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The Harris-Todaro model of labor migration and its commercial policy implications

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GENERAL INTRODUCTION

This dissertation contains three papers on the Harris-Todaro model of labor migration in the developing countries. All the papers either have been or will be submitted to professional journals for publication. All the papers are purely theoretical analyses of commercial policies of a small and open country with surplus labor.

1. Dissertation Organization

The main body of this dissertation consists of a general review of literature, three papers, and a general conclusion, in that order. The literature review part gives a more detailed history of the development of the Harris-Todaro model, the length of which makes it inappropriate to be included in any of the papers that follow.

The first paper discusses some of the properties and the trade policy implication of the classical Harris-Todaro model. In the second paper, a service sector is added to the original structure and its impacts are analyzed. In the third paper, the effects of assuming risk aversion on the part of migrant workers are examined.

Finally, a general conclusion summarizes the major results of the papers and offers suggestions and possible directions for future research on the issue.

A LITERATURE REVIEW OF THE HARRIS-TODARO MODEL

Editors of professional journals in economics usually frown upon the presence of a lengthy introduction or literature review in submitted articles, as is the case with the journals to which the following papers were submitted. Therefore, it is only appropriate to include in this dissertation this more comprehensive literature survey. The first part of this survey is a background introduction of the development and modification of the Harris-Todaro model of labor migration in the context of development economics. The second part attempts to justify using the Harris-Todaro framework in the analyses of commercial policies of a small and open country with labor surplus.

1. The Harris-Todaro Model of Labor Migration in the Literature of Development Economics

It has long been realized that in order for an economy to develop or grow, a large amount of labor has to be transferred from the traditional (or backward) agricultural sector in rural areas, where the productivity of labor is low (or negligible, or zero, or even negative) to the modern manufacturing sector where the productivity of labor is higher and rising due to capital accumulation in that sector.

It should not be surprising, therefore, that, in the

literature of development economics, dualistic models gained popularity over the single-commodity or single-sector theories in the 1950's. A typical dualistic model in development economics contains two sectors, a traditional or agricultural sector in the rural area and a modern or manufacturing sector in the urban area. The most familiar single-sector model is the growth theory of Harrod-Domar (Harrod 1939 and 1948, Domar 1946). The most representative and influential dualistic framework is that of Lewis (1954).

The ideas of surplus labor, subsistence wages, and turning points in the development of a dualistic economy in Lewis (1954) were later rigorously and diagrammatically formalized by Ranis and Fei (1961). Ranis and Fei also showed how agricultural surplus could lead to the growth of industries. The production relations of a dual economy, according to Jorgenson (1961), was characterized by asymmetry. More precisely, he assumed that output in the agricultural sector was a function of land and labor alone (there is no capital accumulation in this sector), and was characterized by diminishing return to scale. On the other hand, the output of the urban sector depended on capital and labor alone (no land was required), and the production function displayed constant return to scale. Since the amount of land and capital in the economy was assumed fixed, the only problem was to allocate labor between the two sectors.

The common features of the dualistic theories discussed so far and some other models of that nature are that 1). there is no unemployment in the modern sector, and 2). the sectoral wage differential is assumed fixed or proportional to the wage level in the urban sector. These models were later labeled as "orthodox" by Corden and Findlay (1971).

The unorthodox thinking was first and independently introduced by several economists, notably among whom were Michael Todaro (1969) and John Harris (Harris and Todaro 1970). The essence of the new thinking, which has to be reminiscent of the Keynesian revolution, is that there can be an equilibrium with the existence of a chronic large amount of urban unemployment.

By the end of the 1960s, the world had seen the rapid growth of urban areas in the developing countries. "From Dar es Salaam to Karachi to Caracas, from land surplus to labor surplus to capital surplus countries, one hears of the ever-increasing flow of rural migrants into urban area and of the inability of the urban economy to provide permanent jobs for even a majority of these workers" (Todaro 1969). For instance, between 1950 and 1960, urban areas in Africa grew by 69%, in Latin America by 67%, and in Asia by 51%, while rural areas grew by only 20% over the same period (Fields 1975). The most important factor that causes urban population explosion has been the migration of labor from the rural areas

into the cities throughout the less developed world. Population growth also contributes to this phenomenon but in a much less scale, since it rarely exceeds 3%. In the context of a dualistic model, the rural sector is discharging labor too rapidly and the urban sector is hiring labor too slowly because it is too highly capital intensive (Lewis 1965). As a result, the "urban manifestations of the employment problem" becomes the most visible feature of poverty and underdevelopment of the Third World countries (Lubell 1988).

It has been pointed out by many that economic considerations, or urban-rural wage differentials, play an important role in determining the extent of labor migration. The higher than competitive urban wage is due to a combination of trade-union pressure, nationalistic government pressure on foreign enterprises, and the new social conscience of big entrepreneurs (Lewis 1965). Citing the case of increasing gap between urban and agricultural earnings in Puerto Rico, Reynolds (1965) argues that minimum urban wages are politically determined, i.e., through legislation. Harberger (1971) distinguishes urban wages into the "protected-sector wages" and the "unprotected urban wages." The former is above the market-clearing level and is believed to be held high by minimum wage laws, by collective bargaining agreements, or by the policy of the hiring company itself. In parts of China, minimum wages have been set up since 1988 by local governments

mainly to prevent joint ventures from exploiting their local employees (China Reform Journal 1994).

More recent studies show that the problem of urban unemployment is not unique to the less developed countries (LDCs). In 1985, while urban unemployment rates of Botswana and Lesotho were as high as 31.2% and 22.3%, respectively, Ireland, France, and Italy recorded 17.3%, 10.2%, and 10.3%, respectively, higher than some LDCs like India or Pakistan (6.8 and 5.0, respectively) (Turnham 1993). In China, where the term "unemployment" did not exist in the official government documents 10 years ago, among the 400 million workers in the countryside, 120-150 million are labelled as "potentially unemployed," which has added enormous pressure to the urban economy and will undoubtedly continue to do so. Regionally, the urban unemployment rates are as high as over 20% (Wang 1993).

It was the observation of "a curious economic phenomenon" in tropical Africa that led to the pioneering work of Harris and Todaro (Todaro 1969; Harris and Todaro 1970). The phenomenon was the continual and accelerating rural-urban labor migration despite the existence of positive marginal products in agriculture.

Todaro's main contribution is the introduction of the probability of employment as an element in the decision making process of a potential migrant. He proposed what he called "a

more realistic picture of labor migration in less developed countries", i.e., a two-stage process. The first stage is where the rural migrant enters the urban area and settles down in the so called "traditional urban sector" (or more popularly, the informal sector) for a certain period of time. The second stage is reached when the migrant finds a more permanent job in the modern sector. Note that Todaro and later on some others did not consider the informal urban sector explicitly, its employees (usually underemployed) not being distinguished from those who are not employed at all. They make no income on their own and were supposed to live out of the support of their relatives in their origins or in the cities (for a vivid description of the informal sector, see Lewis (1954)).

The probability of landing a job, according to Todaro, depends on the number of newly created jobs in the modern sector, the size of the population of the urban unemployed, and the length of time a migrant has been in the urban area. At any time, jobs were allocated as if by lottery. Understandably, the longer one has been in the urban area, the more likely he will find a job in the manufacturing sector. The criterion used in making the decision to migrate or not is the expected relative present real values of the two choices.

An important extension in this direction was done by Harris and Todaro (1970), where they formulated the idea that

the rural wage is equated to the expected urban wage, into the now famous Harris-Todaro equation, or

$$w_a = \beta w_m,$$

where w_a is the flexible wage in the agricultural sector which is equated to the value of the marginal product in that sector, β is the probability of employment, depending on the number of newly created jobs and the size of the population of the urban unemployed, and w_m is the wage in the manufacturing sector and is assumed to be fixed institutionally (either because of union activities or a friendly government towards to the workers in the modern sector) above the competitive level. (Many empirical results showed that (real) wages were consistently higher in unionized sectors. (Amacher 1989, 603-605)) Unlike in the orthodox models, the urban wage, not the sectoral wage differential, is assumed to be fixed.

A very effective illustration of what we will refer to as the Harris-Todaro (HT hereafter) model was given by Corden and Findlay (1975). Their geometric presentation of the model was straightforward and elucidating. The major contribution, however, is the introduction of the intersectoral capital mobility into the original HT model. They also treated the economy as small and open, enabling the prices of the products from both sectors to be fixed. It is important to note that

the HT model as was in Harris and Todaro (1970) or Corden and Findlay (1975) does not assume asymmetry about the production technologies.

The policy implications of the HT model are understandably different from those of the orthodox models. When there is a wage differential with no urban unemployment, a wage subsidy in the manufacturing sector is clearly the first best policy, which restores the output of the modern sector to its level under no labor market distortion. With urban unemployment, a wage subsidy alone may not be optimal. Harris and Todaro (1970) suggested a wage subsidy to the manufacturing sector, combined with a restriction on migration. A uniform wage subsidy was proposed by Bhagwati and Srinivasan (1974) and Corden (1974), but, as pointed out by Corden and Findlay (1975) who also found wage subsidies were superior to other methods, the financing problem can not be ignored.

Here it is worth giving more attention to the work of Corden and Findlay (1975) since it is from their framework where we extend the line of research. Given sectoral capital mobility and small country assumptions, and using the net change in the value of total outputs as criterion, they also concluded that output subsidies, especially a subsidy on the manufactures, were even less desirable than wage subsidies. A output subsidy on the agricultural sector, they noted, could

be beneficial if capital is sector specific. A tariff on imports of manufactures, which raises the urban output but lowers the agricultural output and is equivalent to a subsidy to the manufacturing sector financed by taxing the agricultural sector, was considered undesirable since it may cause other distortions (eg. distortion in consumption). We will compare our results with CF's in the first paper of this dissertation where we consider production subsidy and tariff simultaneously and use utility maximization as criterion in evaluating policy or policy combinations.

Despite its popularity among economists, some of the assumptions of the HT model have been subjected to criticism and gone under revision ever since it was developed. (For instance, see Stiglitz 1974, Lapan 1976, Yap 1977, Montgomery 1985, Cole and Sanders 1985, etc.) The main critiques are summarized by Williamson (1988) as:

1. The lottery style job allocation excludes investment in job search on the part of the immigrants;
2. The informal sector is not explicitly modelled;
3. There is not enough evidence to support the assumption of a rigid wage in the modern sector. Moreover, besides trade union pressure or minimum wage legislation, the wage differentials among sectors could be explained as well by, say, firm-

specific training costs;

4. The issue of discount rates and rational migrants is ignored;
5. The influence on decision making of risk and risk attitudes on the part of the potential immigrants is not included; and
6. Differentials in skill levels among the migrants are not accounted for.

It is of greater interest to us to note that Corden and Findlay (1975) touched upon the issues of workers being risk averse and the handling of the urban informal sector (they referred to it as the urban service sector). A modified Harris-Todaro equation was proposed to allow for the consideration of risk attitude. The equation took the following form:

$$w_a = w_e,$$

where $w_e = \sigma\beta w_m$ is the expected urban wage and $0 \leq \sigma \leq 1$ was the measurement of risk aversion. The immediate implication of incorporating risk aversion into the HT model is a higher urban employment rate (β). We will later express this idea in terms of utility functions. It is worth mentioning the two special cases imbedded in the above equation. If $\sigma = 1$, or if workers are risk neutral, it reduces to the original HT model; if $\sigma = 0$, or the expected wage is zero, either because

manufacturing jobs are not available to the unemployed or workers are extremely risk averse, it becomes the orthodox wage differential model where there is no unemployment in the urban area. Therefore, wage subsidies are more effective when σ is lower than when it is higher.

