ON MODELLING THE INFLUENCE OF SECTORAL POLICIES ON THE
SPATIAL CONCENTRATION OF INDUSTRIAL ACTIVITIES

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Introduction

In this paper we present two models which attempt to explain how the spatial pattern of economic activities in a developing economy may be linked directly (through the structure of production) to the economy-wide policies used to promote economic development. The models examine (using a comparative-statics approach) how changes in sectoral policies, which have no explicit spatial dimension, may implicitly increase the degree of spatial concentration of economic activities and population. It emerges clearly from both models that the extent of the spatial effects generated by such sectoral policies depends on the nature of the competitive equilibrium in factor markets, the speed of adjustment of different factors to changes in sectoral policies, and in particular, the degree of long-run sectoral- and locational-specificity of different factors of production.

The paper comprises two independent subsections in which each of the models is separately presented. In the first subsection we examine the sectoral and spatial effects of the introduction of a range of sector-specific policies, in the framework of a two sector, two factor (capital and labour), small-open-economy model. Alternative assumptions about the process of selecting locations for production units in the economy, and about the ownership and structure of production are considered. The analysis, which assumes that a wage difference exists between the two sectors,\(^1\) shows that even when all

\(^1\) It is argued below that this assumption is appropriate to many developing countries.
production units in the economy are completely footloose across all locations, any policy which favors one sector relative to the other alters the spatial pattern of development in that country, unless factor mobility is economy-wide and instantaneous across sectors and locations. In the model instantaneous movement of labour and sluggish movement of capital are assumed, so that even if both factors become completely mobile over time, this temporary sluggishness generates locational effects which persist in the long run. While this model is very simplistic in its representation of the process of sectoral and spatial adjustment to sectoral policies, it points clearly to the mechanisms whereby such policies are not spatially-neutral, even though locations themselves play no special role in the production process. Some possible measures of the extent of the spatial effects of certain sectoral policies are presented and discussed.

In the second section of this paper, an alternative model is presented. Here factors are defined both in terms of the sectors in which they are employed, and the locations at which they are supplied. Furthermore, sectors are classified as being either footloose or location-specific. In the case of the footloose sector, each of the factors employed in production is available at all locations, while in the case of the location-specific sector, at least some factor used in production is supplied only at particular locations. In this model, an expansion of the footloose sector has differential spatial effects, dependent on the supply of non-sector-specific factors, assumed locationally-bound in the short run, but interlocationally mobile in the longer run. Once again, the speed of factor adjustment is crucial, and unless the rather heroic assumption of instantaneous
reallocation can be made, sectoral policies induce spatial effects, even when the sector being favoured is not locationally-specific. The analysis points to the interdependence between sectoral policies, which have no explicit spatial dimension, and policies which are explicitly spatial, in that they may alter the relative supplies of location-specific factors of production at different locations. In particular, the provision of urban services is discussed; in the long run such services are choice-variables for governments, as sectoral policies are in the short run.

Both models concentrate on intra- and inter-sectoral links which are generated by factor market adjustments alone, and demonstrate how these prove sufficient to establish causal links between economy-wide sectoral policies and the spatial distribution of sectors in an economy. To the extent that there are strong intra- and inter-sectoral links through the production process itself (external economies, economies of agglomeration, etc.), additional spatial effects result from changes in sectoral policies (see Henderson (1980)); furthermore, if input or output markets are spatially concentrated, and transport costs are significant, these spatial effects may be reinforced. Inter-locational links through factor markets have been emphasised for two reasons: firstly it is contended that such links are especially important in developing countries, where more efficient use of scarce factors is crucial to the process of development;¹ and secondly, these links tend to be overlooked in much of the literature concerned with intra-country spatial analysis, which is oriented towards developed rather than developing economies.

¹ For a discussion of this issue in the context of the Brazilian economy, see Ruane (1980).
These models attempt to form the basis for an analytic framework, which can be used to examine the spatial consequences of sectoral policies. This framework can be adapted to take account of the particular characteristics of factor markets in individual countries, and provides a structure in which the net effects of sectoral and spatial policies may be estimated.
TRADE AND INDUSTRIAL INCENTIVES AND THE SPATIAL DISTRIBUTION OF ECONOMIC ACTIVITY
The purpose of this paper is to investigate how trade and industrial policies used by a developing country to foster economic growth, can implicitly influence the spatial pattern of development in that country. A version of the familiar neo-classical two-sector model is developed to demonstrate how tariffs, output- or factor-subsidies can alter the way in which development occurs spatially in an economy, even when the location-selection process for all production units in the economy is random. To the extent that location-selection is non-random, these spatial effects are shown to be magnified, as all factors in the economy gravitate towards the government-protected sector.

