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FACTOR MIGRATION AND INCOME DISTRIBUTION IN SOME DEVELOPING COUNTRIES

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ABSTRACT

A three factor, two sector general equilibrium model is used to determine long run income distributional impacts of factor supply changes associated with international migration in developing and newly industrializing countries. Factor intensity rankings among three factors (capital, skilled and unskilled labor) between two industries (agriculture and manufacturing-services) play a critical role in determining which factors are natural friends with respect to migration. A result common to all countries is observed friendship between capital and unskilled labor: reducing (increasing) the supply of one will lower (raise) payments to the other.

1. INTRODUCTION

This study determines the income distributional impacts of factor supply changes in some developing and newly industrializing countries using the traditional three-factor (capital, skilled labor, unskilled labor), two good (agriculture, manufacturing-services) general equilibrium trade model. Ruffin (1981) demonstrates that, in a small open economy, extreme factors, those differing most in factor intensity between sectors, are natural enemies in the sense that an increase in supply of one factor will lower the return to the other at constant commodity prices. The middle factor in the intensity ranking is shown to be a friend of both extreme factors. Our study develops this model in a manner which permits the identification of extreme factors, and hence factor friendship patterns from actual data on

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factor shares in national income for 11 countries.[1] Relative factor payment-endowment elasticities are calculated for the first time, and are used to indicate the strength of factor friendship patterns within each country. Results enable us to identify the impact on factor payments of unskilled labor immigration, the brain drain, and productive capital flows in both sending and receiving countries. These findings make it possible to evaluate the long run effects of policies which influence the international flow of productive factors.

2. THE MODEL

Capital (K), unskilled labor (U), and skilled labor (S) are used in this general equilibrium model to produce agricultural goods (A) and manufactured goods (M). Services are included with the latter. General properties of this type of trade model are summarized in Jones and Scheinkman (1977) and Chang (1979). Exogenous factor endowments are represented by $v_i (i = U, S, K)$, and endogenous factor payments by w_i. Goods' prices are exogenous and represented by $p_j (j = A, M)$, endogenous outputs by x_j. Effects of changing factor endowments upon factor payments, the $\partial w_i / \partial v_h \equiv v_{ih} (i, h = U, S, K)$ results of the model, are of interest. Algebraic signs and relative magnitudes of these effects can be determined from the factor mix or a_{ij} terms, which indicate the amount of each factor i used to produce one unit of good j expressed in home currency terms.

Factor shares are written $f_{ij} = w_i a_{ij}$, where w_i is the unit factor payment in domestic currency. Factor intensity rankings can be determined from factor shares, since $f_{iA} / f_{iM} = a_{iA} / a_{iM}$. For reference, $a_i \equiv a_{iA} / a_{iM}$. Suppose the factor intensity ranking is $a_K > a_U > a_S$, as in Figure 1, which depicts full employment of each factor and equilibrium output levels. Endpoints of each full employment line are v_i / a_{ij}. A factor's marginal opportunity cost of a one unit increase in agricultural output in the neighborhood of the equilibrium e is represented by that line's slope. Figure 1 is used by Ruffin (1981) to show the two extreme factors (K and S) must be enemies, and the middle factor (U) is a friend of each extreme factor.

The model is characterized by competitive pricing, $p_j = \Sigma_i w_i a_{ij}$, and full employment, $v_i = \Sigma_j a_{ij} x_j$. Technical substitution terms between factors are

[1] Previous theoretical studies [Rivera-Batiz (1986, 1984, 1982a, 1982b), Thompson (1984), Kirwan and Holden (1986), and Djajic (1986)] of the welfare effects of international migration on the source country have been conducted using a two-factor, two-sector model where one sector produces non-traded goods. These studies draw a distinction between temporary and permanent migration, and between welfare effects of remittances used for consumption and investment spending in the source country. None of these studies attempt to provide an emipirical evaluation of factor friendship patterns.