The importance of the urban informal sector can be seen from the data reflecting the proportion of urban labor force employed in that sector for different LDC cities: Calcutta, 43 percent; Bogota, 45 percent; Lagos, 50 percent; Mexico City, 34 percent. It is now well recognized that an informal sector exists and is growing in many other LDC cities largely because of rural-urban migration (Cole and Sanders 1985).

To replace the zero productivity unemployment pool with a low productivity service sector, Corden and Findlay (CD hereafter) (1975) suggested a constant and positive service wage for all the non-manufacturing workers. In other words, there is no urban unemployment anymore. As pointed out by Corden and Findlay, the constant wage assumption is very easy to handle. It should be pointed out that the constant service wage assumption makes CD's three-sector model no different from the original HT model as far as the properties of model and its policy implications are concerned. To see this, one only needs to examine and compare the HT condition for the two models. CD's assumption would lead to the following HT condition:

$$w = \beta W + (1 - \beta)e,$$

where e is the constant and positive service wage. The above can be written as

$$w' = \beta W',$$

where $w' = w - e$, and $W' = W - e$. Mathematically, it is exactly the same as in the HT model.

On the other hand, Chao and Yu (1990) assumed a flexible wage for the service sector in their work with a three-sector HT model. Thus, as in CD, no attempt was tried to distinguish between the jobless and the service-employed workers. It may look simplistic, but it is actually a very realistic assumption for many of the LDCs. We will discuss this matter later in the dissertation.

The most important critique to the HT model, as noted by Williamson (1988), is the failure to address the relationship between risk and migration, which was discussed by Stark and Levhari (1982), Karz and Stark (1986), etc. These authors discussed production and employment risk (due to natural disasters, for instance), which exacerbates poverty and misery in the rural sector and is considered an incentive for migration. Thus risk aversion on the part of the potential immigrants will raise the urban unemployment. In this dissertation, we will adopt a very different approach

regarding risk and risk aversion. In other words, we will consider the employment risk in the urban area and discuss its effect on the urban employment rate and the optimal commercial policies.

2. Commercial policies for a Harris-Todaro Economy

The purpose of the first three articles is to evaluate and compare commercial policies adopted by some of the LDCs. In other words, we find ourselves engaged in the debate of the superiority of the outward-oriented vs the inward-oriented strategies. We will do so for an HT type economy which, we believe, describes the situations in many LDCs in the modern world.

It is by now a generally accepted belief that outward (or export) oriented development strategies are superior to the inward looking (or import substitution) strategies. The often cited examples are the successful east Asian countries of Taiwan, Korea, and Singapore, and the not so successful countries like India, Brazil, Chili, and several other Latin American countries.

It is argued (Balassa 1989) that the import substitution policies in many LDCs are biased against the primary (or agricultural) sector which happens to be the export sector, while export oriented polices provide similar incentives to both sectors. In countries that practice inward looking

strategies, the limitation of the domestic markets and the lack of competition led to allocative and technological inefficiency. On the contrary, outward looking countries are able to mobilize domestic resources effectively in the production of goods that have to be competitive in the vast world markets, which in turn allows the exploitation of the economies of scale and technological improvement. As a result, total factor productivity increased at annual rates of over 3 percent in some outward-oriented LDCs while in some of the inward-oriented LDCs increases were less than 1 percent or even negative.

Given the post war experiences of development of the Third World, proponents of the inward-oriented strategies have become less staunch. The most effective argument for the policies remains that of the infant industry (Bruton 1989). It is believed that even in this situation, protection should be only a short run policy. It should also be noted that production subsidy is superior to import protection to achieve the infant industry objectives.

It is in our opinion that many LDCs have entered or are approaching what was described as the "take off" stage by Lewis (1954) and Fei and Ranis (1961), characterized by the rapidly growing industries, continual and sizable transfer of labor force from the traditional rural sector, and persistent problems of high urban unemployment and underemployment rates.

In the traditional sector, however, labor surplus is no longer a prominent phenomenon and labor productivities have improved, partly due to technological investment taken place in that sector. As Harberger (1971) points out, "data seem to contradict the idea that great masses of labour can be withdrawn from the agrarian sector without a palpable loss in product."

The above discussion justifies the policy analyses set in an HT framework later on in this dissertation. The distinct and common feature of the two or three articles that follow is that an indirect utility function and its maximization is used to evaluate a policy or policy combination (production subsidies and import tariff on manufactured goods). We are aware of the critiques to the HT model (Williamson 1988) and fully appreciate some of the extensionary works (e.g. Fields 1975). We will address the two most important critiques to the original HT model, namely, the absence of the traditional urban sector and the failure to include risk attitude on the part of the potential migrants and its influence on the migration decision.

We are also aware of the fact that the first best policies to correct a labor market distortion caused by minimum wages are wage subsidies or packages that include wage subsidies (Harris and Todaro (1970), Bhagawati and Srivansan (1974), etc.). In practice, however, wage subsidies are often

politically and financially infeasible (Corden and Findlay 1975). Therefore, in this dissertation, we will focus on the second or even third best policies that are more practical and are actually employed in many LDCs, namely, production taxes (or subsidies) and, more importantly to us, import tariffs that are almost ubiquitous.

As mentioned earlier, the criterion used in policy evaluation is the maximization of the social utility function. The social utility is derived by either the inclusion of the societal income in the utility function or the summation of all the individual's utility giving equal weight to each and every member of the society. We will also assume that capital income is evenly distributed among the agents of the economy. Labor income, however, differs among them. Therefore, the income level of an individual depends on whether and where the individual is employed. Therefore, a worker employed in the urban manufacturing sector earns more than a worker employed in the agricultural sector who earns more than an unemployed person.

It should be noted that all the wage incomes are in real terms because in this dissertation throughout, we will use the agricultural output as numeraire. In Harris and Todaro (1970), the urban output served as numeraire.

The first paper of the dissertation discusses some of the properties and optimal commercial policies in the HT model a

la Corden and Findlay (1975), i.e., it is a small and open economy, with two inputs, capital and labor, both employed in both sectors. Capital is assumed to flow freely intersectorally. We find that in this two-sector-two-input model, an HT economy should tax its import competing manufacturing sector or subsidize its agricultural sector and no import tariff should be levied on the imports of manufactured goods.

In the second paper, the urban traditional sector (we name it the service sector) is included for the similar policy analyses. We differ from the literature (eg., Chao and Yu 1990) in applying Jorgenson's notion of asymmetry into the structure, by assuming that the production in the service sector involves only labor. Following Chao and Yu (1992), we also assume that the service wage is flexible. The implication of this assumptions is discussed in more detail later.

With this three-sector model, we hope that we can explain the expanding gap between the prices of the service sector in the LDCs and the industrialized countries. One of the policy implications of the inclusion of a third sector is that the optimal tariff can be positive under certain situations.

Risk and risk aversion has not received the attention it deserves. Works by Stark and Levhari (1982) and Kats and Stark (1986) deal with the risk involved in the rural sector.

Understandably this sort of risk and risk aversion (diversification) is a further incentive for rural-urban migration. The data, however, seem not to support this reasoning. Fields (1975) reported that the real urban unemployment rates were lower than what the HT model would predict.

In the third paper, we consider the risk of unemployment in the urban sector and risk aversion on the part of the job-seekers. It is clear that employment risk and risk aversion should deter migration and the urban unemployment rates so predicted should be closer to what was reported. An interesting result is that the optimal tariff is necessarily positive if the job-seekers are risk averse and no production subsidy is used.

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TRADE POLICIES AND WELFARE IN A HARRIS-TODARO ECONOMY

A paper submitted to Southern Economic Journal

Jiong Chen

Abstract

This paper investigates optimal trade policies of a small open Harris-Todaro (HT) economy with urban unemployment and intersectoral capital mobility. An import tariff is shown to be welfare-reducing in an HT economy. However, if an optimal production subsidy, which is negative, is used, the optimal tariff is zero. In the absence of a production subsidy, the optimal tariff is negative. This implies that a reduction of tariff implemented by a free trade agreement would improve the welfare of an HT economy. These results are contrasted with those of sector-specific HT models.

1. Introduction

In many developing countries rising unemployment is often attributed to increases in foreign imports, triggered by declining foreign prices of imports. To correct the chronic unemployment problem, some developing countries chose an import substitution strategy by shutting off imports, whereas others adopted an outward-oriented policy by promoting

exports. North American Free Trade Agreement (NAFTA) was favored by Mexico but opposed by organized labor in this country because it was feared that NAFTA may increase unemployment in the U.S. Which of these policies is more effective in reducing unemployment and raising domestic income?

Protection has been ardently supported as a practical cure for unemployment in Chile and Argentina and many other LDCs in Latin America.[1] Similarly, India adopted import substitution strategies behind high protection and a considerable bias against exports (Ballassa, 1988). The literature has also justified the use of tariffs for small countries under uncertainty and unemployment (e.g., Choi and Lapan, 1991; Choi and Beladi, 1993). But in general, protection distorts the trade pattern and magnify the extent of the Leontief Paradox by limiting imports of capital intensive products into these developing countries that suffer from high labor unemployment (Casas and Choi, 1985).

In the literature there have been two types of models that analyze trade problems in the presence of unemployment. The generalized unemployment models have been developed by Brecher (1974a, b) and Batra and Seth (1977).[2] In these models, wage rigidity is ubiquitous and unemployment exists in all sectors, and they are appropriate to analyze the impact of trade policies on unemployment in developed economies. The Harris-

Todaro (1970, HT hereafter) model, on the other hand, assumes sector-specific wage rigidity and permits unemployment only in the urban sector. Thus, the HT model is appropriate for investigating the impacts of trade policies of LDCs that suffer from urban unemployment, and it has been subsequently used by Hazari (1986), Batra and Beladi (1990), Chao and Yu (1990), Hazari and Sgro (1990), and Marjit (1991).

This paper uses the HT model to investigate optimal trade policies for a developing country with labor unemployment. As in Corden and Findlay (1975), we assume that capital is mobile between sectors. It is shown that an import tariff is welfare-reducing in an HT economy. If an optimal production subsidy, which is negative, is used, however, the optimal tariff is zero. The negative production subsidy on the importable is equivalent to a production subsidy on the exportable. Our findings have an important policy implication on trade policies of a labor surplus economy; an import tariff is welfare reducing, and therefore, for instance, the reduced tariffs of Mexico implemented by NAFTA would probably improve welfare of Mexico, which may be viewed as an HT economy.[3]

2. The Basic Model

Consider a small open HT economy which has two sectors, a rural sector and an urban sector. Unemployment exists only in the urban area because of a fixed urban wage, but rural

workers are fully employed and paid a flexible wage. To analyze optimal trade policies of an HT economy, we employ the following assumptions:

(i) Fixed supplies of capital (K) and labor (L) inputs.

(ii) Capital is fully employed, but labor unemployment exists in the urban area because the fixed urban wage W is higher than the flexible rural wage w.

(iii) The economy is small and imports the urban output X and exports the agricultural output Y, which is used as numeraire.