On the basis of the methodology used in the paper to evaluate the extent of the influence of government policies on the spatial pattern of development, some statistics are derived to measure this influence, and possible applications of this methodology are discussed.
TRADE AND INDUSTRIAL INCENTIVES AND THE SPATIAL DISTRIBUTION OF ECONOMIC ACTIVITY

Summary and Conclusions

In this paper a simple two-sector, neo-classical model is presented and extended to show how policies used to foster economic growth in developing countries can, despite having no explicit spatial dimension, implicitly influence the spatial pattern of development within those countries. The analysis concentrates on studying the effects of introducing four different policies commonly used to foster development - tariffs, output-, capital- and labour-subsidies - on the sectoral, and subsequently spatial pattern of development. The effects of these policies on different sectors and locations are examined over two time periods: firstly, the short-run, when labour is the only mobile factor in the economy (the \textit{static} effects), and secondly, in the long-run, when all factors are mobile (the \textit{dynamic} effects). Two alternative hypotheses about location-selection process by producers in the economy are considered: firstly, that location selection is completely random, i.e., ex ante all projects can locate equally profitably at any location in the country, and secondly, that the location selection process is completely non-random, i.e., ex ante certain locations will always be preferred to others by producers.

The main findings of our analysis are the following:

The introduction of any policy which fosters one (or more) sectors in the economy relative to the other sector(s) \textit{inevitably} alters the spatial pattern of the development in that country, even when all projects in the relatively protected sector are completely foot-loose.

The extent to which the spatial pattern of development in a country is altered by the introduction of policies which favour certain sectors over others is greater, the larger the short-run sectoral output response to the introduction of the policy.
The effects on the spatial pattern of development in a country of introducing policies which protect some sectors relative to is greater the more location-specific (less footloose) are the projects in the protected sector.

If the number of locations at which a particular sector or industry can operate profitably is limited, then a policy which protects this sector or industry relative to others in the economy, whose plants are more footloose, biases the spatial pattern of development in favour of these profitable locations.

If the industries fostered by government policies are located in a small number of large centres (which is often the case in developing countries) then, even if currently the projects in this sector are completely footloose, the introduction of such policies reinforces the existing concentrated spatial pattern.

The tendency for labour to move interlocationally in response to expected rather than actual wages reinforces any trend towards spatial concentration implied by sector-specific development policies.

From our analysis we conclude that the implicit spatial bias created by national policies used to foster development could be substantial and deserves the serious attention of policy makers. We present several methods of estimating the bias based directly on our methodology in the paper, and suggest that these measures be added to those already used to evaluate the degree of success or development policies.
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Section 1
THE SPATIAL DIMENSION OF ECONOMIC DEVELOPMENT

1.1 Introduction

The purpose of this paper is to investigate how the trade and industrial policies used by a developing country to foster economic growth can implicitly influence the spatial pattern of development in that country. In this section we outline the context in which this question is raised, and the evidence which suggests that a causal relationship exists between the development policies and the observed spatial concentration of economic activities in developing countries. In addition we consider the question of why the spatial pattern of development within a country is important and present the plan of the paper.

1.2 Background

Until approximately fifteen years ago, the trend in both developing economies and the economics profession was to concentrate on economic growth as the major target for developing countries. The success of policies used to foster economic development was measured solely in terms of changes in gross domestic product, and no attention was paid to the effects of the policies used on income distribution especially, nor on urban development, physical environment, etc. The main justification for ignoring income distribution and using economic growth alone to measure improvements in economic development, was that growth would ensure that all individuals would be made better-off absolutely. Thus it was argued that even if inequality in the country increased in the short run, so that some individuals became relatively worse-off, the policies used should be those which would achieve the fastest rates of growth possible, irrespective of their effects on the distribution of income; redistribution of the social and economic benefits of growth should be deferred to the longer run.
The objective of faster growth was typically formalized in policies designed to foster the expansion of manufacturing industry in developing countries; such an expansion, it was argued, would lead to higher per capita incomes, reduced dependence on trade in agriculture and industrial raw materials (which were subject to large price fluctuations), more employment opportunities in manufacturing industries, etc. The policies used generally took the form of high tariffs to protect the industrial sector from outside competition (on infant-industry grounds) and a variety of other trade and industrial incentives to encourage both domestic and foreign investment in the manufacturing sector. (For a survey of the range of policies used in many countries, see, for example, Little, Scitovsky and Scott (1970) and Balassa (1971, 1975).

However, in the past fifteen years there has been a growing scepticism with this approach, both among development economists, and perhaps as yet to a lesser extent among the policy makers in developing countries. While growth rates in developing countries in the post-war, and in particular in the post-Independence period have been impressive (see World Development Report, 1978, chapter 2), the policies have been particularly unsuccessful in generating employment (see Morawetz (1974)) and in reducing poverty in developing countries (see World Development Report, 1978), chapter 2). Indeed the policies used have often resulted in groups of individuals in a developing country being made worse-off absolutely, despite high rates of growth in the economy (see World Development Report, 1978).

