**Trade-Off Between Emigration and
Remittances in the Portuguese
Economy**

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ABSTRACT

This paper develops an optimal growth model in which resident labor force is allowed to emigrate due to wage differentials in the home and host countries and to send back remittances. The model is implemented with Portuguese data to determine the welfare and growth effects of the substantial emigration flow of the 1960's, as well as the potential effects of the liberalization of labor force movements that will follow the recent integration of Portugal in the European Economic Community (EEC).

Simulation results suggest that past emigration has positive welfare effects, which means that the positive effects of remittances dominate the negative welfare effects of de-population. However, the annual growth of domestic production has been slowed down by about half a percentage point. In turn, the liberalization of Portuguese labor force movements in the EEC is likely to provoke a substantial flow of new emigrants if the current trend of low increase in the domestic real wages persists. New emigration will at best tend to stagnate domestic production as remittances will become increasingly important. Still, under most scenarios new emigration is welfare-improving for the resident population.

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1. Introduction

Portugal has traditionally been a country of emigration - directed in the last three decades to the European Economic Community (EEC), in particular France and Germany. In the recent past, emigration has been hindered by legal and economic conditions both in Portugal and in the host countries. These, coupled with a long-run improvement in the economic conditions in Portugal, explain why the enormous wave of emigration in the 60's was followed by a slowdown in the late 70's and by a situation of virtually no emigration in the early 80's. With the recent integration of Portugal in the EEC, the legal barriers to the movements of the Portuguese labor force within the Community will have to be removed. However, the real wage gap between Portugal and the EEC, in particular France and Germany, is not likely to disappear. In fact, the pursuit of policies tending to raise the relative real wage rate is highly undesirable for the Portuguese economy because of their effects on the international competitiveness of Portuguese exporting goods. All given, upon liberalization of labor movements, Portugal will likely face heavy pressure towards a drain of laborers to the EEC - further emigration is likely to take place.

This paper has two main objectives. The first objective is to study the effects of past emigration on the Portuguese economy under the assumption that the current barriers to further emigration are maintained. In fact, the Portuguese emigrated labor force in the EEC is substantial - about 13% of the total Portuguese national labor force - and as such it is bound to have some impact in the domestic economy, both as foregone labor force, and as a source of remittances. The second objective of this paper is to study the potential effects on the Portuguese economy of the

liberalization of the Portuguese labor force movements in the EEC.

The answers to these two questions are of great relevance in terms of policy-making. Traditionally, while formally wailing the loss of citizens, the Portuguese governments have been always eager to foster emigrants' remittances as opposed to create the conditions for the emigrated workers to return to the country. Remittances have been perceived as an important factor in terms of the balance of payments but especially as a complementary source of savings to the economy. Accordingly, several incentive schemes - higher interest rates, currency-denominated bank accounts, are just two examples - have been designed to capture such remittances. The desirability and benefits of these policies are empirical matters. The most adequate policies to be pursued, be they designed to encourage remittances or discourage emigration/promote return of emigrated workers, depend on the evaluation of the net effects of past emigration. On the other hand, faced with renewed international mobility of the labor force, the Portuguese economy will have to go through a structural adjustment process. In this sense, the impact of liberalization in terms of further emigration as well as the potential effects of such future emigration in the domestic economic growth and well-being have been questions of paramount concern for the recent Portuguese governments. This paper attempts to give partial answers to the above questions by emphasizing the trade-off between foregone labor force and emigrant's remittances in the Portuguese economy.

This paper models the Portuguese economy in a context of optimal growth with emigration and remittances along the lines of Macedo (1977) and Pereira (1982). In Macedo (1977), the standard neo-classical growth model - see Solow (1956) for seminal work in this area - is modified so that part of the domestic labor force is allowed to emigrate due to wage differentials between the home and the host countries. While the reduction in labor force via emigration is costly in terms of foregone domestic production, it might be compensated by the increase in national income which results from emigrants' remittances to their families. In Pereira (1982), Macedo's

model is extended to an optimal control framework and the trade-off between emigration and remittances for the home economy is spelled out.