Let L_j and K_j denote the labor and capital employed in sector j, respectively. The output of the urban manufacturing sector is

$$X = F(L_x, K_x), \tag{1a}$$

and the output of the rural sector is

$$Y = G(L_y, K_y), \tag{1b}$$

where $F(\cdot)$ and $G(\cdot)$ are linearly homogeneous production functions.

Capital is a variable input and is mobile between the two sectors. Capital rental r is the same in both sectors and capital is fully utilized. However, due to wage rigidity in the manufacturing sector, some unemployment exists in the urban area.

Profit of the urban sector is

$$\pi_x = PF - WL_x - rK_x, \tag{2a}$$

where P is the producer price of the urban output and W is the fixed urban wage. Profit of the rural sector is

$$\pi_y = G - wL_y - rK_y, \tag{2b}$$

where w is the flexible rural wage and the price of the numeraire Y is unity. Observe that marginal product of inputs are homogeneous of degree zero in K and L. In the short run, however, capital input is fixed, and marginal product of labor is decreasing in L.[4] The first order conditions for optimal labor employment are:

$$PF_L - W = 0, \tag{3a}$$

$$G_L - w = 0. \tag{3b}$$

The solution of (3a) and (3b) yields conditional labor demand functions, $L_x = L_x(K_x, P, W)$ and $L_y = L_y(K_y, P, w)$.

The rural wage w is equal to the expected urban wage. Thus, the relationship between the wages in the two sectors is given by the HT condition,

$$w = \beta W = W/(1 + \lambda), \tag{4}$$

where $\beta \equiv 1/(1 + \lambda)$ is the probability of employment, and $\lambda \equiv$

L_u/L_x is relative unemployment in the urban sector.

In the HT model, labor demand falls short of labor supply,

$$(1 + \lambda)L_x + L_y = L, \tag{5a}$$

where $\lambda L_x = L_u$ represents labor unemployment in the urban sector. Capital market clearing requires

$$K_x + K_y = K. \tag{5b}$$

Equations (1a) - (5b) complete the description of the production side of the HT model.

3. Responses of Factor Prices and Urban Unemployment

Perfect competition in product markets implies that the zero profit condition holds in "long run" equilibrium, although some labor unemployment exists in the urban sector because of wage rigidity. Thus, prices are equated to unit costs,

$$P = Wa_{Lx} + ra_{Kx}, \tag{6a}$$

$$1 = wa_{Ly} + ra_{Ky}, \tag{6b}$$

where a_{ij}'s are the input-output ratios.

First, consider how fixing the urban wage W above that for the full employment level affects the flexible rural wage w and capital rental r. Differentiating (6a) and (6b) with

respect to W and holding P constant gives

$$\partial r/\partial W = - a_{Lx}/a_{Kx} = - L_x/K_x = - 1/k_x < 0, \qquad (7a)$$

$$\partial w/\partial W = k_y/k_x < 1, \qquad (7b)$$

$$\partial (w/r)/\partial W = [(\partial w/\partial W)r - w(\partial r/\partial W)]/r^2$$

$$= (rk_y/k_x + w/k_x)/r^2 > 0, \qquad (7c)$$

where $k_j \equiv K_j/L_j$ is the capital-labor ratio in sector j. Thus, an increase in the urban wage unambiguously lowers the capital rental and the flexible wage-rental ratio, w/r. The manufacturing sector is assumed to be more capital intensive ($k_x > k_y$), and hence $1 > \partial w/\partial W > 0$, i.e., as the manufacturing wage increases the flexible rural wage increase less than proportionately. Differentiating (4) with respect to W gives

$$\partial \lambda/\partial W = [k_x - (1 + \lambda)k_y]/wk_x > 0, \qquad (7d)$$

if the Neary (1981) stability condition that the urban sector as a whole is capital abundant relative to the rural sector ($k_x > (1 + \lambda)k_y$) is satisfied. Thus, an increase in the urban wage increases unemployment in the urban sector.

In the Heckscher-Ohlin trade model, an increase in the price of a traded good necessarily raises one factor price and lowers the other, depending on the capital intensities of traded goods. How does a change in the producer price of the

importable affect equilibrium factor prices in the HT model? Since the urban wage is fixed, a change in P only affects capital rental r and the flexible rural wage w. Differentiating (6a) and (6b) and noting that $Wda_{Lx} + rda_{Kx} = wda_{Ly} + rda_{Ky} = 0$ yields

$$dP = a_{Kx}dr,$$

$$0 = a_{Ly}dw + a_{Ky}dr.$$

Thus, we get

$$\partial r/\partial P = 1/a_{Kx} = X/K_x > 0. \qquad (8a)$$

$$\partial w/\partial P = - k_y(X/K_x) < 0. \qquad (8b)$$

Thus, in the HT model, an increase in the price of the importable raises capital rental and reduces the flexible wage. Observe that this result is independent of factor intensities of traded goods. Intuitively, as the price of the importable increases, the capital rental in that sector has to rise to maintain the zero profit condition because the urban wage is fixed, which will attract more capital from the rural sector so as to equalize the capital rental between the two sectors. To maintain zero profit, the flexible wage must decline to offset the rise in unit cost caused by the increase in capital rental.

Differentiating the HT condition (4) with respect to w and

holding W constant yields

$$\partial\lambda/\partial w = - (1 + \lambda)/w < 0. \qquad (9)$$

Hence,

$$\partial\lambda/\partial P = (\partial\lambda/\partial w)(\partial w/\partial P)$$

$$= [(1 + \lambda)k_Y/k_X](X/wL_x) > 0. \qquad (10)$$

This implies that an increase in the price of the importable will decrease the probability of urban employment, $\beta = 1/(1 + \lambda)$. Intuitively, an increase in the price of the importable decreases the rural wage, which in turn induces more workers to seek employment in the urban area, thereby reducing the chance of urban employment.

The results in this section are summarized in the following proposition.

PROPOSITION 1: In a small open HT economy, an increase in the price of the importable increases capital rental, decreases the rural wage, and increases urban unemployment.

4. Welfare Analysis

Consumer preferences are represented by a monotone increasing and quasi-concave utility function,

$$U = U(C,D),$$

where C and D denote the aggregate consumption of the exportable and the importable, respectively. Let I denote consumer income, p the domestic consumer price, and let C(p,I) and D(p,I) be the demand functions obtained by maximizing U subject to a budget constraint, C + pD = I. Then the indirect utility is written as

$$V \equiv V[p,I] = U[C(p,I),D(p,I)].$$

Import demand is given by

$$Q = D(p,I) - X(P), \tag{11}$$

and tariff revenue is

$$T = (p - p^*)Q = tQ, \tag{12}$$

where p^* is the foreign price of the importable, $t \equiv p - p^*$ is a specific tariff on the importable.

We now investigate the effects of a production subsidy and a tariff on the HT economy in the short run. For policy analysis, capital inputs are assumed to be fixed and the supply curves are positively sloped. Let s denote the domestic subsidy on the production of the importable. Then the domestic producer price is $P \equiv p + s = p^* + t + s$. Profit maximizing competitive firms collectively maximize producer revenue

$$R = PX + Y. \tag{13}$$

Consumers receive income from the sale of factor services. Total factor income is $wL_y + WL_x + rK_x + rK_y$. Profit dividends to consumers are $\pi_X + \pi_Y = (PX - WL_x - rK_x) + (Y - wL_y - rK_y)$. Net government revenue is $G = (tQ - sX)$. Thus, total income is the sum of factor payments, profits, and net government revenue, and is equal to the sum of producer revenue and the net government revenue, $I = R + G$, or

$$I = PX + Y + tQ - sX = pX + Y + tQ, \tag{14}$$

since $P = p + s$.

To analyze the effect of import tariff and production subsidy on welfare, we first consider their impacts of on import, producer revenue and income. Differentiating (13) and using the first order conditions, (3a) and (3b), and the HT condition in (4), we have

$$dR = XdP + PdX + dY = XdP + PF_L dL_x + G_L dL_y + (PF_K - G_K)dK_x$$

$$= XdP + WdL_x + wdL_y = XdP + w[(1 + \lambda)dL_x + dL_y].$$

Total differentiating (5a) gives

$$(1 + \lambda)dL_x + L_x d\lambda + dL_y = 0.$$

Thus,

$$dR = XdP - wL_x d\lambda. \qquad (15)$$

From (10), we have

$$d\lambda = [(1 + \lambda)k_y/k_x][X/(wL_x)]dP$$

$$= [\delta X/(wL_x)]dP$$

where $\delta = (1 + \lambda)k_y/k_x$. Therefore,

$$dR = X(1 - \delta)dP. \qquad (15')$$

Thus, $dR/dt = dR/ds = (1 - \delta)X$. Moreover, if the Neary stability condition is satisfied ($\delta < 1$), then for given foreign price p^*, $dR/dP > 0$. In other words, if $k_x > (1 + \lambda)k_y$, then an increase in t or s increases the producer revenue.

Next, totally differentiating (14) gives

$$dI = dR + Qdt + tdQ - sdX - Xds, \qquad (16)$$

where $Q = D(p,I) - X$, and

$$dQ = D_p dp + D_I dI - X'dP$$

$$= D_p dp + D_I(dH + Qdt + tdQ) - X'(dp + ds).$$

Rearranging terms, we have

$$dQ = [1/(1 - tD_I)]\{[D_p' - \delta D_I X - (1 + sD_I)X']dt$$

$$+ [- \delta D_I X - (1 + sD_I)X']ds\}. \qquad (17)$$

where $D_p^u \equiv (D_p + DD_I)$ is the slope of the compensated demand curve. Note that since $D_p^u < 0$, we get $dQ/dt < dQ/ds < 0$. That is, an import tariff reduces import more than a production subsidy.

Substituting dR and dQ into (16), we obtain

$$dI = [1/(1 - tD_I)]\{[(D - \delta X - (t + s)X' + tD_p]dt$$

$$+ [- \delta X - (t + s)X']ds\}. \qquad (16')$$

Thus, $dI/ds < 0$ for all $t \geq 0$, $s \geq 0$. However, the sign of dI/dt is indeterminate.

We now examine the effects of changes in a tariff and a production subsidy on welfare. The indirect utility function is rewritten as

$$V[p,I] = V[p, PX + Y + tQ - sX]. \qquad (18)$$

Totally differentiating (18), using the Roy's identity, and noting $dp^* = 0$, gives

$$dV = V_p dp + V_I dI = V_I(- Ddt + dI)$$

$$= V_I(-Ddt + dR + tdQ + Qdt - sdX - Xds)$$

$$= [V_I/(1 - tD_I)]\{[tD_p^u - \delta X - (t + s)X']dt$$

$$+ [- \delta X - (t + s)X']ds\}$$

$$= [V_I/(1 - tD_I)](\alpha dt + \beta ds), \qquad (19)$$

where $\alpha = tD_p^u + \beta$, and $\beta = - \delta X - (t + s)X'$. Note that $dV/ds = V_I(dI/ds) < 0$ and $dV/dt < 0$ for all $t \geq 0$, $s \geq 0$. That is, a tariff or a production subsidy reduces the welfare of a small country in the HT labor-surplus economy.