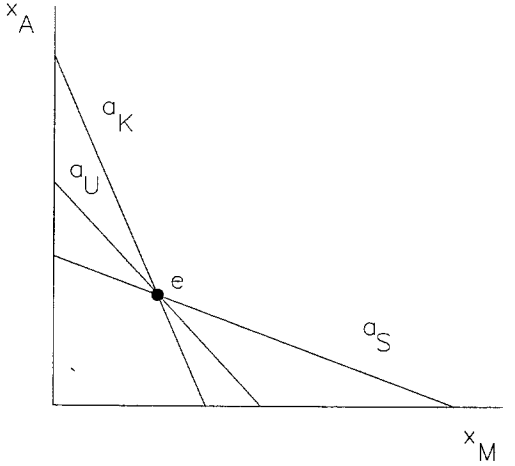

Fig. 1. Full employment lines.

written $s_{hi}=\Sigma_j x_j \partial a_{hj}/\partial w_i$. Differentiate the full employment equation to find $dv_i=\Sigma_j a_{ij}dx_j+\Sigma_h s_{hi}dw_{hi}$. From differentiating the competitive pricing condition and cost minimizing behavior of firms, it follows that $dp_j=\Sigma_i a_{ij}dw_i$. This completes the system, which can then be solved for the $\partial w_i/\partial v_h$ or v_{ih} terms, as shown in the Appendix. Introduce the following: $a_{KU}\equiv a_K-a_U$; $a_{US}\equiv a_U-a_S$; $a_{KS}\equiv a_K-a_S$; $b_1\equiv a_{KM}a_{UM}a_{KU}$; $b_2\equiv a_{UM}a_{SM}a_{US}$; and $b_3\equiv a_{KM}a_{SM}a_{KS}$. Results of interest are: $v_{KK}=b_2^2/D$; $v_{UU}=b_3^2/D$; $v_{SS}=b_1^2/D$; $v_{KU}=-b_2b_3/D$; $v_{KS}=b_1b_2/D$; and $v_{US}=-b_1b_3/D$. Reciprocity or symmetry of the system insures that $v_{ih}=v_{hi}$. The system determinant, D, is negative in the three factor case. Diminishing marginal returns in the full general equilibrium are then reflected by negatively signed v_{ii} terms.

Friendship elasticities $E_{ih}\equiv(v_h/w_i)v_{ih}$ depend in part upon the value of D, the determinant, which in turn depends upon values of substitution elasticities. Since data are not available to estimate a production or cost function for each sector in each country to calculate substitution elasticities, an alternative approach is used. Strengths of friendship elasticities relative to E_{KK}, the own capital elasticity, can be deduced from available national income data. The following notation is introduced: $\beta_1\equiv f_{KM}f_{UM}a_{KU}$; $\beta_2\equiv f_{UM}f_{SM}a_{US}$; $\beta_3\equiv f_{KM}f_{SM}a_{KS}$; $Y_i\equiv w_iv_i$, the total payment to factor i; $Y_{ih}\equiv Y_i/Y_h$; and $e_{ih}\equiv -E_{ih}/E_{KK}$, $i,h=U,S,K$. Straightforward algebra leads to

$$\begin{bmatrix} e_{SS} & e_{SU} & e_{SK} \\ e_{US} & e_{UU} & e_{UK} \\ e_{KS} & e_{KU} & e_{KK} \end{bmatrix} = \begin{bmatrix} -Y_{SK}\beta_1^2/\beta_2^2 & Y_{UK}\beta_1\beta_3/\beta_2 & -\beta_1/\beta_2 \\ Y_{SK}\beta_1\beta_3/\beta_2 & -Y_{UK}\beta_3^2/\beta_2^2 & \beta_3/\beta_2 \\ -Y_{SK}\beta_1/\beta_2 & Y_{UK}\beta_3/\beta_2 & -1 \end{bmatrix}.$$

If factors i and h are friends, e_{ih} will be positive since E_{KK} is negative. Each factor is its own enemy, since e_{SS}, e_{UU}, and e_{KK} are clearly negative. Any of the terms β_1, β_2, and β_3 may be negative, depending on the observed factor shares. Any one of the elasticities E_{SU}, E_{SK}, or E_{UK}, may be negative, indicating technical complementarity, and the other two would be positive indicating technical substitution. Relative magnitudes of the e_{ih} have meaning within each country, but not across countries, since E_{KK} may vary from one country to another.