The optimal growth model in this paper is a discrete-time version of Pereira's model generalized to accomodate numerical implementation. This model is used to simulate the overall impact of emigration for the home country under different scenarios. Such scenarios are related to the evolution of the wage gap as conditioned by the rate of growth of the international wage rate, and the domestic rate of technological progress. Simulation results suggest that under the status quo of no further emigration, past emigration will have a positive welfare effect in the Portuguese economy. This reflects a systematic gain of about 17% over the bench-mark in terms of per capita consumption. The implication is that the positive effect of a steady flow of emigrants' remittances will override the negative welfare effect of depopulation. In turn, the growth of domestic production is slowed down by about half a percentage point vis-a-vis the bench mark. In the light of these simulation results, the traditional policies of the Portuguese governments of encouraging remittances rather than the return of the emigrants seem to be justified.

In turn, the liberalization of the international movements of the Portuguese labor force in the EEC is likely to provoke a substantial flow of new emigrants if the current trend of relatively low increase in the domestic real wages persists together with low domestic technical progress. Emigration will be substantially lower under less pessimistic scenarios - about 300 thousand workers in a decade for moderate growth of the international wages and moderate domestic technical progress. In general, new emigration will tend to depress or at the best stagnate domestic production. On the other hand, remittances can be anticipated to have an increasing role in the national income. Together, expanded national income is simulated to boost current consumption and depress investment. All considered, allowing further emigration is under most scenarios welfare improving for the resident population. These results suggest that the government should try to defer the liberalization of labor force movements until such a time in which the negative effects of

further emigration on domestic production will be minimized by increased investment and productivity.

This paper is organized as follows. Section 2. details the theoretical model as well as the characterization of the optimal trajectories for the economy. Section 3. presents the different simulation scenarios and the simulation results. Finally, section 4. provides a summary of results and some concluding remarks. In addition, a data appendix is included.

2. The Optimal Growth Model and the Optimal Trajectories

The general optimal growth model with emigration and remittances in this paper - an extension of a model developed in Pereira (1982) - can be specified as follows.

$$(1) \text{Max}\{C\} SW = \sum_{0 \leq t < \infty} r^t U(C_t/L_t)$$

where

$$(2) U(C_t) = \ln(C_t/L_t)$$

subject to:

(i) national accounting identity

$$(3) R_t + F(K_t, L_t) = C_t + I_t \quad (t=0, \dots, \infty)$$

where

$$(4) F(K_t, L_t) = (1+TP)^t A_0 K_t^b L_t^{1-b}$$

(ii) equations of motion for the state variables K_t and E_t

$$(5) K_{t+1} = I_t + (1-d)K_t \quad (t=0, \dots, \infty)$$

$$(6) (E_{t+1} - E_t)/E_t = g + \theta(W_t/V_t) \quad (t=0, \dots, \infty)$$

where

$$(7) G(W_t/V_t) = h[1 - (W_t/V_t)]$$

(iii) labor force equations

$$(8) P_t = zE_t + L_t \quad (t=0, \dots, \infty)$$

$$(9) P_t = (1+g)^t P_0 \quad (t=0, \dots, \infty)$$

(iv) domestic wage rate determination

$$(10) W_t = (1-b)A_t(K_t/L_t)^b \quad (t=0, \dots, \infty)$$

(v) remittances equation

$$(11) R_t = s_e V_t E_t \quad (t=0, \dots, \infty)$$

$$(12) V_t = (1+v)^t V_0 \quad (t=0, \dots, \infty)$$

(vi) initial conditions on the stock variables

$$(13) K_0 = K^0 \text{ and } E_0 = E^0$$

(vii) feasibility constraint on the control variable C_t

$$(14) 0 \leq C_t \leq R_t + F(K_t, L_t) \quad (t=0, \dots, \infty)$$

where C_t is consumption, the choice variable; K_t is the capital stock; I_t is investment; L_t is the domestic labor force; E_t is the emigrated labor force; R_t is emigrants' remittances; W_t is the domestic wage rate; P_t is the exogenous total labor force; V_t is the exogenous international wage rate; and, $0 < r < 1$ is the subjective discount rate to be interpreted as the constant marginal

rate of transformation between present and future utility; A_0 is the output scaling factor; TP is the Harrod-neutral rate of technical progress; b is the capital share in total output; g is the natural growth rate of the native labor force; d is the depreciation rate of capital stock; z adjusts for different labor force participation rates between domestic and emigrated population; h measures the responsiveness of emigration to changes in the wage differential; s_e is the savings rate of emigrated labor force; and v is the rate of growth of the international wage rate.

The objective function to be maximized (1), is a time separable social welfare indicator, SW . This indicator is specified as the discounted value at time 0 of the intertemporal stream of utility, as measured by a well-behaved time-invariant utility function $U(\cdot)$, defined on the space of domestic consumption per unit resident labor force. In the sequel, the functional form for the utility function is given by (2).

