologischen Positionen noch mit marktwirtschaftlichen Radikalkuren die grossen Probleme der Welt wirklich gelöst werden können.

In Erstaunen versetzt den Leser auch die frühe und unkonventionelle Auseinandersetzung mit neuen, aber grossen Problemen und Fragen. Gegen Ende der 60er Jahre beschäftigte sich Jöhr ernsthaft und gekonnt mit so verschiedenen Themen, wie dem "Nord-Süd-Konflikt", der "bedrohten Umwelt" und der "Rebellion der Jugend". Die entsprechenden Beiträge im Sammelband sind originell und fruchtbar. Kein besserwisserischer Ton ist auszumachen, wie auch simple Rezepte fehlen. Die Analyse überzeugt. Die Empfehlungen sind ausgewogen und zurückhaltend formuliert.

Der zweite Teil befasst sich mit den 1952 publizierten "Konjunkturschwankungen". Obwohl das ursprüngliche Werk vergriffen ist, dürfte dieses doch weiter bekannt(er) sein. Nebst einem Wiederabdruck der zentralen Aussagen über den "Kernprozess" und dessen "sozialpsychologischen Erklärung" runden die kommentierenden Beiträge aus späterer Zeit das Bild ab. Typisch für Jöhr ist auch hier der Mut, nicht nur Erkenntnisse der Psychologie in die Ökonomie zu integrieren, sondern auch die Vorläufer aus der Welt der Literatur bis hin zu den Naturwissenschaften in einem separaten Beitrag abzuhandeln.

Schon zu meiner Zeit als Assistent in den späten 60er Jahren wollte Jöhr die "Konjunkturschwankungen" völlig überarbeiten und als Buch in toto neu herausgeben. Er hat diesen Plan wohl nie ganz aufgegeben, aber auch nie ganz mit der ihm sonst eigenen

Zähigkeit verfolgt. Die im zweiten Teil zusammengetragenen Beiträge sind Fragmente der unternommenen Anläufe, decken aber gleichzeitig auch den tieferen Grund für das "Scheitern" der Überarbeitung auf: Die Grundideen von 1952 sind dieselben geblieben und haben auch heute noch in ihrer ursprünglichen Form Bestand.

Der dritte Teil ist der grossen Liebe W.A. Jöhrs zur Dogmengeschichte gewidmet. Auch hier überrascht nebst der erwarteten Gründlichkeit das Unkonventionelle. So hat W.A. Jöhr z.B. nicht nur das Lebenswerk von EUCKEN aufgearbeitet, sondern Beiträge auch Aussenseitern wie SOMBART oder SOREL gewidmet. Aber selbst illustre Namen wie RUDI DUTSCHKE, MAO, MARKUSE und selbst CHE GUEVARA wurden des Blicks durch die ökonomische Brille als würdig empfunden. Wer Jöhr persönlich nur oberflächlich gekannt hat, musste den Eindruck eines konservativen und introspektiven Forschers und Menschen gewinnen. Wer ihm näher stand, durfte seine schöpferische Seite kennen lernen. Intellektuelle Neugier trieb ihn an, und Zielstrebigkeit liess ihn auch vordergründig "Abseitiges" zu Ende führen. Auch W.A. Jöhr ist nicht alles gelungen. Der vorliegende Band hat tatsächlich das Beste zusammengefügt. Festschriften greiser Kollegen oder gesammelte Schriften kürzlich verstorbener Denkmäler des Faches sind häufig eine Pflichtübung - für die Herausgeber wie die Rezensenten. Das vorliegende Werk gehört definitiv nicht in diese Kategorie. Die Beiträge wurden sorgfältig und taktvoll ausgewählt und kompetent kommentiert. Das Buch erfüllt somit eine ganz wichtige Funktion. Wie schon sein Titel "Der Auftrag der Nationalökonomie" erinnert uns hier einer der Grossen des Fachs noch einmal eindringlich und überzeugend, dass wir einen "Auftrag" haben bzw. hätten: einen Beitrag zur Lösung der Probleme zu leisten.

