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Macroeconomic Policies and the Best Environmental-Oriented Policy in Agricultural Sector of Iran (Case of Soil Erosion)

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Abstract: This study investigated how the appropriate environmental policy may change during a long-term macroeconomic planning and under different policy weights. For this purpose, a simple general equilibrium model has been established. Results showed that choosing the appropriate policy is depend on preferences of government; so that when weight of environmental factors in policy making is less than 40% (weight of economic factors is more than 60%), lowland food production subsidies policy is preferable policy and when weight of environmental factors is more than 40%, upland food production tax policy is appropriate policy. Base on results of this study, as the weight of environmental and economic factors changed in this study, one can think about changing the weight of any of economic factors. For example, if PPI doesn't have any importance in policy making, it can be eliminated and if government wants to give more attention to consumer prices than producer prices, policy maker can set the weight of CPI more than that of PPI in ranking.

Key words: Economic, ranking, soil erosion, general equilibrium, simulation

INTRODUCTION

Soil is one of the important factors of agriculture production that prepares the ground for other factors and it has a vital rule in prevention of some undesirable social phenomena such as immigration. Soil erosion is frequently mentioned as a major economic and environmental problem especially in developing countries (Hosseini and Ghorbani, 2001, 2004; Hosseini *et al*., 2003; Wu *et al*., 2003; Ghorbani and Hosseini, 2004b; Min-Jun and Kevin, 2004; Demeke and Coxhead, 2006; Long *et al*., 2006). More than annually 100 million m^2 sediment behind dams shows the severity of soil degradation in uplands of Iran.

Soil erosion is either due to rapid and uncontrolled deforestation of slopping uplands and their conversion to agriculture or soil-degrading and erosive agricultural practices in uplands. While the former had been more noteworthy, the latter is frequently mentioned as a serious problem in developing countries (Hosseini *et al*., 2003; Ghorbani and Hosseini, 2004a; Senahoun *et al*., 2001; Long *et al*., 2006).

Whereas many analysis of soil erosion problem are looking for the solutions in upland areas themselves, some evidence shows that macroeconomic polices such as taxes, tariff rates and relative price changes can induce substantial changes in both lowland and upland agricultures, even in developing countries which don't seem to have strong market linkages (Long *et al*., 2006; Coxhead and Demeke, 2004; Coxhead and Jayasuriya, 1995).

In most of the developing countries trade and tax policies, such as trade liberalization policies or Pigovian tax, are being implemented. The impacts of these policies on the environment via induced changes in relative prices have important macroeconomic policy implications and have attracted serious attention (Deal, 2004; Goodwin and Smith, 2003; Senahoun *et al*., 2001; Gueorguieva, 2005). There are arguments for and against the idea that trade liberalization could promote environmental degradation in developing countries. Some researchers believe that environmentally beneficial policy results could, under some circumstances, be achieved by indirect policies-such as trade policies-as effectively as direct policies-such as Pigovian tax policies (Coxhead and Jayasuriya, 1995). Together with examining these conclusions for Iran's situation, this study tried to pay more attention to practical problems of such environmental policy makings. First problem is that Iran is a relatively wide country in which there are several provinces with different geographical and economical characteristics. These differences prevent offering a unique policy for all the country. Second, preferences of government between economic and environmental factors probably play a key

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role in policy making. In other words, weight of economic and environmental factors in policy making may affect choosing the appropriate environmental or economic policy. Third, in many of developing countries like Iran, environmental factors have a very small importance in macro-planning and increasing their weight in policy making needs a long term planning in which government can increase the weight of environmental factors gradually. During such long-term planning, appropriate environmental policy may change as the weight of environmental factors increase.

This study investigated the environmental and economic effects of four trade and tax policies under different circumstances in Iran. Then, compared and chose the appropriate policies under various economic and environmental policy weights. Results of this study can help policymakers in planning of agricultural sector in macroeconomic level and establishing plans and projects on agricultural lands to decrease the soil erosion and move to environmental-oriented policies and thereby, improving the productivity of lands.

MATERIALS AND METHODS

For this purpose, a simple general equilibrium model has been established. Despite the simplicity, this model can reflect key structural and policy features of such economies as well (Coxhead and Jayasuriya, 1995). Under discussion policies are: tree crops export subsidy, upland food production tax, manufacturing import tariff and lowland food production tax. While the two first policies have a direct effect on upland use pattern, the two last ones have an indirect effect on it.