The national accounting identity (3) states that total national income at any t is generated by domestic production $F(\cdot)$, as well as by emigrants' remittances. Given non-satiation total income is to be exhausted by consumption and investment expenditures. The domestic production function as in (4) is a constant returns to scale Cobb-Douglas function with Harrod-neutral technical progress.

The equation of motion for capital (5) reflects the fact that investment is the gross (net plus depreciation) increase in the capital stock. In turn, the equation of motion for emigration (6) reflects the idea that rate of increase in emigration has a natural (exogenous) component associated with the demographic growth of the national labor force g , and an endogenous economic component $G(\cdot)$ related to the differential between the domestic and the international wage rates. The emigration function is required to satisfy first $G(1)=0$ (i.e. when domestic wages rise to the international level E_t is stabilized), and second $\partial G/\partial(W_t/V_t)<0$ (i.e. the higher the wage differential, the higher the changes in emigration caused by economic factors). In particular, $G(\cdot)$

is parametrized as in (7).

Total labor force - domestic plus emigrated as in (8) - grows at an exogenous rate g , as in (9). The domestic wage rate is consistent with cost-minimizing behavior and is determined as in (10) as the value of the marginal productivity of labor. (Notice that we are implicitly treating W_t as the real wage rate.) Equation (11) establishes that remittances depend not only on the international wage rate - postulated to grow at an exogenous rate v , as in (12) - but also on the savings rate of the emigrated labor force. Finally, (13) are the terminal conditions on the stock variables and (14) are boundary conditions on the control variable C_t .

Model (1)-(14) can be rewritten in a condensed form as follows:

$$(15) \text{ Max } \{C_t\} SW = \sum_{0 \leq t < \infty} r^t \{ \ln[C_t / ((1+g)^t P_0 - zE_t)] \}$$

$$\text{s.t. } (16) K_{t+1} = (1+TP)^t A_0 K_t^b [(1+g)^t P_0 - zE_t]^{1-b} + s_e V_t E_t - C_t + (1-d)K_t \quad (t=0, \dots, \infty)$$

$$(17) E_{t+1} = \{1+g+h[1-[(1-b)A_t(K_t/[(1+g)^t P_0 - zE_t])^b]/V_t]\} E_t \quad (t=0, \dots, \infty)$$

$$\text{s.t. } (18) K_0 = K^0 \text{ and } E_0 = E^0;$$

$$\text{s.t. } (19) 0 \leq C_t \leq R_t + F(K_t, (1+g)^t P_0 - zE_t) \quad (t=0, \dots, \infty)$$

The Hamiltonian function associated to this problem is given by

$$(20) H(K_t, E_t, C_t, q_{1t+1}, q_{2t+1}) = r^t \{ \ln[C_t / ((1+g)^t P_0 - zE_t)] \} \quad (t=0, \dots, \infty)$$

$$+ r^{t+1} p_{1t+1} [(1+TP)^t A_0 K_t^b [(1+g)^t P_0 - zE_t]^{1-b} + s_e V_t E_t - C_t + (1-d)K_t]$$

$$+ r^{t+1} p_{2t+1} [\{1+g+h[1-[(1-b)(1+TP)^t A_0 (K_t/[(1+g)^t P_0 - zE_t])^b]/V_t]\} E_t]$$

In the above, $q_{it+1} = r^{t+1} p_{it+1}$ with $i=1,2$ are the co-state variables interpreted as the discounted shadow prices of additional capital and emigration, measured in terms of utility. Accordingly, the Hamiltonian function may be interpreted as the imputed utility value at t of income - consumption plus investment - plus the imputed utility value of additional emigration, all discounted to time zero.