3. METHODOLOGY AND DATA

Factor shares (f_{ij}) in national income are calculated for each country from data reported in United Nations (1982b, 1987) publications.[2] National income components include employee compensation and net operating surplus. The latter represents the payment to owners of capital, and is comprised of four property-type incomes: proprietor's income, rental income, corporate profits, and net interest. Together, these components constitute the total value of worker and capital owner claims against each year's output.

Total employee compensation is allocated between skilled and unskilled labor by combining International Labor Organization (1982, 1988) figures on numbers of unskilled workers in the economically active population by industry with estimates of the average unskilled wage. Production workers, operatives, laborers, farm workers, and service workers are included in the unskilled labor group. Professional and technical workers, administrators, managers, clerical, and sales workers are considered skilled labor.

Since figures on wages by skill group and sector are not available for developing countries, it is necessary to derive a proxy for the unskilled wage. This is accomplished by comparing employee wage levels in each of the 28 subsectors of manufacturing, reported for each country in a United Nations (1982a, 1985) publications. Four subsectors having the lowest wage levels are identified as being intensive in unskilled labor. The average of wage levels in these subsectors is used as an indication of the unskilled wage.[3]

Factor payments to owners of capital and each skill group are aggregated to form two sectors: agriculture (including hunting, forestry,

[2] Since Taiwan cannot be mentioned individually in U.N. publications, data for Taiwan were obtained from Directorate-General of the Budget, Accounting, and Statistics (1982). This publication presents data in the exact same format as that used in U.N. publications, thus calculations for all countries in our sample follow the same conventions.

[3] Apparel, furniture, wood, footwear, and leather appeared most often as low wage subsectors. Similar procedures were used both by Lary (1968), who identified labor intensive products using figures on value-added per employee in manufacturing, and Isbister (1971), who identified unskilled workers as those receiving the lowest industry wage.

fishing, mining, and quarrying), and manufacturing (including services). Expressing factor shares as a percentage of each sector's contribution to national income yields factor shares for each country.[4]

4. RESULTS

Table 1 contains each country's factor shares. Owners of capital, which includes land, receive a large share of income in these countries.[5] Each factor's share in national income is found to vary considerably across countries, suggesting tests of factor proportions theory should not assume identical factor payment shares.

Factor intensity rankings, presented in Table 2, identify two general patterns of relative factor usage. Type 1 countries, which include Ecuador, Korea Rep., Taiwan, Turkey, and Venezuela, have capital and skilled labor as extreme factors, with unskilled labor as the middle factor. Capital is the most intensive input in agriculture, with unskilled labor in manufacturing.

TABLE 1
Factor Shares

	f_{KA}	f_{KM}	f_{UA}	f_{UM}	f_{SA}	f_{SM}
Type I:						
Ecuador	0.938	0.845	0.061	0.065	0.001	0.090
Korea, Rep.	0.813	0.496	0.182	0.183	0.005	0.321
Taiwan	0.620	0.415	0.365	0.323	0.015	0.262
Turkey	0.919	0.665	0.080	0.224	0.001	0.111
Venezuela	0.796	0.607	0.189	0.147	0.015	0.246
Type II:						
Bolivia	0.701	0.686	0.292	0.175	0.007	0.139
Brazil	0.324	0.692	0.649	0.129	0.027	0.179
Chile	0.523	0.587	0.451	0.162	0.026	0.251
Colombia	0.620	0.659	0.253	0.127	0.127	0.214
Mauritius	0.428	0.569	0.553	0.208	0.019	0.223
Peru	0.807	0.665	0.185	0.102	0.008	0.233

[4] Factor shares are calculated using the most recent factor share data available. These are: Ecuador, Venezuela, 1985; Colombia, Korea Rep., Mauritius, 1984; Peru, Chile, 1982; Taiwan, 1981; Bolivia, 1980; Turkey, 1976; and Brazil, 1973. Other countries could not be included due to data unavailability.