Since at least 1970 it has become clear that higher growth rates do not necessarily guarantee greater economic welfare for a developing country, and that a different approach to development is required. This change in approach, namely from measuring the success of policies in terms of a rather narrow concept of economic growth, towards a broader measure of the increase in economic welfare is already evident in recent literature in development economics. It is reflected clearly in the emphasis on using changes in social rather than econ-
omic (private) profitability as a criterion for choosing between investment projects (see Little and Mirrlees (1968, 1974), UNIDO (1972), Squire and van der Tak (1975)) and in discussion of the extent to which developing countries face a trade-off between equity and efficiency in the short run (see Little, Scitovsky and Scott (1970) and Anand and Joshi (1979)). The change in approach is also evident in the policy operations of international agencies involved in giving assistance to developing countries; these agencies now take account explicitly of the effects of their economic aid programmes on income distribution, congestion in urban areas, etc., and not only their effects on growth rates and proximate targets like the balance of payments (see World Development Report, 1978, especially chapters 2 and 8). So far governments in developing countries have shown little financial commitment to targets other than growth, and in particular to improving income distribution, although most of them have given strong verbal commitments to reducing poverty, generating additional employment opportunities, etc. (See Bertrand et al. (1978) chapter 1, (A) and (B) for a detailed analysis of the objectives of, and policies used in Nigeria to foster growth and redistribute income.)

1.3 Trade and Industrial Policies and the Spatial Pattern of Development: Causal Relationship or Spurious Correlation?

It is in the context of this broader assessment of the effects of development policies that attention has been focussed recently on the spatial dimension of economic development. In particular, attention has been drawn to the high concentration of economic activities in a small number of urban centres, and especially the dominance of the capital city in the development process. In a recent paper, Renaud (1978) analysed the trends in urbanization patterns in developing countries at different stages in the development process, and discussed the influence of transportation, industrialization, migration, external economies and spatial linkages on these patterns. Renaud questioned the
extent to which government policies, especially in fostering the expansion of the industrial sector, may in part be responsible for the high concentration of economic activities in a small number of urban centres, even though these policies are essentially non-spatial in character. The claim that policies operated at a national level to foster economic development may implicitly influence the spatial pattern of economic activities in a country has been made elsewhere: for example, Beier, Churchill et al. (1975) argued that policies 'governing trade protection, exchange rates, tax policy, etc. all have obvious impacts on the pattern of spatial development in a country' (p. 46) while Richardson (1977) suggested that 'almost all macro and sectoral policies have unintended side-effects on the spatial distribution of activities' (p. 3). In this paper we attempt to determine whether these assertions are correct, and to what extent the strong spatial concentration of development within developing countries, which has been widely commented upon, may be attributed to the trade, industrial and taxation policies in operation in such countries.

In another recent study, Bertrand et al. (1978) examined the spatial impact of sectoral policies used in Nigeria to foster the development of the manufacturing sector. Commenting upon the distribution of economic activities in Nigeria, they noted the excessive (in terms of urban congestion and the stated aims of government policy) growth of the capital relative to all other centres since Independence. From estimates which reveal that the 'implicit subsidy to firms in Lagos (the capital) ... accounts for 84% of the total net subsidy to industry' (p. 103) they concluded that 'the implicit spatial effects of industrial incentive policy are inconsistent with both the objective of dispersal of industry from congested industrial centres and the objective of even development'. The crucial link in the argument used by Bertrand et al. is that the high proportion of the subsidy going to the Lagos area is indicative of a bias in the structure of development policies towards Lagos. (The fact that so much of the implicit subsidy goes to the capital in direct contravention of stated government policy supports the argument that an implicit bias exists). How-
ever, it is not made clear from their paper what the nature of the causal relationship between these development policies and the concentration of industry in the capital is – to what extent do these subsidies bias development towards Lagos, and cause the distribution of economic activity to differ from that which would exist in the absence of the policies in use, or in the presence of spatially-neutral policies? In other words, is the concentration of industry in Lagos causally related to the policies used to foster industry, as implied by Bertrand et al., or, are we witnessing a spurious correlation, so that the same distribution would exist in the absence of these policies? The intention of this study is to attempt to understand under what circumstances a bias in the spatial pattern of development can be directly attributed to the package of development policies used in the economy.