The solution to the optimal growth problem (15)-(19) is characterized by using the discrete-time version of Pontryagin's Maximum Principle (see Luenberger (1979) for example). If, (K_t^*, E_t^*) and $\{C_t^*\}$ represent the optimal state and control trajectories respectively for the optimal control problem (15)-(19) then there is an adjoint trajectory (p_{1t}^*, p_{2t}^*) such that together $\{K_t^*, E_t^*, C_t^*, p_{1t}^*, p_{2t}^*\}$ satisfy:

(viii) the state equations of motion as in (16) and (17)

(ix) the initial conditions for the state variables as in (18)

(x) the co-state equations of motion

$$(21) \quad p_{1t} = r p_{1t+1} [b(K_t / [(1+g)^t p_0 - z E_t])^{b-1} + (1-d)] \\ + r p_{2t+1} [-hb(b-1)(1+TP)^t A_0 (K_t / [(1+g)^t p_0 - z E_t])^b E_t / K_t Y_t] \quad (t=0, \dots, \infty)$$

$$(22) \quad p_{2t} = r p_{1t+1} \{(-z)(1-b)b(1+TP)^t A_0 [K_t / [(1+g)^t p_0 - z E_t]]^b + s_e Y_t\} \\ + r p_{2t+1} [\lambda \{ (1+g+h[1-((1-b)(1+TP)^t A_0 (K_t / [(1+g)^t p_0 - z E_t])^b) / Y_t]) E_t \} / \partial E_t] \\ + \{z / [(1+g)^t p_0 - z E_t]\} \quad (t=0, \dots, \infty)$$

(xi) terminal conditions on the co-state variables

$$(23) \quad \lim_{t \rightarrow \infty} r^t p_{it+1} = 0 \quad i=1,2$$

(xii) the Hamiltonian variational condition for the control variable

$$(24) \quad 1/C_t = r p_{1t+1} \quad (t=0, \dots, \infty)$$

These necessary conditions for optimality can be interpreted as follows. Conditions (viii) and (ix) just recover the two equations of motion for capital and emigrated labor force and the respective initial conditions. Conditions (x) indicate evolution of the rate of change of the Hamiltonian function derived from changes in the capital stock - equation (21) - and emigrated labor force - equation (22). Otherwise stated, conditions (x) indicate the evolution of the shadow utility price of capital and emigrated labor force, respectively. In turn, conditions (xi) provide terminal conditions for the shadow price variables. These conditions state that the Hamiltonian function does not change as a consequence of variations in the terminal conditions on the state variables. These transversality conditions can still be interpreted as reflecting that the scrap values of capital and emigrated labor force are both zero. Finally, conditions (xii) determine the optimal choice of consumption such that the utility value of income and emigrated labor force is maximized at each and every period. An interior optimal trajectory for consumption is assumed, which means that the inequalities in (19) are satisfied as strict inequalities.

The characterization of the optimal solution to problem (15)-(19) can be interpreted as a two-point boundary problem. In fact, the optimal solution can be seen as the solution to a system of four nonlinear difference equations - two for the state variables and two for the co-state variables - in four unknowns. This system of difference equations has two initial conditions for the state variables and two terminal conditions for the co-state variables. Given the complexity of this problem no attempt is made to develop an analytic solution and 'a fortiori' analytic comparative dynamic results. Instead, in the subsequent sections this optimal growth problem is solved numerically for different configurations of the crucial parameters in the economy.

3. Simulation Experiments and Results

The model in the previous section is implemented numerically using GAMS/MINOS - see Kendrick-Meeraus (1987) for some references to this program. The model is run with a time horizon of thirty-five years.

3.1 Design of the Simulation Experiments

The study of the effects of past emigration as well as the effects of the liberalization of labor movements requires the consideration of three sub-models nested in the general growth model in this paper. The first sub-model is the standard neoclassical growth model. It ignores emigration in the sense that it treats emigrated labor force as if it were still resident. The second sub-model is obtained from the general problem by setting $(E_{t+1} - E_t)/E_t = g$ and $s_g = 0$. It differs from the first sub-model only in that it captures the effect of 'depopulation' in the form of reduced initial total labor force. The third sub-model is obtained from the general problem by setting $(E_{t+1} - E_t)/E_t = g$ in (6). It differs from the second sub-model in that emigrated labor force is now allowed to send remittances back to the home country. In the last two submodels the home country is foregoing labor resources in the form of emigrated labor force and the natural growth rate of emigrated population.

The contrast between the first and the second sub-models allows us to determine the effects of emigration, as a pure loss of labor force. The contrast between the second and the third sub-models allows us to determine the effects of emigrants' remittances. Finally, the contrast between the first and third sub-models allows us to determine the net effects of past emigration - loss of labor force versus emigrants' remittances - when current emigration is blocked or non-existing. On the

Table 1

Welfare Effects of Past Emigration

			BC1	BC2	RC1
TP\	v				
			.01	.02	.03
.01	34.367	31.135	35.613	35.893	36.218
.02	38.007	36.718	38.899	38.119	39.379
.03	41.727	40.378	42.311	42.494	42.704

All considered - the costs of foregone labor force, and the benefits of emigrants' remittances - the global welfare evaluation of past emigration is always positive. It ranges from a 1.4% welfare gain in the most optimistic scenario for the evolution of the domestic economy (TP=.03, $v=.01$) to 5.4% in the most pessimistic scenario (TP=.01, $v=.03$). Such positive net effects reflect the negative opportunity cost of resident labor force, i.e. the persistently higher marginal productivity of the national labor force when in use in the host economy.