[5] A preferred approach would be to disaggregate capital and land. This would result in a different factor use ranking. However, data are not available to permit this separation. Since owners of capital and land are often one and the same in developing countries, our approach should provide a reasonable approximation to the impact of factor supply changes on the personal distribution of income.

TABLE 2
Factor Intensity Ranking

	a_K	a_U	a_S
Type I:			
Ecuador	1.110	0.938	0.011
Korea, Rep.	1.639	0.995	0.016
Taiwan	1.494	1.130	0.057
Turkey	1.382	0.357	0.009
Venezuela	1.311	1.286	0.061
Type II:			
Bolivia	1.022	1.669	0.050
Brazil	0.468	5.031	0.151
Chile	0.891	2.784	0.104
Colombia	0.941	1.992	0.593
Mauritius	0.752	2.659	0.085
Peru	1.214	1.814	0.034

Type II countries, including Bolivia, Brazil, Chile, Colombia, Mauritius, and Peru, have unskilled and skilled labor as extreme factors, and capital is the middle factor. Unskilled labor is intensive in agriculture, skilled labor again in manufacturing.

Factor friendship patterns are determined from the factor intensity rankings, with extreme factors as enemies, and the middle factor a friend of both extremes. Relative friendship elasticities, presented in Table 3, are positive (negative) when factors are friends (enemies). The following discussion is devoted primarily to effects of factor emigration upon the returns to factors left behind. Effects of immigration on factor rewards are inversely stated.

Capital and skilled labor are enemies in Type I countries. Two pairs of friends are identified here, unskilled labor with both skilled labor and capital. Capital outflow drives down the wage of unskilled labor and raises payments to both skilled labor and capital. Emigration of unskilled labor substantially raises the unskilled wage, depresses the returns to capital, and lowers the payment to skilled labor. The brain drain, or outflow of skilled labor, makes unskilled labor worse off, but raises rewards to capital and the remaining skilled labor. If policymakers in Case I countries represent interests of skilled labor and capital owners, this would explain why more emphasis is not placed upon retaining skilled personnel, or encouraging the return of students educated abroad. Policy might also discourage emigration of the unskilled.

Skilled and unskilled labor are weak enemies in Type II countries. Capital is a friend with both skilled and unskilled labor. When either labor type emigrates, capital owners become worse off, while both labor groups

TABLE 3
Relative Friendship Elasticities

	e_{SS}	e_{SU}	e_{SK}	e_{US}	e_{UU}	e_{UK}	e_{KS}	e_{KU}
Type I:								
Ecuador	−0.217	0.011	−1.737	0.010	−17.330	15.410	−0.125	1.125
Korea Rep.	−0.482	0.086	−1.017	0.123	−6.627	4.495	−0.474	1.474
Taiwan	−0.156	0.063	−0.537	0.045	−2.221	1.721	−0.290	1.291
Turkey	−29.301	0.408	−17.646	0.168	−31.266	11.713	−1.661	2.669
Venezuela	−0.001	0.002	−0.052	0.003	−4.283	4.218	−0.014	1.016
Type II:								
Bolivia	−0.564	−0.055	1.972	−0.026	−1.673	2.353	0.286	0.711
Brazil	−3.258	−0.039	3.614	−0.035	−0.034	0.348	0.901	0.097
Chile	−1.020	−0.068	1.652	−0.072	−0.403	1.064	0.618	0.379
Colombia	−1.564	−0.028	2.315	−0.033	−0.414	1.289	0.676	0.321
Mauritius	−1.218	−0.043	1.890	−0.055	−0.136	0.709	0.645	0.191
Peru	−0.248	−0.030	0.963	−0.047	−3.192	4.321	0.258	0.739

experience wage increases. Capital outflow raises the return to capital left behind, while depressing payments to both skilled and unskilled labor.