Analysis of policy change impacts on soil erosion is standing on two key assumptions. First, soil erosion in slopped upland areas is more than flat lowland areas, Ceteris paribus. Second, completely different rates of soil erosion are associated with perennial crops and annual crops in sloping uplands.

The most important models to evaluate the impact of macroeconomic policies on environment are input-output (I-O), econometric, Computable General Equilibrium (CGE) and Linear Programming (LP) models. The limiting factor to utilize each of these models is the unavailability of complete and reliable data. Aside from data problems, each of them has other problems. I-O and LP models assume fixed technical coefficients which may not be appropriate in several cases. Therefore, they do not tolerate substitution of inputs and economies of scale. A limitation of the dynamic econometric models for use in the evaluation of policy impacts again is the unavailability of time-series data, not only for economic variables but more particularly the environmental variables, especially in developing countries (Israel, 1994).

While there are some problems (such as data availability, theoretical problems and computational difficulties) with general equilibrium models, they are more appropriate for present purpose-analyzing environmental and economic impacts of macroeconomic policies. Choosing the general equilibrium approach in our analysis has several reasons. First, the incentives which affect resource allocation in the uplands can be significantly influenced by policies whose direct impact is on another sector, such as a tariff on manufactured goods (Table 1). Second, policies which are supposed to reduce soil erosion must be evaluated also in terms of their impact on other sectors and targets (such as GNP growth and inflation rate). Third, practical and adequate solutions for environmental problems of developing countries, where there are different distortions, usually are second-best instruments instead of first-best Pigovian taxes. General equilibrium models are relevant approaches for policy evaluation in such circumstances (Coxhead and Jayasuriya, 1995).

This study demonstrates a model of a stylized, small, open, developing country with tariff-distorted prices. This model shows how the policy changes affect the allocation of upland land between annual food crops and perennial tree crops. These crop pattern changes give the environmental (here soil erosion) impact of policy changes. Price and output changes are chosen as economic indexes of policy change impacts. Third part shows our database, numerical simulation results of policy changes and choosing the best policy in different

Table 1: Data base for simulations

Parameters	Upland food	Lowland food	Tree crops	Manufacturing	Total
Sector share in GNP	0.051	0.232	0.115	0.602	1
Factor share in total cost					
Upland land	0.735	0.000	0.356	0.000	
Upland labor	0.265	0.000	0.644	0.000	
Lowland labor	0.000	0.357	0.000	0.807	
Lowland land	0.000	0.643	0.000	0.000	
Manufacturing capital	0.000	0.000	0.000	0.193	
Total	1.000	1.000	1.000	1.000	
Budget share of goods	0.347	0.347	0.176	0.477	1
Allen elasticities of factor substitution	0.200	0.500	0.200	0.500	
Initial subsidy and tariff rate (%)	0.000	0.000	0.000	0.300	

policy weights. Last section is allocated to conclusions and the policy implications. This study used the macro-economic data of agricultural sector of Iran and is done in 2007-2008.

RESULTS AND DISCUSSION

Results of sensitivity analysis of 14 different elasticities, which were used in simulations, show that choosing the preferable policy is severely dependent on amount of elastisities. In addition, in some circumstances a policy has well economic and unfavorable environmental (soil erosion) effects and vice versa. Therefore, choosing the policy which is probably most adequate in different situations, policies were ranked using 6 economic and one environmental factor. Ranking of policies is presented in Table 2 as an example of ranking of all 15 various situations.

The policy which decreases the land use in upland food more than the other policies (or increase it less than others), gets 4 points and the policy which decrease the land use in upland food less than the other policies (or increase it more than others), gets 1 point. Ranking the policies for economic factors is exactly same as what explained above for soil erosion factor. After ranking the policies in all 15 situations, points of each policy in all 15 situations were added. Result of ranking for base situation is presented in the first row of Table 3. According to first row of Table 3, lowland food production subsidy policy is probably the most adequate policy in various situation of the country. This conclusion can cast doubt because, as shown in Table 2 the ranking is on the basis of only one environmental factor, but 6 economic factors. That is, weight of economic factors in ranking is six times larger than weight of environmental (soil erosion) factor. Resolving this problem, the weights of environmental and economic factors in ranking were changed and results of ranking in different policy weights are shown in Table 3.