1.4 Does the Spatial Pattern of Development Matter?

Critics of economic theory often argue that the theory ignores the spatial dimension of an economy, and treats all economic activities as if they take place at a single location. While it is correct to argue that economic theory (with the exception of location theory) does not explicitly consider any of the spatial aspects of the economy, it must be said that the theory implicitly allows for the effects of the spatial dimension, by considering external and scale economies, agglomeration economies, public goods, etc., which are the variables which characterize different locations. Economic theorists argue that the fact that economic activities are spatially dispersed creates no special problems for the theory, and can be handled within the neo-classical framework. However, while we would support this general argument, we believe that economists often fail to develop or adapt their models to analyse these spatial questions even though as we shall see in this paper, the tools of neo-classical economics are adequate for such analyses.
There are, it seems to us, essentially two reasons why the spatial pattern of development is important. In the first place, when a country is developing rapidly, the relative advantages for producers in certain centres and/or regions often change (e.g., the agglomeration economies of location in the capital city may be outweighed by congestion costs for a particular industry, as the capital grows above a certain threshold). In order that public utilities be planned and utilized efficiently, it is important that the developing spatial pattern be taken account of, as infrastructure, once installed, is more or less location-specific.

The second and more substantial reason why the spatial pattern of development is important is because of its effects on the distribution of income. While there is no special reason why we should be concerned about the spatial distribution of income per se (a region which is defined as 'poor' receives government assistance, not because it is poor per se, but because its inhabitants are predominantly poor relative to the rest of the country), it will generally be efficient in attempting to achieve a more equitable distribution of income, to take account of the fact that many poor people reside in the same location. This is particularly true as the governments in developing countries are often limited by fiscal constraints in achieving the desired distribution of income. Thus if certain of the policies used to foster economic development tend to create a bias in the spatial pattern of development which conflicts with the government's income distribution targets, then in choosing policies there must be a trade-off between those efficient in achieving the growth objective and those which minimize undesirable biases in the spatial pattern of development. In particular, if the government's ability to redistribute income is severely limited, and the distribution of income is spatially very unequal (which is often a characteristic of developing countries), then the spatial bias implicit in certain policies may be very important. Indeed, if national development policies can influence the spatial pattern of economic activities, the government may wish to use these policies to redistribute income. It has been widely remarked...
by economists (see, for example Little and Mirrlees (1974), chapter 4 and Sen (1975) chapter 1) that employment creation associated with increased economic activity is one of the most efficient methods of income redistribution.

It is intended that this paper should provide a basis for determining whether or not such development policies influence the spatial pattern of economic activities, so that if the direction of influence contradicts that of desired income redistribution, attention is drawn to the need for a trade-off between growth and redistribution objectives, and to the merits of different policies in terms of achieving both these objectives.

1.5 The Plan of the Paper

In Section 2 of the paper we use a simple two-sector neo-classical model to analyse the effects on sectoral outputs and factor returns of introducing non-uniform tariffs, output-, capital- and labour-subsidies, respectively. On the assumption that all projects in the economy are ex ante mobile between all locations (i.e., completely foot-loose), we use this sectoral analysis to derive the spatial implications of each of the four policies:- In Section 3, as an alternative to the assumption that all projects are foot-loose, we consider the opposite polar case where all projects are ex ante location-specific. We also examine the effects of such policies on the spatial concentration of economic activities when labour's willingness to move between locations is based on the expected wage it will obtain, rather than the actual wage paid to employed labour at those locations.

In Section 4 we present several measures of the degree of implicit bias in the most commonly-used policy to foster development, namely tariffs. Based on the methodology used in Sections 2 and 3, these measures may be applied to measure the urban-rural or inter-urban bias arising from the
tariffs, and with care, may be integrated with data on explicitly spatial policies, to derive the net influence of policies on the development of different (groups of) urban centres. Finally, Section 5 suggests some possible applications of this approach.
Section 2

THE NATURE OF THE SPATIAL BIAS IN A SIMPLE MODEL

2.1 Introduction

In this section of the paper we use a version of the familiar neo-classical two-sector model to demonstrate how national economic policies may unintentionally alter (bias) the spatial pattern of economic activity in a developing country. We begin by presenting a typology of the national economic policies to be analysed, and proceed to define more precisely what we mean by saying that these policies 'can implicitly influence the spatial pattern of development' or as several authors have described it, cause 'an implicit spatial bias'. We consider four general types of policies which are used to foster certain sectors or sub-sectors of developing economies: output-, capital- and labour-subsidies and tariffs. In the case of each policy, we examine firstly the resultant sectoral impact in both the short and long run, and secondly, the implied spatial effects under the restrictive assumption that the selection of plant locations is strictly random. Finally, we present some interpretations of the two-sector model analysed.

2.2 Definitions

The national economic policies used to foster the development of the manufacturing sector in most developing countries are of two general classes: firstly, policies which provide uniform subsidies to the manufacturing sector (relative to other sectors in the economy), and secondly, policies which provide differential subsidies to specific sub-sectors within the manufacturing sector. The first class of policies may uniformly subsidize manufacturing, either directly through industry assistance or indirectly through trade policies. Direct assistance to manufacturing industry usually takes the form of output,
(value-added) subsidies, or factor (capital and labour) subsidies. Such factor subsidies given usually include preferential interest rates; grants towards, and tax allowances against, the cost of new investment; special credit facilities, etc. for new projects, and labour subsidies in the manufacturing sector. The trade policies most frequently used are uniform tariffs, quotas, export subsidies, etc. for each sub-sector in the manufacturing sector.