Recently, emigration of unskilled labor from developing countries to the United States has attracted attention in the US and abroad. Thompson and Clark (1983) have identified the United States' factor friendship pattern as falling within Type I. The flow of unskilled labor from Mexico to the United States raises unskilled wages of those left behind, but lowers unskilled wages in the United States. Developing country policymakers' urging that the US admit more migrant workers is an attempt to raise living standards of unskilled labor left behind, and will benefit the migrants as well. Demands from US labor unions for strict enforcement of immigration laws are also explained by the reported results. Skilled workers in Type II countries gain from the emigration, while capital payments decline. Both skilled labor and capital in the US benefit from the inflow of unskilled labor, a result which may explain lax enforcement at the border.

Migration among developing countries, and its impact upon factor payments in receiving and sending countries, can be similarly analysed. A finding common to all countries covered in this study is a relatively strong friendship between capital and unskilled labor. This suggests the flow of productive capital from industrially advanced nations to developing countries, often viewed as an attempt to exploit cheap labor, substantially raises the unskilled wage.

Relative friendship elasticities also provide an indication of the strength of factor friendship within each country. The own unskilled labor elasticity is the largest in all Type I countries, indicating unskilled labor has a great deal at stake when it comes to its own migration. All countries display friendship of moderate strength between capital and unskilled labor. Effect of a changing capital endowment upon unskilled labor's wage is several times the reciprocal effect every country but Taiwan. A considerable loss accrues to unskilled labor when capital flows from these countries. Elasticities relating capital and skilled labor are relatively small in all countries, regardless of whether the two are enemies or friends. Once again, capital's effect upon skilled wages is considerably larger than the reciprocal effect. Skilled and unskilled labor have relatively little at stake when it comes to the other's migration.

5. CONCLUSION

This paper examines the long run impact of international factor migration upon factor payments in 11 developing and newly industrializing countries. Two types of factor friendship patterns are identified. Skilled labor is a friend of unskilled labor and an enemy of capital in Type I countries. Skilled labor and unskilled labor are enemies, with capital a

friend of both skilled and unskilled labor, in Type II countries. Common to all countries is an observed friendship between capital and unskilled labor. Capital inflows substantially raise unskilled wages, as does skilled labor emigration. These findings should help in evaluating the long run income distributional impacts of policies affecting international flows of labor and capital.

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APPENDIX

The entire model is written:

$$\begin{bmatrix} s_{SS} & s_{SU} & s_{SK} & a_{SA} & a_{SM} \\ s_{SU} & s_{UU} & s_{UK} & a_{UA} & a_{UM} \\ s_{SK} & s_{UK} & s_{KK} & a_{KA} & a_{KM} \\ a_{SA} & a_{UA} & a_{KA} & 0 & 0 \\ a_{SM} & a_{UM} & a_{KM} & 0 & 0 \end{bmatrix} \begin{bmatrix} dw_S \\ dw_U \\ dw_K \\ dx_A \\ dx_M \end{bmatrix} = \begin{bmatrix} dv_S \\ dv_U \\ dv_K \\ dp_A \\ dp_M \end{bmatrix}.$$

Solving for the changes with respect to v_S for instance, let $dv_U = dv_K = dp_A = dp_M = 0$. Then divide both sides of the matrix equation by dv_S and use Cramer's Rule to solve for $\partial w_S/\partial v_S$, $\partial w_U/\partial v_S$, and $\partial w_K/\partial v_S$. For instance,

$$\partial w_S/\partial v_S = \frac{\begin{vmatrix} 1 & s_{SU} & s_{SK} & a_{SA} & a_{SM} \\ 0 & s_{UU} & s_{UK} & a_{UA} & a_{UM} \\ 0 & s_{UK} & s_{KK} & a_{KA} & a_{KM} \\ 0 & a_{UA} & a_{KA} & 0 & 0 \\ 0 & a_{UM} & a_{KM} & 0 & 0 \end{vmatrix}}{D} = (a_{KM}a_{UA} - a_{KA}a_{UM})^2/D$$

The determinant D is shown by Chang (1979) to be negative due to concavity of the associated cost functions, so $\partial w_S/\partial v_S < 0$. All of the $\partial w/\partial v$ results can be readily signed.

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