As shown in Table 3, when the weight of environmental (soil erosion) factor is less than 40%, lowland food production subsidy policy is probably the most adequate policy in different situations of the country. Increasing the ratio of environmental factor's weight to economic factors' weight, preference of lowland food production subsidy policy compared to upland food production tax policy decreases. So, that, when soil erosion factor's weight exceeds 40%, upland food production tax policy prefers to lowland food production subsidy policy. It means when policy makers give more importance to environmental factors compared to economic factors, the probability of upland food production tax policy to be the most adequate policy increases. Therefore a long-term planning in which weight of environmental factors is primarily low and gradually

Table 2: Ranking the policies in basic situation

Endogenous variables	10% export subsidy on tree crops	10% tariff reduction in manufacturing	10% upland food production tax	10% lowland food production subsidies
Upland food output	2	1	3	4
Tree crops output	1	2	3	4
Manufacturing output	2	4	1	3
Land use in upland food	1	2	4	3
Consumer price index (CPI)	1	4	2	3
Producer price index (PPI)	4	1	3	2
Real aggregate output	2	3	3	4
Total	13	17	19	23

Table 3: Choosing the best policy under different policy weights

Row	Tariff reduction in manufacturing	Export subsidy on tree crops	Lowland food production subsidies	Upland food production tax	Economic factors' weight (%)	Environmental factor's weight (%)
1	215	220	327	291	86.0	14.0
2	239	244	372	348	75.0	25.0
3	263	268	417	405	67.0	33.0
4	287	292	462	462	60.0	40.0
5	311	316	507	519	55.0	45.0
6	335	340	552	576	50.0	50.0
7	359	364	597	633	46.0	54.0
8	383	388	642	690	43.0	57.0
9	407	412	687	747	40.0	60.0
10	431	436	732	804	37.5	62.5
11	455	460	777	861	35.0	65.0
12	479	484	822	918	33.0	67.0
13	503	508	867	975	31.5	68.5
14	527	532	912	1032	30.0	70.0
15	551	556	957	1089	28.5	71.5
16	575	580	1002	1146	27.0	73.0
17	599	604	1047	1203	26.0	74.0
18	623	628	1092	1260	25.0	75.0

increases may be begun with an indirect policy, which has favorable economic effects and be continued with a direct policy which pays more attention to environmental factors.

Comparing the two trade policies shows that the difference between points of tree crops export subsidy policy and tariff reduction in manufacturing policy stays fixed in various policy weights, though the difference is very small. That is, whether environmental factors have more importance or economic factors have more importance, tree crops export subsidy policy is superior to tariff reduction in manufacturing policy. The most similar study to this study belongs to Coxhead and Jayasuriya (1995), but they only estimated and analyzed the results of one of our 15 different situations, which confirmed present results and didn't proceed to choose appropriate policies under different policy weights or in a long-term planning. As far as writers know, no other related study in soil erosion literature has accomplished to knowledge up to this step.

CONCLUSION

Trade taxes such as import tariff and export tax are important fiscal policy instruments. Also, they are important components of Structural Adjustment Programs (SAPs) that are established to reduce allocative inefficiency. While there are common fears about the negative relationship between SAPs and environment quality, results of this study show trade liberalization policies such as import tariff reduction can establish in a long-term macro-planning and improve the quality of environment, at least in case of soil erosion.

As the weight of environmental and economic factors changed in this study, one can think about changing the weight of any of economic factors. For example, if PPI doesn't have any importance in policy making, it can be eliminated and if government wants to give more attention to consumer prices than producer prices, policy maker can set the weight of CPI more than that of PPI in ranking.

All over the above conclusions the reader mustn't forget the importance of economic and political costs of implementing a policy, which can play a key role in accepting a policy by government. Thus, all the policy recommendations in this study are severely dependent on the pressure of policies on treasury and political problems of implementing the policies. Since evaluating this kind of costs and problems is dependent on extent of policy implementation and some geographical and economic parameters of subject region, this study was unable to do it, while it seems to be necessary doing these evaluations before implementing such policies.

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