The welfare improvements due to emigration and remittances are monotonic increasing in v . This reflects the fact that when the international wage rate is increased one percentage point, remittances increase by $s_g E$. Also, the welfare improvements due to emigration and remittances are monotonic decreasing in TP. This reflects the fact that the higher the rate of technical progress the higher the marginal productivity of labor and 'ceteris paribus' the lower the differential between the wages the emigrated workers are getting in the host country vis-a-vis what they would be getting in the home country. Also, the level of remittances sent back by the emigrated labor force is not affected by changes in the domestic rate of technical progress.

To conclude, under the current legal and economic barriers to further emigration the

existence of emigrated labor force that send back remittances induces a clear welfare improvement over the next few decades to the Portuguese resident population. From this standpoint the policy of the different governments in the past decade of attracting emigrants' remittances rather than attracting the emigrants back to the country seems justified.

The welfare analysis based on the comparisons of social welfare derived from intertemporal consumption per resident population provides only one measure of the effects of previous emigration. This discussion turns now to other possible indicators. The discussion is centered on the base cases - BC1 and BC2 - as well as on three revised cases with moderate rate of domestic technical progress and low (RC1L), moderate (RC1M) and high (RC1H) rates of growth of the international wage rate.

The simulated evolution of consumption per resident worker is depicted in Figure 1. Remittances in the RC1's clearly induce a systematic improvement in the per capita consumption over BC1 and BC2. This fact, which is consistent with the previous welfare analysis, mirrors exclusively an increase in total consumption under the different RC1's, since the resident labor force is the same in the five cases depicted.

The simulated evolution of the capital/labor ratio in the revised cases vis-a-vis BC1 is depicted in Figure 2. The ratios for the three revised cases are not significantly different. However, for all the RC1's the capital-labor ratio is systematically higher than in BC1. This can be accounted for partially by the higher level of resident labor force under BC1. Also, remittances contribute to a quicker growth of the capital-labor ratio in the RC1's vis-a-vis BC1. In the long run the higher capitalization in the status quo tends to disappear, the capital-labor ratios converging to the long run levels in the absence of emigration and remittances. The shorter-run gains stress the importance of transitional effects.

The simulated rate of growth of the domestic production is depicted in Figure 3. The declining

pattern is similar in the base case and the three status quo scenarios. The effects of foregone labor force can be identified as an average half percentage point decline in the rate of growth of the GDP.

Finally, Figure 4 depicts the contribution of remittances to total national income (GDP plus remittances). Under all the RC1's, remittances are a declining component of national income, varying between 8% and 10% for high rate of growth of the international wages and between 5% and 10% for low rates of growth. Naturally, remittances tend to be more important the higher the rate of growth of the international wages.

3.3 The effects of integration: future emigration

In this subsection the effects on the Portuguese economy of the integration of Portugal in the EEC and the future liberalization of the movements of the Portuguese labor force within the EEC are analyzed. The nine revised cases RC2's feature a combination of low, moderate and high rate of growth of the international wage rate with low, moderate and high rates of technical progress. These cases should be contrasted with the corresponding RC1's, which represent the status quo, to measure the consequences of the liberalization of the labor force movements.

The welfare effects of liberalization and the associated increment in emigration and emigrants' remittances under the different scenarios are summarized in Table 2. Lifting the legal barriers to the movements of the Portuguese labor force is in general welfare improving for the Portuguese resident population. The only exception is the scenario reflecting the most optimistic evolution for the domestic economy - high rate of technical progress coupled with low growth of international wages, in which case welfare is reduced by about 10%. At any rate, the welfare effects in the case of potential future emigration are of a higher order of magnitude than the previous analysis of the effects of past emigration. The highest gain is about 47% under high rate

of growth of the international wages and low domestic technical progress.