The first order conditions for an optimal combination of s and t are

$$\alpha = tD_p^u + \beta = 0, \qquad (20a)$$

$$\beta = 0. \qquad (20b)$$

This implies that

$$t = 0, \; s = - \delta X/X' < 0,$$

since $D_p^u < 0$. That is, the optimal production subsidy is negative and the optimal tariff is zero in a HT open economy.

Many LDCs lack revenue source to finance production subsidies, and rely instead on import tariffs. Consider an optimal tariff when the government is constrained to use only tariff ($s = 0$). From (20a), we get $t = - \beta/D_p^u$, or

$$t = \delta X/(D_p^u - X') < 0.$$

That is, the optimal tariff is negative when no production

subsidy or tax is used. These results are summarized below.

PROPOSITION 2: An import tariff is welfare-reducing in an HT economy and the optimal tariff is negative. If a production subsidy is used, however, the optimal production subsidy on the importable is negative and the optimal tariff is zero.

In the traditional HT model, capital is sector-specific, and the optimal policy consists of a wage subsidy in the manufacturing sector and a restriction of labor migration (Harris and Todaro, 1970). Restrictions on labor migration, however, is often considered infeasible by many economists. Bhagwati and Srinivasan (1971) instead proposed as first best policy, (i) a uniform wage subsidy, and (ii) a wage subsidy to manufacturing combined with a production subsidy to agriculture, which they claim to be "equivalent" to a tariff. Corden and Findlay (1975, p. 75) objected to tariffs on imports of manufactures because they conjectured that tariffs may fail to raise net output.

Governments of many LDCs lack revenue source to finance the subsidy to agriculture. Instead they tend to tax imports of manufactures. When capital is mobile between sectors, Proposition 2 shows that such an import tariff is welfare-reducing. Optimal trade policy rather requires a negative tariff on imports. Specifically, for instance, a reduction in Mexico's tariff to be implemented by NAFTA would improve

welfare of Mexico, which may be considered an HT economy.

In a two-good framework, resource allocation depends only on the relative price and hence an import tariff (subsidy) is equivalent to an export tax (subsidy), which is Lerner's symmetry result. Proposition 2 implies that an import tariff is welfare-reducing and that a negative import tariff or an equal export subsidy, which discourages the domestic production of the importable, is welfare improving. However, when both production subsidy and tariff can be used, an optimal policy consists of a production tax on the importable (or equivalently a equal production subsidy on the exportable) and a zero tariff. Many small LDCs tend to rely heavily on import tariffs for revenue. Our result suggests that this practice should be abandoned in favor of a production tax on the importable. For example, let $p^* = \$10$ be the foreign price of the importable. Suppose an LDC imposes a specific tariff of \$1 on the importable. Then the domestic price rises to \$11. If instead a per unit tax of \$1 is imposed on the production of the importable, then the net producer price reduces to \$9. Our result suggests that the latter policy is superior to the former.

5. Terms of Trade Effect under Tariff and Subsidy

We consider the effects of a change in the terms of trade. Using (15) and (16') and noting that $dp/dp^* = 1$ and $dt = ds =$

0, we get

$$dR/dp^* = (1 - \delta)X,$$

$$dI/dp^* = dR/dp^* + t(dQ/dp^*) - sX'$$

$$= (1 - \delta)X + t[D_p + D_I(dI/dp^*) - X'] - sX',$$

where $dQ/dp^* = D_p + D_I(dI/dp^*) - X'$. Rearranging terms, we have

$$dI/dp^* = [(1 - \delta)X + tD_p - (t + s)X']/(1 - tD_I).$$

Thus, we have

$$dV/dp^* = V_p + V_I(dI/dp^*)$$

$$= V_I\{ - D + [1/(1 - tD_I)]/[(1 - \delta)X + tD_p - (t + s)X']\}$$

$$= V_I[- Q - \delta X + tD_p - (t + s)X']/(1 - tD_I).$$

That is, an improvement in the terms of trade necessarily improves welfare of an HT economy.

PROPOSITION 3: An improvement in the terms of trade necessarily improves the welfare of a small open HT economy.

6. Concluding Remarks

This paper uses the HT model to analyze optimal trade policies of a small open labor-surplus economy with

intersectoral capital mobility. An increase in the price of the importable increases the capital rental but decreases the rural wage, regardless of the factor intensities of traded goods. It is shown that an import tariff is welfare-reducing and the optimal tariff is negative. However, if a production subsidy is used, the optimal production subsidy on the importable is negative and the optimal tariff is zero.

East Asia and Latin America have sharply differed in their policies to correct unemployment and to spur economic growth. For example, during the last three decades, East Asian countries, including South Korea and Taiwan, have promoted rapid export expansion, whereas many Latin American countries such as Chile and Argentina relaxed export promotion efforts and shifted to inward orientation (Lin, 1988).

Our analysis has two important implications on trade policies some developing countries adopted during the last three decades. First, When LDCs lack other revenue sources to finance production subsidies, an import tariff raises government revenue but reduces domestic welfare. Thus, an optimal policy is an import subsidy (a negative import tariff), or equivalently, an equal export subsidy. For example, East Asian countries such as South Korea and Taiwan chose outward-oriented strategies. In contrast, Chile and Argentina tightened import controls, raised tariffs, and overvalued their currencies. Our results suggest that import

restrictions in these countries may be welfare-reducing. Second, if revenues can be generated, the optimal policy is not an export subsidy, but a production subsidy on the exportable (which is equivalent to a production tax on the importable). Production subsidy is superior to export subsidy, even though the latter promotes export more directly.

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Endnotes

1. Chile and Argentina experienced unsatisfactory growth with fluctuating export earnings and rapid inflation that depressed domestic output (Lin, 1988). Theoretically, Rivera-Batiz and Romer (1991) suggest that economic integration increases the long run rate of growth, whereas Edwards (1992) explore the linkage between trade policy and growth.
2. As Batra and Seth (1977) point out, the Brecher model has limited applications because it results in complete

specialization or production indeterminacy.

3. That is, even if the positive welfare effects of lower U.S. and Canadian tariffs are not included.
4. In the long run, both capital and labor are variable inputs, and linear homogeneity implies horizontal input demand curves.

SERVICES, UNDEREMPLOYMENT, AND TRADE POLICIES

A paper submitted to Southern Economic Journal

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Abstract

This paper uses a three-sector Harris-Todaro model to investigate trade policies of a developing country. We introduce a nontraded service sector in the urban area which uses only labor as input. An increase in the price of the importable, or a technological progress in the manufacturing sector, lowers the service price under certain circumstances. An optimal policy consists of a zero import tariff and a production subsidy, which can be positive. When no production subsidy is used, the optimal tariff can also be positive. This result may justify the use of protectionist practices in some LDCs with a large informal urban sector.

1. Introduction

Despite the well known theory that a small country does not benefit from trade restrictions, very few LDCs indeed practice free trade. LDCs with little or no market power tend to adopt more restrictive policies than large industrial countries. Moreover, GATT also has provisions for permitting restrictive trade practices in LDCs under special circumstances.

Protection may be viewed as a second best policy when some distortions exist. For example, if the level of unemployment is high, protection may improve the welfare of a labor-surplus economy.

The Harris-Todaro (1970) (HT, hereafter) model has been widely used to investigate urban unemployment in developing countries. The HT model assumes sector-specific wage rigidity, and hence unemployment is not ubiquitous but exists only in the urban sector. The HT model is appropriate for investigating the impacts of trade policies of LDCs that suffer from urban unemployment, and it has been subsequently used by Hazari (1986), Batra and Beladi (1990), Chao and Yu (1990, 1992), Hazari and Sgro (1990), and Marjit (1991).

Two sector models are overly simplistic to describe urban unemployment in many LDCs. In these countries, the urban area provides opportunities for employment outside the manufacturing sector. Only a small fraction of workers who move to the urban area are employed in the manufacturing sector, and the rest — especially those who move late to the urban area — is forced to stay in the informal sector while searching for a permanent job. Todaro (1969) noted that the informal urban sector serves as a springboard for immigrants to enter the formal or manufacturing sector. In fact, it is difficult to distinguish those who are "employed" (usually underemployed) in the informal sector and those who are not

employed at all; many immigrants are supported by their families or relatives who arrived earlier, or are engaged in the family-operated "petty trade" businesses, sharing their income. The "wage" of a worker in the informal sector is just the average income of the sector, which is flexible. For example, as more people move into the informal sector, the average income declines.

Chao and Yu (1992) first developed a three sector Harris-Todaro model to explain the existing and enlarging gap between the prices of services in the LDCs and industrial countries. In their model, capital is assumed to be sector specific and all the sectors use both capital and labor as inputs. Since a flexible service wage is used, there is no urban unemployment. In this paper, we also assume a flexible wage in the service sector. As in the HT model, the agricultural wage is flexible and the manufacturing wage is fixed and higher than the former. But we assume that the service sector uses only labor as input, while the other two sectors, the urban manufacturing and the rural agriculture, use both capital and labor as inputs. This assumption is realistic for the service sector in many developing countries.

In this paper we investigate the employment and welfare effects of commercial policies of a small labor-surplus open economy. It is shown that a technological improvement in the manufacturing sector under certain conditions will widen the

gap in service prices between the developed and developing countries. An optimal trade policy consists of a production subsidy on the manufacturing sector, which can be positive, and a zero import tariff.

2. The Model

We consider a small open economy which embraces two areas and three sectors. The rural area produces the agricultural output Y. The urban area consists of two sectors: the manufacturing sector producing X, and the service sector producing Z. The economy exports the agricultural product Y, which is used as numeraire, and imports the manufactured good X. Services Z are assumed to be a nontraded good. The aggregate supplies of capital K and labor L are assumed fixed. Capital is fully employed, but labor underemployment exists in the urban area due to wage rigidity.

Let L_j and K_j denote the labor and capital employed in sector j, respectively. Let X, Y, and Z denote the outputs of the manufacturing sector, the agricultural sector, and the service sector, respectively. While the agricultural sector and the urban manufacturing sector employ both capital and labor as inputs, the urban service sector uses only labor in the production of its output which is consumed only domestically. The outputs of the three sectors are:

$$X = F(L_x, K_x), \tag{1a}$$

$$Y = G(L_y, K_y), \tag{1b}$$

$$Z = H(L_z), \tag{1c}$$

where the production functions, $F(\cdot)$, $G(\cdot)$, and $H(\cdot)$ are assumed to be linearly homogeneous.

At the beginning of a production period, a worker can choose to work in the urban area or in the rural area. Once the location choice is made, the worker cannot move to the other area during the same production period but is free to move again at the beginning of the next period. Because the rural wage is flexible, employment is guaranteed in the rural area. But if a worker chooses the urban area, there is a chance that the worker may not find a job in the manufacturing sector and end up in the urban service sector.

The manufacturing wage W is fixed and is usually above the flexible rural wage because of union contracts. If unemployed by the manufacturing sector, the worker cannot move to the rural area immediately, but must wait until the next period starts. Thus, urban workers not employed by the manufacturing sector would flock to the service sector, earning much less than a worker employed in the manufacturing sector. On the other hand, capital is completely mobile among the agricultural and the manufacturing sectors and the capital

market is perfectly competitive. Thus, capital rental r is the same in the two sectors.