Erst im Rückblick auf das Gesamtwerk wird mir klar, wie W.A. Jöhr an diesem Auftrag über Jahrzehnte lang festhielt. Mochten seine Zweifel an der Richtigkeit einzelner Theorien oder der Nützlichkeit einzelner Theoreme noch so tief gehen, am Auftrag, sich in den Dienst der Wirtschaftspolitik zu stellen, hat er nie gezweifelt. Ich denke, dass nicht nur der Inhalt des Werkes von W.A. Jöhr zu denken geben sollte, sondern eben der "Auftrag" an sich.

Silvio Borner, Basel

Labour Relations and Economic Performance

Edited by Renato Brunetta and Carlo Dell'Aringa (IEA Conference Volume, No. 95.) London 1990. The Macmillan Press. XIII, 482 p.

Der Band enthält 18 Referate einer sehr gut besetzten Konferenz der International Economic Association, die im Oktober 1988 in Venedig stattfand. Er ist in drei Teile gegliedert, die mit "Corporatism and Economic Performance", "Unions and Incomes Policies" sowie "Labour Flexibility and Unemployment" überschrieben sind.

Die Korporatismusdiskussion wird eröffnet durch einen umfangreichen Beitrag von PHILIPPE C. SCHMITTER, in dem dieser jüngere antikorporatistische Entwicklungen erörtert und ein gewisses Umdenken mit stärkerer Beachtung sektoraler Entwicklung fordert. MICHAEL KENDIX und MANCUR OLSON beschäftigen sich theoretisch und empirisch mit den Unterschieden der Arbeitslosenraten innerhalb von und zwischen Ländern. Anknüpfend an frühere Arbeiten von Olson betonen sie die Rolle von Institutionen und Umverteilungsorganisationen, und sie finden höhere Arbeitslosenraten in stärker gewerkschaftlich organisierten Regionen der USA. Die von Kendix und Olson hervorgehobene U-förmige Beziehung zwischen ökonomischen Erfolgen und Zentralisationsgrad einer Volkswirtschaft spielt auch eine wichtige Rolle bei der grossangelegten empirischen Untersuchung von 18 OECD-Staaten durch HEIKKI PALOHEIMO, doch zeigen die Korporatismuseffekte je nach untersuchter Makrovariablen ein unterschiedliches Bild. Eine Anreicherung der Olsonschen Ideen erfolgt durch COLIN CROUCH, der theoretisch und empirisch zeigt, dass Macht und Einfluss der Gewerkschaften auch von dem Ausmass abhängen, in dem gewerkschaftlich stark organisierte Sektoren dem internationalen Wettbewerb ausgesetzt sind. Auch DAVID SOSKICE bevorzugt bei seinem internationalen Vergleich von Arbeitslosigkeit einen weiter gefassten Rahmen, der aussenwirtschaftlichen Aspekten besonderes Gewicht gibt. RONALD DORE verdeutlicht, dass Arbeitsmarktrigiditäten nicht allein durch wohlfahrtsstaatliche Eingriffe, sondern auch durch Mikro-Korporatismus auf Unternehmensebene hervorgerufen werden können. Während sich die meisten Referate mit OECD-Ländern befassen, beschäftigt sich JEFFREY D. SACHS mit Lateinamerika und dessen populistischen Politikzyklen. Anhand verschiedener Bespiele versucht Sachs zu zeigen, dass die dort vorhandenen grossen Einkommensunterschiede politische und soziale Konflikte hervorrufen, die wiederum falsche politische Entscheidungen und dadurch ökonomische Misserfolge bewirken.