Table 2
Welfare Effects of Future Emigration

	RC1			RC2/RC1 (%)		
TP\w	.01	.02	.03	.01	.02	.03
.01	44.218	49.255	53.105	124.1	137.0	146.6
.02	41.150	47.098	51.896	106.8	120.4	131.8
.03	38.747	43.844	49.932	91.6	103.2	116.5

As with the analysis of the effects of past emigration the welfare gains from liberalization vary directly with the rate of growth of the international wage rate. However, the effects are now much larger. In fact, when further emigration due to wage differentials is permitted, the change in remittances due to a percentage point change in w is $s_e E(1 + e_{Ew})$, where e_{Ew} is the positive elasticity of emigration with respect to the international wage rate. Also, the welfare gains vary inversely with the rate of domestic technical progress. The higher TP the lower the wage differential between Portugal and the EEC and the lower the potential for future emigration flows. Also, the lower the emigrated labor force the lower are remittances.

To conclude, opening up the Portuguese economy to allow for further emigration flows into the EEC is in most scenarios welfare improving for the domestic economy. From this standpoint the policy of the last few Portuguese governments of pursuing integration in the EEC seems to be justified. Notice that it is the Portuguese integration that provides the institutional setting for the elimination of the barriers to the movements of the Portuguese labor force.

The welfare analysis based on the comparisons of intertemporal social welfare derived from the path of consumption per resident population provides only one measure of the potential effects of liberalization. This discussion turns now to other possible indicators. The discussion is centered on comparing the RC1 and RC2 with moderate rate of domestic technical progress and low (RC1L,RC2L), moderate (RC1M,RC2M) and high (RC1H,RC2H) growth of the international wage rate.

The evolution of emigrated labor force as a percent of the national labor force under the different scenarios is shown in Figure 5. Currently emigrants comprise about 13%. The simulations of the Portuguese economy in the first decade after liberalization places the percentage of emigrants in the national labor force between 18% in the case of low growth of international wages and 24% in the case of high growth. Given the differences in the labor force participation rates between domestic and emigrated labor force these percentages correspond to the actual emigration of between 220 and 470 thousand workers, respectively.

Also, the simulation results seem to imply that for sluggish evolution of the European economies - low growth of the international wage rate and low domestic technical progress - no substantial new emigration will take place. Only 75 thousand workers would leave the country in a ten year period. However, a substantial new wave of emigration is likely to occur if the current trend of low increase of the domestic wage rate persists. In fact, when the difference of vitality between the Portuguese and the EEC economies is exacerbated - high rate of growth of the international wage rate and low domestic technical progress - about 500 thousand workers are simulated to leave the country.

The relationship between welfare gains and optimal emigration shows a "Laffer curve" effect (see Figure 6). For low levels of emigration increasing emigration is welfare improving. The welfare gains peak at 120 thousand new emigrants in a ten year period and decline after that. For

very high levels of emigration welfare gains are actually negative. This 'Laffer Curve' effect suggests that for low or moderate levels of emigration, a further increase in emigration will generate high remittances relative to the domestic marginal productivity of labor. However, for high levels of emigration, the marginal productivity of domestic labor becomes very high and the wage differential between home and host countries very low. The relative impact of remittances will then be minimized and eventually be dominated by the loss in domestic labor force.

The simulated evolution of the capital-labor ratio in the RC2's vis-a-vis the corresponding RC1 is depicted in Figure 7. The simulations show clearly lower capital-labor ratios under liberalization when compared with the status quo. These ratios converge in the long run to about one fifth of the status quo values. This process of decapitalization reflects the reaction of the economy to the shock of labor movement liberalization by increasing current consumption and lowering investment often to such a level that not even capital depreciation is being covered. The same idea can be obtained from Figure 8, which represents consumption per resident worker. It shows that allowing emigration and the correspondent remittances leads to a consumption spree: consumption per capita in the initial years about duplicates the status quo values.

Figure 9 depicts the rates of growth of domestic GNP under future emigration. Domestic production is systematically decreasing as a result of foregone labor force via emigration, and the above phenomenon of decapitalization. Even in more favorable scenarios, say high technical progress and low international wage growth, the domestic production is basically stagnant. In turn, the simulations show a significative increase in the relative importance of remittances (see Figure 10). As a result of both the loss of domestic production and increased emigrants' remittances, the economy is relying more and more on emigrants' remittances. From the current 10%, remittances are simulated to be between 18% for low rates of growth of the international wages and 32% for high rates after one decade.