16 In practice it is the custom for many developing countries, while fostering the manufacturing sector generally (relative to the rest of the economy), to provide differential assistance to sub-sectors within manufacturing. Again, these policies can be classified as either trade or industrial. Trade policies typically found involve a complex structure of tariffs (which lead to a wide range of variation in the rates of effective protection between different sub-sectors), quotas, import prohibitions, non-tariff levies, prior deposits, etc.), while individual countries use a wide range of industrial policies to foster particular sub-sectors of industry (discretionary investment grants, credit facilities, licensing, etc., and in certain countries where government intervention in promoting the industrial sector is considerable, assistance with research, marketing, infrastructural services, labour training, etc. are also found).

17 In general most developing countries use a combination of uniform and sector-specific subsidies of both the trade and industrial varieties. To the extent that individual governments have strong views on the relative desirability of promoting individual sub-sectors of manufacturing (because of known externalities, linkages, etc.), then the dominant policies used will be sector-specific; furthermore, to the extent that the fiscal structure of most developing countries are weak and under-developed, trade policies will be used more extensively than general industrial policies. In particular, tariffs are the instruments most widely used to foster the manufacturing sector in developing countries, because of their administrative simplicity and their being revenue-raising rather than revenue-disbursing instruments of policy (see (Corden (1974) and Ruane (1976)).
In the remainder of this paper we concentrate on tariff, output- and factor (capital and labour) subsidising policies, distinguishing between their being uniform or sector-specific in manufacturing. While the actual range of policies used is much wider, there is a sense in which each policy can be reduced to its components, and expressed in whole or part, as a factor (capital or labour), output or trade subsidy. Thus in subsequent discussions we consider only these four categories, and ignore with little loss in generality, all other hybrids.

Before turning to consider our model, three further points of definition and clarification are useful. Firstly, for the most part we are only concerned with national economic policies which, although not pursued in order to influence the location of economic activities, may exhibit an implicit spatial bias; we are not directly concerned with policies whose explicit objective is to alter the spatial pattern of development. Secondly, we examine three different dimensions of spatial distribution: (i) urban-rural; (ii) inter-urban (distinguishing particularly between large and small cities, the capital city and other cities); and (iii) inter-regional, which is essentially a hybrid of (i) and (ii). Although the concept of inter-regional economic flows essentially overlaps (i) and (ii), it is important that it be considered separately for two reasons; firstly, it is often the only spatial concept which can be measured because of data limitations, and secondly, explicit government policies on redistribution are, for political and administrative reasons, often formalized at the regional level.

Thirdly, we must define what we mean when we say that government policies 'influence' or 'bias' the spatial pattern of development, and in particular, against which benchmark do we judge the present spatial distribution of manufacturing industry. The benchmark which we use here is the spatial pattern of manufacturing industry which would exist in the absence of these national economic policies, because this benchmark allows useful intuition and provides obvious analytical ad-
vantages. However, it is important to note that this is not necessarily the most appropriate benchmark, as it assumes implicitly that the government would not intervene in any other way to foster the development of the country. At least conceptually, a more appropriate comparison might be between the current spatial pattern of industry and that which would exist if spatially-neutral policies were used to foster economic development. Such spatially neutral policies are likely to involve the fostering of all sectors of the economy to differing degrees, and not just the manufacturing sector, i.e., spatially-neutral policies are unlikely to be sectorally-neutral. Unfortunately, without a full-blown general equilibrium model of the economy, such a comparison would be difficult to analyse, and impossible to measure, so we will confine our attentions to the non-intervention alternative.

2.3 Method of Analysis

In order to make explicit the mechanisms whereby national economic policies used to foster the development of the manufacturing sector can influence the spatial pattern of manufacturing industry and through it the spatial distribution of income, we use a very simple two-sector model.\(^1\) It is not intended that such a model provide a realistic description of the structure of a developing economy, but rather that it be used to demonstrate, for the case of a uniform or sector-specific subsidy, how a bias might arise. It is then argued that in general when the assumptions of this simple model are relaxed in favour of more realistic assumptions, the extent of the bias is greater. The value of using this simple model is that our focus is directed towards the process which generates the spatial bias, whereas in more complex models, that process is less clear.

\(^1\)An algebraic and geometric formulation of this model may be found in Ruane (1982), which analyses the effects of tariffs on the spatial distribution of economic activities.
2.4 The Model

22 The approach taken throughout this section is to examine the impact of different trade and industrial policies on each sector in the economy (i.e., the effect of policies on the expansion of sectors, factor rewards, etc.) and then consider the spatial consequences of policies, allowing for different assumptions about the process of location selection in the economy and the ownership and structure of production. The model which we employ is the simplest possible to capture the elements of a developing economy and yet allow an analysis of the nature of the spatial bias.