Der zweite Teil des Konferenzbandes ist Fragen der Einkommenspolitik und der Gewerkschaften gewidmet. JOHN MCCALLUM diskutiert Möglichkeiten der Einkommenspolitik im nordamerikanischen Kontext und verweist auf das erfolgreiche kanadische Experiment von 1976 - 78, das jedoch selbst in Kanada in den achtziger Jahren nicht wiederholt werden konnte. Einkommenspolitik und Arbeitsbeziehung in Italien stehen im Mittelpunkt einer spieltheoretischen Analyse von RENATO BRUNETTA und CARLO CARRARO sowie einer empirischen Untersuchung von LUCRECIA REICHLIN und MICHELE SALVATI, die den Beschäftigungsrückgang und Produktivitätsanstieg der achtziger Jahre

auf eine komplizierte Interaktion von gewerkschaftlicher Verhandlungsposition und Wirtschaftspolitik zurückführt. Einen guten Überblick über Gewerkschaftswirkungen in Grossbritannien bietet DAVID METCALF. Die empirische Evidenz deutet darauf hin, dass britische Gewerkschaften Produktivität, Profitabilität und Beschäftigung verringern, für ihre Mitglieder Lohndifferentiale durchsetzen und Diskriminierungen benachteiligter Gruppen abbauen. Die unterschiedliche Entwicklung der gewerkschaftlichen Mitgliederstärke in westlichen Industrieländern, die nicht auf die (überall ähnliche) Beschäftigungsstrukturentwicklung oder einen Wandel der Einstellungen zurückgeführt werden können, analysiert RICHARD FREEMAN. Er stellt fest, dass korporatistische Arbeitsbeziehungen, hohe Inflationsraten und hohe Arbeitslosigkeit (dort wo Gewerkschaften Arbeitslosengeld ausgeben) den gewerkschaftlichen Organisationsgrad positiv beeinflussen, und dass scheinbar geringe institutionelle Unterschiede grosse Auswirkungen haben können.

Um Flexibilität und Arbeitslosigkeit dreht sich der dritte Teil des Buches. SAMUEL BOWLES und ROBERT BOYER konstruieren verschiedene Modelle, in denen Flexibilität und Dezentralisierung des Arbeitsmarktes sich - entgegen weitverbreiteter Ansicht - nicht positiv auswirken. In einem völlig entgegengesetzten Ansatz argumentiert ANDREW NEWELL und JAMES SYMONS empirisch gestützt, dass die Arbeitslosigkeit in Grossbritannien (und in anderen Ländern) ab den siebziger Jahren fast zwangsläufig steigen musste: das durch Weltkriegs- und Depressionserfahrungen ausgelöste "goldene Zeitalter" einer Aversion der Arbeitnehmerschaft gegen Arbeitslosigkeit - gekennzeichnet durch moderate Lohnforderungen, geringe Flukturation sowie "Heim- und Herd"-Einstellungen - sei zu Ende gegangen. ASSAR LINDBECK und DENNIS J. SNOWER wenden ihre "insider-outsider"-Theorie auf interindustrielle Lohnstrukturen an und zeigen auf, wie die Kosten eines Scheiterns von Tarifverhandlungen und damit die durchsetzbaren Lohnerhöhungen für alle Arbeitnehmer eines Wirtschaftszweiges von Variablen wie Gewinn, Kapitalintensität, Konzentration und Insider-Macht abhängen. Eine Effizienzlohninterpretation favorisieren hingegen CARLO DELL'ARINGA und CLAUDIO LUCIFORA bei ihrer ökonometrischen Quer- und Längsschnittanalyse der Lohnfindung und Produktivitätsentwicklung in Italien. Mit dem Vergleich von Arbeitsmarktinstitutionen beschäftigt sich DAVID MARSDEN. Er stellt fest, dass in Frankreich und Italien interne Arbeitsmärkte vorherrschen, während in Grossbritannien und Deutschland qualifizierte Arbeitnehmer Zugang zu vielen Firmen haben. Im abschliessenden Referat kritisiert GUY STANDING massiv das Konzept einer angebotsorientierten Wirtschaftspolitik, doch hat er - ausser einem blinden Glauben an den Wohlfahrtsstaat - keine überzeugende marktwirtschaftliche Alternative zu bieten.