To sum up, the simulation results for the liberalization of the Portuguese labor force movements in the EEC suggest that new emigration will be welfare improving for the domestic labor force. This gain is due to the substantial increase in emigrants' remittances together with the reduction of the resident population. However, these welfare improvements are somewhat artificial in that they are obtained at the cost of decapitalization and stagnating or declining domestic production.

From the policy point of view the simulation results suggest that the Portuguese authorities should try to delay the liberalization of the movements of the Portuguese labor force in the EEC. The delay should be maintained until such time when the differences of standards of living in Portugal versus the EEC - as reflected by the domestic and foreign wage rates - is substantially reduced. Then only moderate emigration will be generated and the welfare gains over the current state of affairs will be maximized. Also, the delay would allow the use of the extensive community funds being channeled into the country to counteract the phenomenon of decapitalization and sluggish domestic production that will follow liberalization.

4. Summary and Concluding Remarks

This paper develops an optimal growth model in which part of the national labor force is allowed to emigrate and to send remittances to the home country. The model emphasizes the trade-off between emigration as foregone labor force and a source of remittances.

The model is numerically implemented for the Portuguese economy to study the effects on welfare and domestic production of the emigration in the 60's and early 70's, as well as the potential effects of liberalizing the movements of the Portuguese labor force in the EEC. The major

conclusions of this study can be summarized as follows. Past emigration is projected to have positive welfare effects in the Portuguese economy under the status quo. That means that the positive effect of a steady flow of remittances overrides the negative welfare effects of depopulation. In the light of these simulation results, the traditional policies of the Portuguese governments of encouraging remittances rather than the return of the emigrants seem to be justified. Furthermore, the loss of labor force is compensated by intensified capitalization. The capital-labor ratio is between 5% and 20% above the bench-mark. This is a transitional effect since simulations suggest a fast convergence to the same long-run levels. Remittances are simulated to have a declining importance in the national income even though the growth of domestic production is slowed down by about half a percentage point vis-a-vis the bench mark.

On the other hand, the liberalization of the international movements of the Portuguese labor force in the EEC is likely to provoke a substantial flow of new emigrants if the current trend of relatively low increases in the domestic real wages persist together with low domestic technical progress. Emigration will be substantially lower under less pessimistic scenarios - about 300 in a decade for moderate growth of the international wages and moderate domestic technical progress. In general, new emigration will tend to depress or at best stagnate domestic production. On the other, remittances can be anticipated to have an increasing role in the national income. Together, expanded national income is simulated to boost current consumption and depress investment. All considered, allowing further emigration is under most scenarios welfare-improving. These gains reflect a substantial positive impact on consumption per resident worker, due both to increased consumption and lower resident labor force.

The above results should be considered in the light of some critical assumptions and omissions in this paper. First, given the full-employment nature of the model, the optimal paths simulated represent the maximum potential of the economy and not its actual sub-utilization

optima. Accordingly, all the conclusions above should be interpreted as referring to potential or full-employment properties of the economy. On the other hand, emigration can be perceived as a way of relieving unemployment pressures in the economy. In this sense the benefits of emigration are understated by the model in this paper. Second, the model does not consider international trade flows. In the case of the Portuguese economy, international trade deficits are systematically covered in good part by emigrants' remittances to generate positive current account balances. In this sense emigration is instrumental in minimizing difficulties in the balance of payments. Again, the model in this paper understates the benefits of emigration for the Portuguese economy.

Both issues - balance of payment effects and unemployment - are difficult to tackle within the already complex framework of this model and are considered to be outside the realm of this paper. At any rate, the added complexity would cloud the trade-off between emigration as foregone labor force and source of remittances and make the interpretation of the results difficult.

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APPENDIX

DATA AND PARAMETER SPECIFICATION

To perform the simulations, a set of actual data for the Portuguese economy in the base year is 1986 is used. The following are the initial values for the variables in the model. The units are billion of 1986 dollars - unless otherwise stated.

- GDP - $Y_0 = 25,227$. Source: [4].

- remittances - $R_0 = 2803$. Source: [1].

- expenditure - $Y_0 + R_0 = 28,030$. Source: [4].

- consumption - $C_0 = 21984$. Source: [4].

- investment - $I_0 = 6046$. Source: [4].

- capital stock - $K_0 = 86372$.

There are no good data on the Portuguese capital stock. The figure above is consistent with a capital/output ratio of 3.5 and a net increase of 1% in the capital stock in 1986.

- resident labor force - $L_0 = 4\,670$ thousand. Source: [4].