23 The model has two sectors, X and Y, which are assumed for the rest of Section 2 to consist of production units distributed randomly throughout the country. In defining the distribution of production units to be random we are assuming that producers in both sectors are indifferent as between all possible locations in the economy, since all locations involve identical costs and benefits to both sectors, and all individual production units are footloose. The economy has two factors of production, which are assumed for the present to be fixed in supply, labour (L) which is intersectorally mobile, and capital (K) which is immobile at least in the short run. (When capital is immobile, the model is essentially a three-factor model, as there is no relationship between the rate of return to capital in both sectors). The X-sector is assumed throughout to be capital-intensive (in both physical and value terms) relative to the Y-sector. Production functions in both sectors are assumed to be well-behaved, exhibiting constant returns to scale and diminishing marginal productivity of both factors. Producers are presumed to be profit maximizers, equating the payment to each factor to its value marginal product (VMP).

24 In addition the economy is taken to be small and open, in the sense that it trades with the rest of the world at given prices. This assumption is fairly plausible for many developing countries, although less so for the larger ones. The assumption has the well-known analytical advantages that it permits us to ignore the demand side of the
economy, and that no terms of trade effects result from any of the policies considered. While the capital market(s) is(are) characterized by flexible prices and competition, there is a distortion in the labour market, such that, despite intersectoral labour mobility, there is no uniform wage in the economy. We assume that the wage in the X-sector is above the economy's equilibrium wage, while the wage in the Y-sector is perfectly flexible, so that there is full employment. This assumption is appropriate for many developing countries, which are characterized by non-uniform prices in the labour market (even allowing for skill differences, rational labour-hoarding on the part of producers, etc.), and typically, it is the capital-intensive sector which is the high-wage sector. The higher wages in the X-sector are assumed to be truly distortionary, resulting from the presence of trade unions in that sector; these trade unions insist on a minimum real wage for labour employed in the X-sector, defined in terms of the X-good, the Y-good, or a combination of both, which is above the equilibrium real wage in the economy. (An alternative assumption often used to describe trade-union behaviour in both developing and developed countries is that the wage in the unionized sector is higher than that in the non-unionized sector by a constant differential. This case is discussed in detail by Jones (1971), Magee (1976), and Neary (1978). We shall however concentrate on the minimum-wage assumption, because it seems more typical of the constraints imposed by trade unions).

2.5 Tariffs and the Sectoral Pattern of Development

Using the framework of this simple economy, and given the assumption that production plants in the X- and Y-sectors are randomly distributed throughout the country, we wish to consider how the introduction of a tariff on the X-good would affect outputs and factor returns in both sectors, and via this process, the spatial pattern of development. (Given the model as we have described it, there are only
two rational reasons why the government should wish to protect the X-sector per se: either the government is forced to use tariffs as a third best policy to correct for the distortion in the X-sector labour market, and/or that there are production externalities associated with the X-sector which are not internalized by producers in that sector, so that the social cost of producing the X-good is less than the private cost). We consider the two alternative assumptions about the capital market noted above, namely that capital is sector-specific (SSC) in the short run, and that it is intersectorally mobile (ICM) in the longer run. Furthermore, we consider two alternative polar assumptions about the X-sector wage rigidity; firstly, that it is rigid in terms of the X-good, i.e., labour wishes to maintain a constant share of the value of output in the X-sector; and secondly, that it is rigid in terms of the Y-good, which suggests that if trade unions are rational in their behaviour, the Y-good must be the sole or at least main consumption good for labour in the X-sector. In practice the wage is more likely to be rigid in terms of both goods, with weights determined by consumption patterns of X-sector workers, but consideration of the two polar cases gives us the range in which sectoral-output adjustment and changes in factor returns must lie.

2.5.1 Sector Specific Capital

The immediate effect of a tariff on the X-good is to raise its price to domestic consumers and producers, and to raise the value marginal products of capital and labour in the X-sector (\(VMP_{KX}\) and \(VMP_{LX}\) respectively) by the extent of the price rise, for given initial allocations of capital and labour to the X-sector. Now if wages in the X-sector are downwardly rigid in terms of the X-good, trade unions in the X-sector will push their wage demands immediately up to the level of the \(VMP_{LX}\), given by the post-tariff price of the X-good. In this case producers in the X-sector have no incentive to employ any more labour, and since capital is intersectorally-immobile, the X-sector does not expand as a result of the tariff. The effect of the tariff on factor returns is to raise the wage and rental in the X-sector in terms of
the Y-good, and leave them unchanged in terms of the X-good, while the wage and rental in the Y-sector fall in terms of the X-good and are unchanged in terms of the Y-good. The tariff serves to widen the gap between X-sector and Y-sector real wages (unless labour in each sector only consumes that sector's output), while causing rentals in the two sectors, assumed identical before the introduction of the tariff, to diverge.