Let Y be the numeraire and its price be unity. Profits of the three sectors are:

$$\pi_x = pF - WL_x - rK_x, \tag{2a}$$

$$\pi_y = G - wL_y - rK_y, \tag{2b}$$

$$\pi_z = bH - eL_z, \tag{2c}$$

where W is the fixed wage in the manufacturing sector, e the flexible "wage" in the service sector, and p and b are the producer prices of the manufactures and services, respectively.

Perfect competition in product markets implies that the zero profit condition holds in "long run" equilibrium. Thus, unit costs are equated to producer prices,

$$p = a_{Kx}\, r + a_{Lx}\, W, \tag{3a}$$

$$1 = a_{Ky}\, r + a_{Ly}\, w, \tag{3b}$$

$$b = a_{Lz}\, e, \tag{3c}$$

where a_{ij} is the amount of input i to produce one unit of good j. Factor market clearing requires

$$L_x + L_y + L_z = L, \tag{4a}$$

$$K_x + K_y = K. \qquad (4b)$$

Recall that at the beginning of a period, a worker is free to enter the urban or rural area. Following the HT model, we assume that the flexible rural wage is equated to the expected urban wage,

$$w = [L_x/(L_x + L_z)]\ W + [L_z/(L_x + L_z)]\ e, \qquad (5)$$

which is the Harris-Todaro condition with two urban wages.

Consumer preferences are represented by a monotone increasing and quasi-concave utility function, $U = U(B,C,D)$, where B, C, and D denote consumption of the services, the exportable (agricultural), and the importable (manufactures), respectively. Since service is a nontraded good, $B = Z$. Let t denote a specific tariff levied on imports, and let p^* be the world price of the importable. The domestic consumer price of the importable is

$$\rho = p^* + t. \qquad (6)$$

Suppose the home country also supports the import competing sector. Let s denote the per unit subsidy on the production of the manufactured good X. Then the domestic producer price of the importable is

$$p = p^* + t + s, \qquad (7)$$

Let I denote consumer income, and let $B(b,\rho,I)$, $C(b,\rho,I)$, and $D(b,\rho,I)$ be the demand functions obtained by maximizing U subject to the budget constraint. Then the indirect utility is written as

$$V \equiv V[b,\rho,I] = U[B(b,\rho,I),C(b,\rho,I),D(b,\rho,I)].$$

Import demand is

$$Q(b,\rho,I) = D(b,\rho,I) - X(p). \tag{8}$$

Consumer income I is endogenously determined, and it can be written as

$$I = rK + WL_x + wL_y + eL_z + tQ - sX, \tag{9}$$

where the first four terms are payments to factors, (tQ - sX) is the net government revenue, and is, following tradition, assumed to be rebated to the consumers. Using the HT condition, equation (5), we can rewrite (9) as

$$I = rK + wL + tQ - sX, \tag{10}$$

because $WL_x + wL_y + eL_z = wL$, i.e., total labor income is the product of the agricultural wage w and the total number of workers in the economy L.

3. Responses of Factor and Service Prices

In the Heckscher-Ohlin trade model, an increase in the price of a traded good necessarily raises one factor price and lowers the other, depending on the capital intensity of traded goods. How does a change in the terms of trade affect factor prices in this three-sector HT model? Since there are two traded good and two factors, the addition of the service sector into the original HT model do not alter the effect of the a change in, say, the price of manufactures on the returns to factors. Totally differentiating equation (3a) - (3b) and noting that $dW = 0$ and $rda_{Kx} + Wda_{Lx} = rda_{Ky} + wda_{Ly} = rda_{Kz} + eda_{Lz} = 0$, we have

$$\partial r/\partial p = 1/a_{Kx} = X/K_x > 0 \qquad (11a)$$

$$\partial w/\partial p = -a_{Ky}/(a_{Ly}a_{Kx}) = - k_yX/K_x < 0. \qquad (11b)$$

The derivatives are the same as in the standard two-sector HT model, as mentioned earlier.

The service wage e and the service price b are also endogenous and determined domestically. The impact of a change in the price of the importable p on e can not be determined in the system of equations (3a)-(3c). We use the HT condition (5) to study the effect on the service wage of a change in p. Let $\beta = L_x/(L_x + L_z)$ be the relative employment in the urban manufacturing sector, then we can rewrite (5) as

$$w = \beta W + (1 - \beta)e, \qquad (5')$$

Taking the partial derivative of both sides with respect to p and noting $\partial W/\partial p = 0$ yields

$$\partial w/\partial p = (W - e)(\partial\beta/\partial p) + (1 - \beta)(\partial e/\partial p),$$

which, after rearranging, leads to

$$\partial e/\partial p = [1/(1 - \beta)][\partial w/\partial p - (W - e)(\partial\beta/\partial p)], \qquad (11c)$$

where $1 - \beta > 0$, $\partial w/\partial p < 0$, and $(W - e) > 0$. Differentiating $\beta = L_x/(L_x + L_z)$ yields

$$\partial\beta/\partial p = [(L_x + L_z)(\partial L_x/\partial p) - L_x(\partial L_x/\partial p + \partial L_z/\partial p)]/(L_x + L_z)^2$$

$$= [1/(L_x + L_z)^2][L_z(\partial L_x/\partial p) - L_x(\partial L_z/\partial p)]$$

$$= \{L_xL_z/[p(L_x + L_z)^2]\}(\epsilon_x - \epsilon_z), \qquad (12)$$

where $\epsilon_x = (\partial L_x/\partial p)(p/L_x)$ and $\epsilon_z = (\partial L_z/\partial p)(p/L_z)$ are the elasticities of labor supply in the manufacturing and the service sectors, respectively, with respect to the price of the manufactures. It is obvious that $\epsilon_x > 0$ but the sign of ϵ_z is ambiguous. Even when $\epsilon_z > 0$, it is reasonable to assume that $\epsilon_x - \epsilon_z > 0$, because a change in p, the price of manufactured goods, has only indirect effect on the employment of the service sector. In this case, $\partial\beta/\partial p > 0$.

An implication of this result is that an increase in the

production subsidy or a tariff in the import competing sector or tariff may alleviate the problem of urban underemployment outside the manufacturing sector. Finally, equation (3c) implies that $\partial b/\partial p$ has the same sign as $\partial e/\partial p$. These results are summarized below.

Proposition 1: In a Harris-Todaro economy with services, an increase in the price of the importable increases capital rental but reduces the wages in the rural sector; it also reduces the service wage and the service price if $\epsilon_x - \epsilon_z) > 0$.

It should be noted that the standard two-sector HT model can be viewed as a special case of the present model where e = 0. Thus (5′) implies $\partial\beta/\partial w = 1/W > 0$ and (11c) implies $\partial\beta/\partial p = (\partial\beta/\partial w)(\partial w/\partial p) < 0$, since $\partial w/\partial p < 0$ from (11b). Thus, in the two-sector HT model, an increase in the price of the manufacturing sector reduces the relative employment in that sector.

Many authors observed the widening gap in the prices of services between rich and poor countries. Chao and Yu (1992), for example, attribute this phenomenon to technological progress, based on a three-sector HT model with capital immobility and a rigid manufacturing wage.

This paper provides an alternative explanation for the widening wage gap in the service sectors, using a three-sector HT model with asymmetrical production structure. Suppose that

an improvement in technology occurs in the manufacturing sector. To assess the impact of a neutral technological change in manufacturing, the production function in (1a) is replaced by $X = \alpha F(K_x, L_x)$, where $\alpha \geq 1$. Because of constant returns to scale technology, a technological progress ($\alpha > 1$) is equivalent to an increase in the output price (from p to αp). After replacing p with αp, equations (3a) - (3c) and (5) can be used to analyze the effects of a technological improvement. This implies that a neutral technological progress in the manufacturing sector will lower the price of services if $\epsilon_x - \epsilon_z > 0$.

To predict the behavior of service price in rich countries, important changes have to be made about the assumptions. First, the service sector in rich countries also uses capital input, which is becoming increasingly important. Specifically, services are assumed to be more capital intensive than agriculture and less intensive than manufactures. Second, as in Chao and Yu (1992), we assume that labor market distortions do not exist in rich countries (i.e., W = e = w and w is flexible). In this case, the zero profit conditions for the three sectors are written as:

$$p = a_{Kx}\, r + a_{Lx}\, w, \qquad (3a')$$

$$1 = a_{Ky}\, r + a_{Ly}\, w, \qquad (3b')$$

$$b = a_{Kz}\, r + a_{Lz}\, w. \qquad (3c')$$

Differentiation of equations (3a') - (3c') leads to, among others, $\partial b/\partial p > 0$, if the manufacturing sector is most capital intensive and the agricultural sector is most labor intensive.[1] Therefore, a technological progress in the manufacturing sector increases the service price in rich countries.

Proposition 2: In a Harris-Todaro economy, a neutral technological improvement in the manufacturing sector lowers the price of services, if $\epsilon_x - \epsilon_z > 0$, whereas it raises the price of services in a rich country if $k_x > k_z > k_y$. Thus, such a technological improvement widens the gap between the service prices in developed and developing countries.

4. Tariff, Subsidy, and Welfare

In this section, we analyze the effects on the expected welfare of a production subsidy to the manufacturing sector and a tariff on imports. Totally differentiating $V(b,\rho,I) = V(b,p^* + t,I)$, using the Roy's identity, and noting that $d\rho = dt$, $dp = dt + ds$, we have:

$$dV = V_\rho d\rho + V_b db + V_I dI = V_\rho dt + V_b b_p (dt + ds) + V_I dI$$

$$= V_I[-\ (D + Bb_p)dt - Bb_p ds + dI], \qquad (13)$$

where, as defined earlier, B, C, and D denote consumption of the services, the exportable (agricultural), and the importable (manufactures), respectively. Since service is a nontraded good, B = Z, the output of that sector. Variables with subscripts b, p and ρ denote the corresponding partial derivatives. For instance, $b_p = \partial b/\partial p$. Totally differentiating (10) gives

$$dI = Kdr + Ldw + Q + tdQ - sdX - Xds$$

$$= [Kr_p + Lw_p - sX']dp + tdQ + Qdt - Xds$$

$$= [Kr_p + Lw_p - sX' + Q]dt$$

$$+ (Kr_p + Lw_p - sX' - X)ds + tdQ, \qquad (14)$$

where $X' \equiv dX/dp$, $Q = Q(b,\rho,I) = D(b,\rho,I) - X(p)$ and

$$dQ = D_\rho d\rho + D_b db + D_I dI - dX$$

$$= D_\rho dt + D_b b_p(dt + ds) + D_I dI - X'(dt + ds)$$

$$= [D_\rho + D_b b_p - X']dt + D_I dI + [D_b b_p - X']ds. \qquad (15)$$

Combining (14) and (15), we have

$$dI = [1/(1 - tD_I)]\cdot\{\sigma + t[D_\rho + D_b b_p - X']\}dt$$

$$+ [1/(1 - tD_I)]\cdot\{\sigma - D + t[D_b b_p - X']\}ds, \qquad (16)$$

where $\sigma \equiv Kr_p + Lw_p - sX' + Q$. Finally, substituting (16) into

(13) and using (11a) and (11b), we have

$$dV = [V_I/(1 - tD_I)](\gamma dt + \delta ds), \tag{17}$$

$$\delta = -(t + s)X' + (1 - L/L_y)K_y/a_{Kx} + (tD_b^u - B)b_p, \tag{18a}$$

$$\gamma = \delta + tD_p^u, \tag{18b}$$

where $D_p^u \equiv D_\rho + DD_I$ (< 0) is the slope of a compensated demand curve, $D_b^u \equiv D_b + BD_I$ is the change of compensated demand for D with respect to a change in the price of services, and X′ is the slope of the domestic supply of the importable. For an optimal solution to exist, the term $(1 - tD_I)$ must be invariant in sign.[2]

Assume that services and agricultural product are normal. Then $1 - \rho D_I > 0$ and $1 - tD_I > 0$. If services and the importable are Hicksian complements, then an increase in the price of a good decreases the compensated demand for its complement $(D_b^u = B_p^u < 0)$.