Abgesehen von dieser und wenigen Ausnahmen sind die Referate im allgemeinen von hohem Niveau und gut verständlich. Wo erforderlich, werden meist empirische Belege herangezogen, ohne dass die Beiträge zu Zahlengräbern oder mathematisch-ökonometrischen Selbstdarstellungen werden. Insgesamt bietet der Konferenzband einen guten Querschnitt der Forschung auf den Gebieten Korporatismus, Arbeitsbeziehungen, Gewerkschaften sowie Arbeitsmärkte und ist deshalb allen Interessierten zu empfehlen.

Claus Schnabel, Köln

Einführung in die Wirtschafts - und Sozialstatistik der Schweiz.

Ed. par Peter Bohley et Armin Jans. Berne 1990. Paul Haupt. X, 396 p. 34 frs.

La parution, en été 1990, d'un livre consacré à une introduction à la statistique économique et sociale en Suisse doit être cosidérée comme un événement primordial dans le monde des économistes. En effet, un tel ouvrage faisait cruellement défaut aussi bien parmi les chercheurs et étudiants des Hautes Ecoles que dans les administrations, les grandes enterprises, les associations qui, de près ou de loin, s'intéressent à l'économie. Deux personnes ont eu le courage de se plonger dans les dédales de la statistique officielle en Suisse, non pas seulment pour en donner une énumération descriptive, mais pour nous en fournir une analyse complète, transparente et structurée. Cette analyse discute les fondements, les concepts, les méthodes d'élaboration et les utilisations de sept domaines de la statistique, ceci en vue d'assurer une liaison toujours plus étroite entre théorie et pratique P. BOHLEY et le Docteur A. JANS de l'Université de Zurich se sont adjoints pour réaliser cet ouvrage des spécialistes des différents thèmes traités.

Les chapitres relatifs aux différents domaines de la statistique économique et sociale en Suisse sont précédés d'une présentation de Monsieur CARLO MALAGUERRA consacrée à la place et à l'organisation de la statistique suisse. Selon le Directeur de l'Office fédéral de la statistique, l'activité statistique doit être, non seulement l'accomplissement d'une tâche administrative, mais un service public pour tous, dont le but est de parvenir à la livraison d'informations statistiques fiables, indispensables à la politique, aux administrations, à l'économie, à la science et au public, et ceci de facon conviviale. Sept principes fondamentaux sont cités par Monsieur Malaguerra pour pouvoir atteindre cet objectif: l'amélioration de la production des statistiques existantes, l'élargissement du domaine de l'information statistique, l'inscription des fondements juridiques dans une loi cadre, le renforcement de la situation de l'Office fédéral de la statistique, le développement des activités de recherche et la participation active au travail des organisations internationales.

Le premier chapitre qui ouvre l'analyse des divers thèmes est, comme il se doit, consacré à la statistique de la population, puisque la population est l'élément moteur de l'économie d'un pays. Ecrit par Monsieur W. HAUG, Chef de la division Population et emploi à l'OFS, ce chapitre, après une définition du champ couvert par cette statistique présente ses méthodes d'enquête et ses sources. Le recensement de la population y est discuté en détail, tant sur le plan de son organisation, que sur celui de la protection des données et de leur utilisation. Il en est de même des micro-recensements consacrés à des thèmes particuliers. Les sources administratives avec leur complexité et leur limites sont aussi présentées, ainsi que les statistiques dites de synthèse telles que le bilan démographique, les prévisions de population, la population active. La discussion des méthodes d'enquête et des sources est suivie d'une analyse comparée dans le temps de l'état et de la structure de la population ainsi que des moteurs de son évolution que sont la mortalité, la fertilité, les mariages, les divorces et les mouvements migratoires.