If, on the other hand, wages in the X-sector are downwardly rigid in terms of the Y-good, when the tariff is imposed, the post-tariff VMP\text{LX} will exceed the unchanged wage demanded by trade unions in that sector. Producers in the X-sector will have an incentive to employ more labour, up to the point where, for the given stock of capital in the X-sector, the VMP\text{LX} at the new price for the X-good, is equal to the wage demanded in the X-sector. After the reallocation of labour from the Y- to the X-sector, the rentals in the X- and Y-sectors will be higher and lower respectively in terms of both goods compared to their pre-tariff levels, because the re-allocation of labour has raised and lowered the VMP\text{KX} and the VMP\text{KY} respectively. On the other hand, the wage in the X-sector is lower in terms of the X-good and unchanged in terms of the Y-good, while the wage in the Y-sector is higher in terms of the Y-good, and may be higher or lower in terms of the X-good. With the re-allocation of labour, output in the X-sector has increased at the expense of Y-sector output.

2.5.2 Intersectoral Capital Mobility

If capital is mobile in the longer run, then in both cases, capital will move into the X-sector in response to that sector's higher rental. (The concept of capital mobility we have in mind here is that the higher rental in the X-sector leads owners of capital in the Y-sector to run-down their stock of capital in the Y-sector, thereby freeing resources for investment in the X-sector). In the case of both types of wage rigidity, the re-allocation of capital will be accompanied by labour; the factors will move into the X-sector in the
same proportions as exist in that sector following any adjustments which have taken place during the SSC period, so that the sectoral capital-labour ratio is unchanged as output expands. Hence the capital-labour ratio will always be higher when the wage rigidity is defined in terms of the X-good rather than the Y-good. This rigidity in the factor allocation is due directly to the wage rigidity, which ensures that for labour-market equilibrium, as \( VMP_{LX} \) increases with the addition of capital to the X-sector, additional labour will be employed in the X-sector only up to the point where the \( VMP_{LX} \) is equated to the minimum wage. Capital will continue to move out of the Y-sector until such time as the rentals in both sectors are equated at the same rental in the X-sector before capital became mobile. At this point the capital market is in equilibrium.

What are the effects of the tariff on output and factor returns when capital is intersectorally mobile? In the first place X-sector output will always be higher than its pre-tariff level, to a greater extent when the trade-union wage rigidity is in terms of the Y- rather than the X-good. In both cases, after the reallocation of capital, the post-tariff real rental in the economy exceeds the pre-tariff real rental, unless the rental is defined solely in terms of the X-good (owners of capital consume only the X-good) and the wage rigidity is defined also in terms of the X-good, in which case the real rental is unchanged. The post-tariff real rental in the economy will always be identical to the rental in the X-sector at the end of the SSC adjustment period and will be higher when the wage rigidity is defined in terms of the Y-good. The post-tariff wage in the X-sector will be constant in terms of the X-good and higher in terms of the Y-good, when the wage rigidity is defined in terms of the X-good, and constant in terms of the Y-good, and lower in terms of the X-good, when the wage rigidity is defined in terms of the Y-good; the nominal wage will always be higher when the rigidity is defined in terms of the X-good.

1 In the absence of a wage distortion, the wage in the X-sector would be equal to the economy-wide wage, and would have fallen in terms of both goods following the imposition of a tariff on the output of the capital-intensive sector, assuming ICM. This is the well-known Stolper-Samuelson result.
Finally the post-tariff wage in the Y-sector is lower in terms of both goods than the pre-tariff wage, when the wage rigidity is defined in terms of the X-good (the gap between wages in the two sectors has widened), while it is lower in terms of the X-good and may be lower or higher in terms of the Y-good, when the X-sector wage rigidity is in terms of the Y-good. The ambiguity concerning the effects of the tariff on the real wage in the Y-sector occurs because the wage in that sector rises in nominal terms in the short run (when capital is sector-specific) but falls when capital becomes mobile between sectors, as production in the X-sector, because of its rigid-wage distortion, expands at a capital-labour ratio increasingly in excess of that in the Y-sector, leading to a continuous relative decline in the demand for labour as the capital-intensive sector expands.