At an optimal combination of production subsidy and import tariff (s,t), $\delta = \gamma = 0$. This implies $tD_p^u = 0$, or

$$t^* = 0, \tag{19a}$$

and the optimal production subsidy is

$$s^* = [(1 - L/L_y)K_y/a_{Kx} - Bb_p]/X', \tag{19b}$$

which is indeterminate in sign, since $1 - L/L_y < 0$ and $b_p =$

$\partial b/\partial p < 0$. This implies that in the absence of a tariff, a production subsidy to the import competing sector can increase welfare. This verifies the well known result that a production subsidy is superior to a tariff, since a tariff may improve employment but not welfare when both policy instruments are used.[3] These results are summarized below:

Proposition 3: In a three sector HT economy with services, the optimal policy consists of a production subsidy and a zero tariff. The production subsidy is also zero for small industrial countries ($w = W = e$), but in developing countries, the production subsidy to the import competing sector can be positive.

The intuition for this result is straightforward. In this Harris-Todaro economy, there is one rigid wage, the fixed manufacturing wage W. Obviously, the first best policy is to eliminate the wage distortion in the urban area, but the fixed wage is institutionally determined. Since the wage distortion originates in the domestic economy, a production tax or subsidy is more efficient and beneficial than a tariff. Once an optimal production subsidy/tax is chosen, there is no need to further distort consumer prices – except to exploit monopoly power in trade for a large economy – and hence an import tariff is redundant.

Next, consider optimal policies when the government is

constrained to use only one instrument. For a given production subsidy, an optimal tariff satisfies

$$\partial V/\partial t = \gamma = 0,$$

which gives the optimal tariff as

$$t^{o} = [sX' + Bb_p - (1 - L/L_y)K_y/a_{Kx}]/[D_p^u - X' + D_b^u b_p]. \quad (20a)$$

In general, the sign of t^{o} is indeterminate. That is, for any given $s \geq 0$, the optimal tariff t can be positive or negative. This result is not inconsistent with Chen and Choi's (1993) finding that the optimal tariff is negative in the standard two-sector Harris-Todaro model. In fact, except for the terms related to the service sector (b_p and D_b^u), equation (20a) is exactly the same as its counterpart in the two-sector model. The important implication of (20a) is that an import tariff may be justified in the existence of a service sector, unlike the traditional HT model where the informal sector is not included.

For a given import tariff, the optimal production subsidy satisfies

$$\partial V/\partial s = \delta = 0,$$

which gives the optimal subsidy as

$$s^{o} = [(1 - L/L_y)K_y/a_{Kx} - tX' + (tD_b^u - B)b_p]/X'. \quad (20b)$$

For any given t, the optimal production subsidy s can be positive or negative. If t = 0, then we get a globally optimal production subsidy in (19b). Again, this means that it may be economically sensible to protect the manufacturing industries in the LDCs in the presence of a service sector in urban areas.

5. Concluding Remarks

This paper introduced a service sector into the traditional Harris-Todaro model and investigated optimal trade policies of a labor-surplus developing economy. The traditional HT model is overly simplified in that the urban workers rejected by the manufacturing sector are all unemployed. However, in most LDCs, urban workers may have a second chance to find employment by accepting a lower wage in the service sector. Moreover, in many low-income LDCs the service sector is the major source of urban employment.

We have developed a three-sector Harris-Todaro model of a labor-surplus open economy. It was shown that an increase in the price of the importable (the manufactured good) not only reduces the flexible wage in the rural sector, but also the wage in the service sector and the price of services. Likewise, a technological progress in the manufacturing sector reduces the price of services in LDCs under certain circumstances, widening the gap between the service prices in

the poor and rich countries.

An optimal trade policy for an HT economy with services consists of a zero tariff and a production subsidy. The optimal production subsidy can be positive or negative, whereas in a two-sector model the optimal production subsidy is negative. Given a production subsidy, the optimal tariff is indeterminate in sign. But once an optimal production subsidy or tax is used, there is no need to supplement it with an import tariff. If no production subsidy is allowed, the optimal tariff can be positive. In contrast, the optimal tariff is negative in the absence of the service sector. Thus, the introduction of the service sector into the traditional HT model may explain why protectionist practices so prevalent in LDCs.

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Endnotes

1. Totally differentiating (3a') - (3c') yields among others

$$\partial b/\partial p = a_{Kz}(\partial r/\partial p) + a_{Lz}(\partial w/\partial p) = a_{Lz}(k_z - k_y)/a_{Lx}(k_x - k_y).$$

Since the service sector is assumed to have intermediate capital intensity ($k_x > k_z > k_y$), then $\partial b/\partial p > 0$.

2. The existence of optimal production subsidy and tariff require that $\partial V/\partial t = \partial V/\partial s = 0$. Moreover, if $(1 - tD_I)$ changes its sign as t or s changes, then it must be zero at some point, in which case $\partial V/\partial s$ or $\partial V/\partial t$ is undefined, and hence an optimal solution does not exist.
3. As a special case, when there is no service sector, (19b) reduces to

$$s = [(1 - L/L_y)K_y/a_{Kx}]/X',$$

which is unambiguously negative. See also Chen and Choi (1993) where a two-sector HT model is studied.

EMPLOYMENT RISK, RISK AVERSION, AND TRADE POLICIES

A paper to be submitted to Journal of Political Economy

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Abstract

This paper considers trade policies and welfare in a Harris-Todaro model with risk averse workers. Workers are assumed to have identical and homothetic preferences, but their incomes differ, depending on whether and where they are employed. When workers are equally weighted, maximizing social utility is equivalent to maximizing the utility of a rural worker. An optimal policy consists of a production subsidy on the exportable and an import tariff. This model explains the widespread use of import tariffs of manufactured goods along with production subsidies on the export sectors in some LDCs.

1. Introduction

While some developing countries have relied on import substitution policies (Ballassa, 1988), some East Asian LDCs such as South Korea and Taiwan have adopted outward-looking strategies. They have promoted exports by subsidizing production of exportable goods extensively, while limiting imports of finished manufactures. Despite the theory that a

tariff hurts a small open economy, these countries have experienced phenomenal economic growth. On the whole, these strategies seem to have been quite successful. During the 1963-73 period, the growth rates of strongly outward-oriented developing countries were 7.4%, whereas those of strongly inward-oriented developing countries recorded an average growth rate of about 1.7% (World Bank, 1987).

The Harris-Todaro (1970, HT hereafter) model of a labor surplus economy captures a stylized fact in many LDCs: continuous labor migration to the urban sector and high urban unemployment. Wage is assumed to be flexible and employment is guaranteed in the rural sector, whereas in the urban sector wage is fixed institutionally at a level above the competitive wage. The urban workers face unemployment risk; the urban workers earn a higher fixed wage if employed, but earn nothing if unemployed. The HT model explains the use of production subsidies on the exportable goods in these countries (Bhagwati and Srinivasan, 1974). However, it does not explain why an import tariff should also be employed, despite its widespread use in LDCs.[1] Chen and Choi (1993) demonstrate that a tariff is welfare-reducing in an HT economy.

The underlying assumption of the HT model is that the flexible rural wage is determined at a level equal to the expected wage in the urban sector. In other words, workers are indifferent between a random compensation in the urban

sector and a nonrandom rural wage, equal to the expected wage in the urban sector. This implies that workers are risk neutral. With the exception of Corden and Findlay (1975) suggesting that workers may be risk averse, the literature has since adopted the risk neutrality assumption to explore the properties and policy questions within the HT model (e.g., Marjit, 1991; Neary, 1981; Chao and Yu, 1990).

Corden and Findlay (1975) suggested among others that production subsidies and import tariffs are not desirable in the risk neutral case.[2] Their implicit criterion for evaluating policies was the net change in total output. In this paper we use social utility as a welfare criterion to evaluate trade policies and investigate the implications of risk aversion on trade policies of a small open economy. Workers are assumed to be risk averse, willing to accept a nonrandom wage that is lower than the expected wage in the urban sector. Specifically, rural wage is equal to *certainty equivalent wage* in the urban sector. We adopt a social welfare function that gives equal weights to all workers. The most striking result is that when an optimal production subsidy is employed, an import tariff is welfare improving when workers are risk averse. This could explain why so many LDCs restrict imports of manufactured goods.

2. The Basic Model

The economy consists of two sectors; the urban sector produces a manufactured good X and the rural sector an agricultural good Y. All consumers are workers and receive income from labor services and capital endowment. To extend the Harris-Todaro model to an open economy with risk averse workers, we employ the following assumptions:

(i) Supplies of capital (K) and labor (L) inputs are fixed.

(ii) Each worker has one unit of labor and the ownership of the capital inputs is uniformly distributed among consumers.

(iii) Capital is fully employed, but labor unemployment exists in the urban sector due to wage rigidity.

(iv) The economy is small and imports the urban output X and exports the rural output Y.

(v) Workers are risk averse and have identical and homothetic preferences.

(vi) There is no price uncertainty or production uncertainty.

Because the aggregate capital endowment K is uniformly distributed among L workers, each worker owns $k = K/L$ units of capital and receives capital income rk, where r is the rental rate. Assumption (ii) is used to abstract from distributional issues and to focus on the aggregate welfare analysis.

Although workers have identical preferences in consumption, they may be classified into three categories depending on their income levels. Rural workers are fully employed and receive a flexible wage w. An urban employed worker receives the fixed wage W, which is institutionally set at a higher level than the competitive wage w and, thus W is not allowed to move either downward or upward. An urban worker earns no labor income if unemployed and relies on capital income only.

Let L_i and K_i denote the labor and capital employed in sector i, respectively. The output of the urban manufacturing sector is

$$X = F(L_x, K_x), \tag{1a}$$

and the output of the rural sector is

$$Y = G(L_y, K_y), \tag{1b}$$

where $F(\cdot)$ and $G(\cdot)$ are linearly homogeneous production functions.

Capital is a variable input and is mobile between the two sectors. Thus, capital rental r is the same in both sectors. However, following the HT model, we assume that due to wage rigidity in the urban sector, wages are different between the two sectors.

Profit of the urban sector is

$$\pi_x = PF - WL_x - rK_x, \qquad (2a)$$

where P is the producer price of the urban output and W is the fixed urban wage. Let y be the numeraire. Then the profit of the rural sector is

$$\pi_y = G - wL_y - rK_y, \qquad (2b)$$

where w is the flexible rural wage and the price of the numeraire is $P_y = 1$. Note that marginal product of each input is homogeneous of degree zero in K and L.