Le deuxiéme domaine, décrit par Monsieur P. AMMANN de l'OFIAMT, concerne la statistique du marché du travail. Ce chapître suit la même logique que le premier puisqu'il commence par la délimitation du champ et par les définitions et qu'il met ensuite l'accent sur les méthodes d'enquête et sur quelques résultats. La statistique de l'emploi et du chômage y sont présentées.

La Suisse étant un pays fortement lié à l'étranger, le domaine suivant est bien entendu celui du commerce extérieur qui est décrit et ananlysé par Messieurs H. BALMER et A. ZURWERRA, respectivement Chef de la division Statistiques du commerce extérieur et questions économiques et Chef de la section statistique à la Direction générale des douanes. Après avoir parlé des buts de cette statistique et rappelé son histoire, les auteurs en discutent les fondements, les sources et la récolte ainsi que de façon détaillée tous les thèmes qu'elle englobe.

La statistique des finances publiques est présentée dans le chapitre suivant. Le secteur public y est clairement délimité, de même que les données financières s'y rapportant. Dans un domaine aussi complexe par son organisation, qui relève de la Confédération, des Cantons et des Communes, il était nécessaire d'analyser les divers systèmes comptables en vigueur, ainsi que les propositions de révision en cours. Ceci est réalisé par le Professeur E.BUSCHOR de l'Université de Saint-Gall, par Monsieur A. LIENIN, Directeur du Service de statistique du Canton de Bâle-Campagne et par l'un des éditeurs, Monsieur A. JANS.

Secteur important de l'économie suisse, la banque a sa propre statistique développée par la Banque Nationale Suisse. C'est donc Monsieur C. MENZEL, Directeur de la section statistique de cet établissement qui a rédigé le chapitre consacré à ces informations. Celles-ci concernent la masse monétaire, le marché de l'argent et des capitaux, le marché des devises et les activités bancaires.

L'avent-dernier domaine la statistique des prix. Ecrit par Monsieur D. KOCH, Chef de la section Prix et consommation à l'OFS, ce chapître discute les deux principaux indicesde prix disponibles en Suisse: l'indice des prix à la consommation et l'indice des prix de gros. Les buts de ces indices, les paniers de biens sous-jacents, les méthodes d'enquête et de calculs y sont présentés clairement. D'autres indices sont également analysés, il s'agit de l'indice des coûts à la construction et des parités de pouvoir d'achat.

Le dernier chapitre est écrit par l'un des éditeurs, Monsieur A. JANS et est consacré à la statistique de synthèse par excellence qu'est la comptabilité nationale. Après un rappel des principaux concepts et définitions et un tour d'horizon de la situation actuelle de cette statistique en Suisse, l'auteur en présente ses lacunes.

Cette brève énumération des thèmes traités dans l'ouvrage a un effet extrêmement réducteur de la richesse des informations qu'il contient. Comme déjà mentionné précédemment ce livre est plus qu'une somme de sujets juxtaposés: il présente une réflexion sur l'état et l'avenir de la statistique en Suisse. En effet, chaque chapitre suit la même logique, certainement voulue par les éditeurs, qui dépasse la description pour aller plus profondément vers les concepts et les méthodes de la statistique. Celle-ci n'étant pas une fin en soi, mais devant toujours mieux répondre aux attentes de ses différents utilisateurs,

afin de leur fournir les informations nécessaires à la prise de décisions dans de nombreux domaines économiques et sociaux, chaque chapitre présente également une ouverture sur les résultats du domaine et sur les modifications et révisions en cours ou souhaitées. Des références bibliographiques complètes et actuelles sont aussi disponibles. Nous ne pouvons que remercier et féliciter les auteurs pour la mise à notre disposition d'un ouvrage de référence sur la statistique économique et sociale en Suisse.

Gabrielle Antille, Genève