- emigrated labor force $E_0 = 660$ thousand. Source: [3].

This figure sets the emigrated labor force to about 14% of the resident labor force. In France the Portuguese community (corresponds to total population not to active labor force) is about .9 million people and in other EEC countries about two hundred thousand [3]. Therefore, we are talking about 1.1 million Portuguese emigrants in the EEC vis-a-vis a resident population of 10 million, or 11%. The figure above is obtained by applying the rate of Portuguese labor force participation in France to the whole Portuguese labor force in the EEC (see below).

It should be stressed that emigration to other areas is ignored. There are important Portuguese communities in Brazil and United States. However, these are typical cases of early emigration - forties and fifties - and it is natural to assume that the ties linking these communities to Portugal are not particularly strong. It would be interesting to see how this is reflected in the flow of remittances but I do not have data for that. In any case our main focus of attention is the EEC.

-total national labor force - $P_0=5264$ thousand. Sources: [3],[4].

This figure is consistent with the model, in particular (8).

-domestic real wage rate

The domestic real wage rate is obtained from the model, in particular (10). Also, the initial international wage rate is derived consistently with the model, in particular (11). The initial value of the international wage rate enters in (7) in a normalized way such that no endogenous emigration occurs at $t=1$. T

The implementation of the model requires also a stylized set of structural parameters. These are the values of the parameters in the model:

-Subjective Discount factor - $r=.97$.

The long-run real rate of interest in the economy is used as a proxy for the subjective discount rate. In the base year, the nominal long run (2 to 5 years) rate of interest on loans was 25% [1]. In the same year the inflation rate was around 22% [1].

-Share of capital in domestic expenditure - $b=.58$. Source: [3].

It is obtained from [2] as the average for the period 1970-1978 of the share of capital in the value added of the manufacturing sector.

-Output scaling factor A,

The output scaling factor is a calibration parameter. It is consistent with the economy at the base year in the sense that it is obtained from (4) given b , K_0 , L_0 and Y_0 .

-labor force adjustment parameter - $\alpha=.90$.

It is accepted as a standard fact that the labor force participation of the emigrated population - 50.8% in France for example - is higher than that of the resident population - 46.7% [1].

-emigration reaction parameter - $h=.40$.

Obtained from econometric estimation of equation (17) for the period 1959-1980.

-emigrant's savings rate - $s_e=.20$.

Applies the domestic average propensity to saving to emigrated labor force. Even though the presumption is that emigrants save at higher rate, it is questionable whether or not all savings are converted into remittances. The above figure is a subjective compromise.

-rate of growth of the active labor force - $g=.008$. It is the average rate of growth of the resident labor force for the period 1978-1982 [1]. This is a good approximation under the assumption that these were years without any substantial emigration. This value is consistent with the estimated increase of the resident population for the period 1970-1980 [4] and the forecasts in [4].

-depreciation rate - $d=0.06$.

This value is based on the depreciation rates for the manufacturing sector as reported in [2], .07 for the period 1960-1976, and [8], .045 for the period 1958-1974. However, one might suspect that the depreciation rates on other sectors, for example housing, are much lower, say 2-3%.

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FIG. 1
EFFECTS OF PAST EMIGRATION
CONSUMPTION PER RESIDENT WORKER
in thousand dollars per capita

FIG. 2
EFFECTS OF PAST EMIGRATION
CAPITAL-LABOR RATIO
-revised case/base case 1-

FIG. 3
EFFECTS OF PAST EMIGRATION
RATE OF GROWTH OF GDP (%)

FIG. 4
EFFECTS OF PAST EMIGRATION
CONTRIBUTION OF REMITTANCES TO TOTAL INCOME (%)

FIG. 5
EFFECTS OF FUTURE EMIGRATION
EMIGRATION AS PERCENTAGE OF TOTAL LABOR FORCE (%)

FIG. 6

FIG. 7
EFFECTS OF FUTURE EMIGRATION
CAPITAL-LABOR RATIO
-revised case 2/revised case1-

FIG. 8
EFFECTS OF FUTURE EMIGRATION
CONSUMPTION PER RESIDENT WORKER
in thousand dollars per capita

FIG. 9
EFFECTS OF FUTURE EMIGRATION
RATE OF GROWTH OF THE GDP (%)

FIG. 10
EFFECTS OF FUTURE EMIGRATION
CONTRIBUTION OF REMITTANCES TO TOTAL INCOME (%)

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