Perfect competition in product markets implies that the zero profit condition holds in "long run" equilibrium, although some "equilibrium" labor unemployment exists in the urban sector because of wage rigidity. Thus, prices are equated to unit costs,

$$P = Wa_{Lx} + ra_{Kx}, \qquad (3a)$$

$$1 = wa_{Ly} + ra_{Ky}, \qquad (3b)$$

where a_{ij} denote the amount of factor i employed to produce one unit of product j. Due to wage rigidity, there exists some unemployment L_u in the urban sector. Total demand for labor in the two sectors falls short of the labor supply,

$$(1 + \lambda)L_x + L_y = L, \qquad (4a)$$

where $\lambda \equiv L_u/L_x$ is the relative unemployment in the urban

sector. Capital market clearing requires

$$K_x + K_y = K. \tag{4b}$$

To complete the description of the production side of the model, an additional equation is needed to connect the wages in the two sectors. In the HT model, workers are assumed to be risk neutral, and hence expected urban wage is equal to the flexible rural wage,

$$w = W/(1 + \lambda).$$

In this paper, workers are assumed to be risk averse and they must be paid extra compensation above the nonrandom rural wage for taking a chance in the urban sector, i.e., $w < W/(1 + \lambda)$. This relationship will be more formally described in terms of utility functions later in the paper.

3. Output Prices and Factor Prices

In the Heckscher-Ohlin trade model, an increase in the price of a traded good necessarily raises one factor price and lowers the other, depending on the capital intensity of traded goods. How does a change in the terms of trade affect factor prices in the HT model? Since the urban wage is fixed, a change in p only affects capital rental r and the flexible rural wage w. Differentiating (3a) and (3b) and noting that $Wda_{Lx} + rda_{Kx} = wda_{Ly} + rda_{Ky} = 0$ yields

$$dP = a_{Kx}dr,$$

$$0 = a_{Ly}dw + a_{Ky}dr.$$

Thus, we get

$$\partial r/\partial P = 1/a_{Kx} = X/K_x > 0. \qquad (5a)$$

$$\partial w/\partial P = - k_y(X/K_x) < 0, \qquad (5b)$$

where $k_y = K_y/L_y$. Thus, in the Harris-Todaro model, an increase in the price of the importable raises rental on capital input and reduces the flexible wage in the export sector. Observe that unlike the Stolper-Samuelson Theorem in the Heckscher-Ohlin model, this result does not depend on the factor intensity rankings of traded goods. The result also holds regardless of risk attitudes of workers, because employment risk only affects individual workers, and the competitive firms do not face risk in the price or production uncertainty.

The intuition for this Stolper-Samuelson-like result is straightforward: an increase in the price of the manufactured good necessarily will increase the rental rate (r_X) in that sector since the urban wage rate (W) is fixed, which leads to an increase in the rural rental rate (r_Y) since capital is mobile between sectors. For a small country, the price of the agricultural product is also fixed by the world market, thus the rural wage rate (w) has to decrease in order for the zero-

profit condition to hold.

4. Risk Aversion

Consumer preferences are represented by a monotone increasing and concave utility function, $U = U(C,D)$, where C and D denote consumption of the exportable and the importable, respectively. Let I denote consumer income, land p be the consumer price of the manufactured good X. In the absence of production tax or subsidy, $p = P$. Let $C(p,I)$ and $D(p,I)$ be the demand functions obtained by maximizing U subject to the individual's budget constraint, $C + pD = I$. Then the indirect utility of a consumer is written as

$$V \equiv V[p,I] = U[C(p,I),D(p,I)].$$

Since workers are risk averse in income, $V_{II} < 0$.[3]

Workers have identical preferences, but their incomes are different, depending on whether they are employed in the rural sector, employed in the urban sector or unemployed. Let I^y, I^e, and I^u denote his income when he is employed in the rural sector, the urban sector and when he is unemployed, respectively, i.e.,

$$I^y = rk + w. \tag{6a}$$

$$I^e = rk + W. \tag{6b}$$

$$I^u = rk. \tag{6c}$$

The indirect utility of the worker in the rural sector is

$$V^y = V[p, rk + w]. \tag{7a}$$

If a worker is employed in the urban sector, his utility is $V^e = V[p, rk + W]$, but it is $V^u = V[p, rk]$ if unemployed. The expected utility of the representative urban worker is then

$$V^x \equiv \beta \cdot V[p, rk + W] + (1 - \beta)V[p, rk], \tag{7b}$$

where $\beta = 1/(1 + \lambda)$ is the probability of employment in the urban sector. Note that β and λ move in the opposite directions.

Let the risk premium ρ be implicitly defined by

$$\beta V[p, rk + W] + (1 - \beta)V[p, rk] \equiv V[p, rk + \beta W - \rho]. \tag{8}$$

The left side of (8) is expected utility of a worker entering the urban sector. Note that if the certainty equivalent income on the right side of (8) were equal to the income of a worker when unemployed ($\rho = \beta W$), then the left side would be greater than the right side for all $\beta > 0$. Thus, certainty equivalent income of the urban worker must be greater than the income of an unemployed worker ($\rho < \beta W$). Expected urban wage is βW, and expected total income of a worker in the urban sector is $rk + \beta W$. If the worker is risk neutral, then ρ is

zero, but ρ is positive if the worker is risk averse in income ($V_{II} < 0$).

At the beginning of each period, a worker can enter the rural sector earning the certain but flexible wage w, or he can enter the urban sector, earning a higher and fixed urban wage W if employed, or face unemployment. The equilibrium probability of employment $\beta = 1/(1 + \lambda)$ satisfies the condition that expected utility of income in both sectors, V^x and V^y, are the same, i.e.,

$$V[p,rk + \beta W - \rho] = V[p,rk + w]. \tag{9}$$

This equilibrium condition reduces to the Harris-Todaro condition when the worker is risk neutral in income. Equation (9) shows the relationship between the equilibrium rural wage and the fixed urban wage when workers are risk averse, and hence is called the general HT condition. From (9) and (8), we get

$$w = \beta W - \rho(\beta,p,rk,W). \tag{10}$$

Although the risk premium function $\rho(\cdot)$ depends on the parameters of (8), it can also be observed when the labor market is in equilibrium. The observed difference between the expected wage in the urban sector and the rural wage is thus the risk premium in equilibrium, $\rho = \beta W - w$.

All workers are assumed to have identical and homothetic

preferences. We employ a social utility function which gives equal weights to all workers. That is, the social utility is the sum of utilities of all workers. However, consumer income depends on whether he is employed in the rural sector, or the urban sector, or unemployed. Using the probability of employment, total social utility is $(L - L_y)V^x + L_yV^y$, or

$$S = (L - L_y)\cdot\{\beta V[p,rk + W] + (1 - \beta)V[p,rk]\}$$

$$+ L_y\cdot V[p,rk + w]. \qquad (11)$$

Because workers are mobile between the urban and the rural sectors, the rural wage w is in equilibrium when the general HT condition in (9) is satisfied. Thus,

$$S = L\cdot V[p,rK + w] = LV^y. \qquad (12)$$

That is, the social utility of all workers is the utility of a rural worker (or the expected utility of an urban worker before employment status is known) multiplied by the total number of workers.

5. Tariff, Production Subsidy, and Welfare

We now investigate the welfare implications of production subsidy and import tariff when workers are risk averse. Let t denote a specific tariff levied on imports, and let p* be the foreign price of the importable. The domestic consumer price

of the importable is $p = p^* + t$. Producer price is $P = p + s$, where s is per unit production subsidy on the manufactured good. Import demand is

$$Q(p,I) = D(p,I) - X(P), \tag{13}$$

where I is consumer income, which is endogenously determined. The government collects tariff (or quota) revenue $(p - p^*)Q$, but pays production subsidy sX. Following convention, we assume that net government revenue, $(p - p^*)Q - sX$, is rebated to all workers equally. The per capita rebate is $(p - p^*)q - sx$, where $q = Q/L$ and $x = X/L$.[4] With the rebate, social utility is given by

$$\begin{aligned} S = (L - L_y)\cdot\{&\beta V[p, rk + W + tq - sx] \\ &+ (1 - \beta)V[p, rk + tq - sx]\} \\ &+ L_y \cdot V[p, rk + w + tq - sx]. \end{aligned} \tag{14}$$

Since the expected utility of the urban worker is equal to the utility of the rural worker for any given level of tariff revenue, (14) reduces to

$$S = LV(p, I^y) \equiv V[p, (rK + wL + (p - p^*)Q - sX)/L], \tag{15}$$

where $I^y = (rK + wL + (p - p^*)Q - sX)/L$ is rural worker's income after the revenue rebate. Since the labor endowment L is given, social welfare is maximized if and only if the

utility of the rural worker is maximized.

6. The Effect of Tariff and Subsidy

Recall that preferences are identical and homothetic, so that the income elasticity of demand for the importable good is unity. Thus, the demand for the importable good increases proportionately as income increases, and is independent of the distribution of income among consumers. Observe that the certainty equivalent income of an urban worker is equal to I^y in equilibrium. Thus, the total certainty equivalent income is simply LI^y. Let $d(p)$ denote the demand for the importable good when income is \$1, i.e., $d(p) = D(p,1)$. Then Roy's identity implies $V_p = - V_I d(p) \times$ income.

Actual aggregate income is $I^A = (rK + WL_x + wL_y + tQ - sX)$. Let θ denote the ratio of rural worker's income, I^y, to the actual per capita income, I^A/L, i.e.,

$$\theta = I^y L/I^A$$

$$= (rK + wL + tQ - sX)/(rK + WL_x + wL_y + tQ - sX). \quad (16)$$

Then the total certainty equivalent income of all workers is $I^y L = \theta I^A$. It can be shown that $\theta = 1$ when workers are risk neutral, but $\theta < 1$ when workers are risk averse.[5] Recall that $\beta W > \rho \geq 0$. So, θ is bounded below.[6]

We now investigate how production subsidy and tariff will

affect the social utility. Differentiating (15) totally and noting that the aggregate certainty equivalent income is LI^y, we get

$$dS = L\cdot dV^y = L\cdot (V_p dp + V_I dI^y)$$

$$= L\cdot [-\, d(p) I^y V_I dp + V_I dI^y] = V_I(-\theta D dp + L dI^y) \qquad (17)$$

where $D = D(p, I^A)$ is actual aggregate demand for the manufactured good. Using $P = p + s = (p^* + t) + s$, $dP = dt + ds$ and $dp = dt$ given $dp^* = 0$, the change in the aggregate certainty equivalent income can be written as

$$LdI^y = d(rK + wL + tQ - sX)$$

$$= K(\partial r/\partial p)dp + L(\partial w/\partial p)dp + tdQ + Qdt - sX'dp - Xds.$$

Using (5a) and (5b), we get

$$LdI^y = [L(X/K_x)(k - k_y)]dp + tdQ + Qdt - sX'dp - Xds$$

$$= [(XK_y/K_x)(1 - L/L_y) + D - sX']dt$$

$$+ [(XK_y/K_x)(1 - L/L_y) - sX']ds + tdQ$$

$$= [A + D - sX']dt + [A - sX']ds + tdQ, \qquad (18)$$

where $A \equiv L(X/K_x)(k - k_y) - X = (XK_y/K_x)(1 - L/L_y)$. Substituting (18) into (17) yields

$$dS = V_I(-\theta D dp + L dI^y)$$

$$= V_I\{[(1 - \theta)D + A - sX']dt + [A - sX']ds + tdQ\} \quad (19)$$

It is shown in the appendix that

$$dQ = [1/(1-tD_I)]\{[D_p^u + D_IY' - (1-pD_I)X']dt$$

$$+ [D_IY' - (1-pD_I)X']ds\} \quad (20)$$

where D_p^u is the slope of the compensated demand curve along a given indifference curve. Assume that both goods are normal ($D_I > 0$ and $C_I = 1 - pD_I > 0$). Then, $1 - tD_I > 1 - pD_I > 0$. From (20), an increase in tariff or production subsidy shifts the import demand curve to the left, i.e., $\partial Q/\partial t < 0$ and $\partial Q/\partial s < 0$. Moreover,

$$\partial Q/\partial s - \partial Q/\partial t = - D_p^u/(1 - tD_I) > 0. \quad (21)$$

That is, a decrease in consumption tax (i.e., an increase in the production subsidy followed by an equal decrease in tariff) increases import demand.

The first order conditions for optimal tariff and production subsidy can be derived from (19) and using dQ in (20):

$$\partial S/\partial t = (1 - \theta)D + A - sX' + t(\partial Q/\partial t) = 0, \quad (22a)$$

$$\partial S/\partial s = (A - sX') + t(\partial Q/\partial s) = 0. \quad (22b)$$

Substituting (22b) into (22a) yields $t = (1 - \theta)D/(\partial Q/\partial s -$

$\partial Q/\partial t$). Using (21), we get the optimal tariff and production subsidy

$$t = - (1 - \theta)D/(\theta DD_I + D_p) \geq 0, \qquad (23a)$$

$$s = [A + t(\partial Q/\partial s)]/X' < 0. \qquad (23b)$$

If workers are risk neutral, then $\theta = 1$, and the optimal tariff is zero, but the optimal production subsidy reduces to $A/X' < 0$. Note that since the importable is a normal good, $(\theta DD_I + D_p) = D_p^u + (\theta - 1)DD_I < D_p^u < 0$. If workers are risk averse, then optimal tariff is positive. Since $t > 0$, (23b) implies that optimal production subsidy is negative. These results are summarized below:

Proposition 1: If workers are risk neutral, then the optimal tariff is zero and optimal production subsidy on the importable is negative. If workers are risk averse, however, the optimal tariff is positive and the optimal production subsidy on the importable is negative.

Note that a tariff can be broken down into a consumption tax and a production subsidy. Thus, if the optimal tariff and production subsidy are of the same magnitudes, then the optimal policy would be a net consumption tax. However, (23a) and (23b) indicate that no comparisons of the magnitudes of the tariff and the production subsidy can be made a priori.

Next, consider optimal tariff when no production subsidy is used. Then from (22a) the optimal tariff is

$$t = - [(1 - \theta)D + A]/(\partial Q/\partial t). \qquad (24a)$$

If workers are risk neutral, optimal tariff is negative, but if workers are risk averse, optimal tariff can be positive or negative, depending on the extent of risk aversion.

On the other hand, if no tariff is used, then

$$s = A/X' < 0. \qquad (24b)$$

That is, regardless of risk attitudes, optimal production subsidy is negative when $t = 0$.
When a positive tariff is used, optimal production subsidy is $s = [A + t(\partial Q/\partial s)]/X' < 0$.

Proposition 2: If workers are risk averse, an import tariff can be welfare improving even when no production subsidy is used. If no import tariff is employed, optimal production subsidy is negative regardless of risk attitude.

In the absence of a direct production subsidy, an import tariff can be broken down into a consumption tax and a production subsidy. Under risk aversion, a consumption tax enhances the social utility through a mechanism like that of insurance. A consumption tax can also be viewed as an income tax on the rich urban workers who are the main consumers of

imported goods. Part of this tax is then rebated to the poor. Therefore, an import tariff indirectly transfers income from the rich to the poor. Given that workers are risk averse, or, in other words, the individual indirect utilities are concave in income, such transfers increase the social welfare which is the sum of the utilities of all workers.[7]

The following example illustrates the case of a positive tariff when no production subsidy is used. Suppose that, initially, with $t = 0$ (when there is free trade), $W = 2w$, which means $P \cdot MPL_x = 2MPL_y$, or the labor productivity in the urban sector is twice as much as that in the rural sector. First, consider the case where workers are risk neutral. A simple algebraic manipulation leads to $\beta = L_x/(L_u + L_x) = 1/2$, or the urban employment rate is 50%. Suppose now a positive tariff ($t > 0$) is levied on imports and results in, say, $W = 3w$, and hence $\beta = 1/3$, which is to say that for every 3 workers drawn from the rural sector by an even higher urban wage, 2 workers would be unemployed. Since $P \cdot MPL_x = 2MPL_y$ still holds, there will be a production loss and a welfare loss. To see this, suppose a rural worker produces one unit while an urban worker produces two units. Before the tariff is levied, 3 workers produce 3 units in the rural sector; after the tariff, only 1 of them is employed in the urban sector, producing 2 units.

If workers are risk averse, however, they will not accept β

= 1/3 if a tariff results in the same wage relation as before, W = 3w. Recall that the Stolper-Samuelson-like result in Proposition 1 is independent of risk attitudes. Suppose that a higher rate of employment is required, say, β = 2/3, for some level of risk aversion. In this case, out of every 3 workers drawn from the rural sector, 2 will be employed in the urban sector, producing 2 units each, and obviously, there will be a gain in production because of the tariff.

7. Concluding Remarks

This paper investigated the properties of a generalized HT model with risk averse workers. It is assumed that the consumer-worker receives income from capital endowment and also from the sale of labor services, but labor income depends on whether and where the worker is employed. To focus on the welfare impacts of trade policies on LDCs, we assume that capital endowments are uniformly distributed among workers. Since labor is mobile between the urban and the rural sectors, risk averse workers insure that the flexible rural wage is equal to the certainty equivalent wage, which is less than the expected wage in the urban sector.

We employ a social welfare function which gives equal weights to all workers. It is shown that maximizing social welfare is equivalent to maximizing the utility of the rural worker. Thus, any policy that raises the utility of a rural

worker (or the expected utility of an urban worker) raises social welfare. If workers are risk neutral, then a tariff necessarily hurts a small open economy, and hence the traditional HT model cannot explain the widespread use of tariffs in LDCs. We have shown, however, that if workers are risk averse and an optimal production subsidy is used, an import tariff necessarily improves the welfare of an HT economy.

This model provides a possible explanation for the widespread use of production subsidies in the export sector and import tariffs in some developing countries. If workers are risk averse, an optimal policy consists of a negative production subsidy and a positive tariff. A negative production subsidy on the importable is equivalent to a production subsidy in the export sector. Our analysis shows that export promotion strategy alone is not optimal in an HT economy but it should be supplemented by an import tariff. This result is consistent with the policies of some LDCs such as South Korea and Taiwan.

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Appendix

With aggregate income I^A, the import demand can be written as $Q = D(p, I^A) - X(P)$, and,

$$dQ = D_p dp + D_I dI^A - X'dP, \qquad \text{(A1)}$$

where $I^A = rK + wL_y + WL_x + tQ - sX = PX + Y + tQ - sX$,

$$dI^A = PX'dP + XdP + Y'dP + tdQ + Qdt - sX'dP - X\,ds$$

$$= (pX' + X + Y')dP + Qdt - Xds + tdQ. \qquad \text{(A2)}$$

Substituting (A2) into (A1) yields,

$$dQ = D_p dp + D_I[(pX' + X + Y')dP + Qdt - Xds + tdQ] - X'dP$$

$$= D_p dt + [D_I(pX' + D + Y') - X']dt$$

$$+ [D_I(pX' + Y') - X']ds + tD_I dQ$$

$$= [D_p + DD_I + D_I Y' - (1 - pD_I)X']dt$$

$$+ [D_I Y' - (1 - pD_I)X']ds + tD_I dQ.$$

Rearranging terms, we get (20).

Endnotes

We would like to thank Alan Deardorff for his helpful comments. The usual caveats apply.

1. See also Choi and Beladi (1993) for optimal tariff policies for a small open economy with general unemployment risk.
2. In Corden and Findlay (1975), production subsidies and import tariffs are considered separately, whereas this paper permits the government to use both instruments simultaneously.
3. It is well known that the direct utility function $U(\cdot)$ is concave if and only if the indirect utility function $V(p,I)$ is concave in income.
4. In addition to rebates of net government revenue, the total profits,

$$\Pi = PF + G - WL_x - rK_x - wL_y - rK_x,$$

are also distributed to consumers as dividends, but they are equal to zero in equilibrium.

5. $\theta = (rk + w + tq)/(rk + WL_x/L + wL_y/L + tq)$

$= (rk + w + tq)/(rk + (1 + \lambda)(w + \rho)L_x/L + wL_y/L + tq)$

$= (rk + w + tq)/(rk + (w + \rho)(L - L_y)/L + wL_y/L + tq)$

$= (rk + w + tq)/(rk + w + tq + \rho(1 - L_y/L))$

$= (rK + wL + tq)/(rK + wL + tq + \rho(L_x + L_u))$.

6. In most countries, labor income is 3 - 4 times capital income. To get a reasonable estimate, assume that $WL_x + wL_y = 3rK$. Let $L = 1$, and assume that $L_y = .3$, $L_x = .6$, and that urban wage is twice the rural wage, $W = 2w$. Then actual per capita income, $r + WL_x/L + wL_y/L = 2w$, whereas rural worker's income, equal to certainty equivalent income of the urban worker, $rk + w = 1.5\ w$. In this case, $\theta = .75$.

7. The author is indebted to Dr. Harvey Lapan for the intuition provided here.

GENERAL CONCLUSIONS

The pioneering work on labor migration of John R. Harris and Michael P. Todaro in 1970 has generated such enormous interest and later contributions that it is impossible to discuss in the general terms the Harris-Todaro (HT) model in one Ph.D. dissertation. It is because of the versatility of the HT framework that it can be easily adopted to embrace debates on trade policies for an HT type economy.

This dissertation consists three articles and deals with the topic of international trade policies of a small and open country with surplus labor in the context of the Harris-Todaro model. The basic structure is that of Corden and Findlay, whereupon necessary modifications are added to allow for the discussions on the effect of the presence of a service sector and risk averse workers.

The essence of the results is that protectionist practices are welfare reducing for a two sector HT economy with risk neutral workers but maybe beneficial in the presence of a nontraded service sector or risk averse workers. More precisely, with a third sector, the nontraded service sector, that uses only labor as input, production subsidies to the import competing industry or import tariffs can be welfare improving. When workers are risk averse, the optimal police combination is a positive production subsidy and a positive

tariff. Thus, large amount of urban unemployment (or, underemployment as characterized in the service sector in this dissertation) and risk attitude of the workers can be used as justification (as the infant industry argument) for some LDCs' trade restraining practices.

Possible extensions from this point include introducing dynamics into the present static model and empirical studies.

It is only reasonable to assume that the process of migrating into a city and seeking urban employment is not a one-shot deal, instead, it involves continual adjustment of the perceived and actual probability of landing a profitable urban job, as well as the adjustment of the expectation of workers. Rational expectation may also be incorporated into the model so that workers maximize the discounted present value of their income stream over a certain period of time.

Many of the analytic results can be tested statistically. For instance, the relationships between urban unemployment is predicted to fall if a higher tariff is levied on the importable. Both time series and cross country studies can be conducted to see how the prediction holds in the real world.