30 This completes our analysis of the sectoral impact of tariff on the output of the capital-intensive sector, for both SSC and ICM cases. While the outcome depends crucially on the terms in which the wage rigidity in the capital-intensive sector is defined, we can say, less precisely, that capital will in general gain (and will certainly not lose) as a result of the tariff on the capital-intensive good, when capital is intersectorally mobile, while capital in the X and Y sectors will probably gain and lose respectively (and certainly will not lose and gain respectively) when capital is sector-specific. Labour on the other hand will more likely, but not necessarily, lose because of the tariff, particularly labour in the Y-sector, which will be worse-off the better-off is labour in the X-sector. We now turn to consider what the spatial impact of these sectoral results will be.
2.6 Tariffs and the Spatial Pattern of Development

31 We recall that the assumption we have made about the spatial distribution of production units in both sectors is one of randomness. Our intention in this section is to show that even when the process of location selection is completely random, the introduction of a tariff on one sector's output can alter the spatial distribution of development in the economy. Furthermore, as we shall argue in Section 3, when the process of location selection is non-random these spatial effects will be magnified. The distinction which we have made above, between capital's being sector-specific and intersectorally-mobile is crucial in this analysis.

2.6.1 Sector Specific Capital

32 In paragraphs 26 and 27 we described the adjustment of production at the sectoral level to the introduction of a tariff. We now wish to examine this effect at the level of the individual production unit within the two sectors. Assuming in the first place that the wage rigidity is defined in terms of the X-good, we saw that with SSC, the individual producer has no incentive to expand his production by employing addition labour, since the trade unions have pushed up the wage in the X-sector by the full extent of the price increase of the X-good resulting from the tariff. However, both labour and capital employed at plants in the X-sector at the point when the tariff is introduced have increased their factor returns in terms of the Y-good. Thus to the extent that the Y-good is consumed by X-sector workers (which assumed that either the trade union's policy of fixing the minimum wage in terms of the X-good is irrational, or that the trade unions, on the basis of information about government preferences in promoting the X-sector relative to the Y-sector, expect the price of X-output to rise relative to that of Y-output) and owners of capital (those in receipts of X-sector equities or bonds) the real incomes of both groups have increased at the expense of workers and owners of capital in the Y-sector, unless it is argued that workers and owners of capital in the two sectors have different consumption patterns which
is somewhat implausible. Therefore, even when output is unchanged as a result of the tariff, there is what we call a static gain (corresponding to the period where capital is sector-specific) to existing workers and owners of capital in the X-sector. The gain in income to the X-sector workers is unquestionably a gain to the locations of all existing X-sector plants, at the expense of locations with existing Y-sector plants. If we assume that the owners of X-sector capital live in the same locations as the plants in which they have invested, then the gain in income to owners of capital is likewise a gain to the location in which existing plants are located. While in general we would not expect all owners of capital to reside in the same locations as their investments, we would expect that a considerable amount of the static gain to the owners of X-sector capital would accrue to the locations of existing plants.

In the case where the wage is rigid in terms of the Y-good, the impact of the tariff on the locations of existing plants is larger. Individual firms in the X-sector expand and employ additional workers up to the point where the $VMP_{LX}$ at the post-tariff price of the X-good is equal to the wage demanded by the trade unions in the X-sector, which is unaffected by the change in price of the X-good. Thus labour transfers from employment in Y-sector plants to work in existing X-sector plants at the higher X-sector wage. Capital is sector-specific, and the owners of X-sector capital gain both from the increase in the price of the X-good as before, and from the higher $VMP_{KX}$, as additional labour is employed on the existing stock of X-sector capital. Workers in the X-sector (existing and additional) earn the same wage as before the tariff, in terms of the Y-good and a lower wage in terms of the X-good, while the income to owners of capital increases in terms of both goods. The location effect of the tariff is to expand high-wage employment on existing capital in the X-sector, leading to an increase in the number of high-wage employees at all locations in which the existing X-sector plants are located. As before, the incomes of the existing owners of capital are raised, and to the extent that these individuals reside in the same locations as the plants in
which they have invested, there is a further gain to these locations from the imposition of the tariff.

34 Both of these polar cases illustrate how there will be a static gain to the locations in which X-sector production plants are situated, as a result of the tariff on the X-good. The locational impact of the static gain will be larger when the wage rigidity is in terms of the Y-good rather than the X-good, and the individuals who have existing investments in the X-sector reside in the same locations as their capital. Any expansion of output when the stock of capital in the X-sector is fixed must take place at existing plant locations, and cannot occur at any other locations in the economy. Thus the expansion resulting from the tariff is biased in favour of locations with existing X-sector plants, even though the process of selecting plant locations is perfectly random. These simple cases illustrate clearly the inevitable static gains which accrue to the locations of existing plants, when capital is sector-specific. We now turn to consider what happens when the SSC assumption is relaxed and capital becomes intersectorally mobile.

2.6.2 Intersectoral Capital Mobility

35 As our analysis in paragraphs 28 to 29 has shown, when capital is mobile, the imposition of a tariff on the capital-intensive good leads to a transfer of capital into that sector from the less capital-intensive sector. Given the wage rigidity in the X-sector, production of the X-good expands at that sector's equilibrium capital-labour ratio when capital was sector-specific, so that all the expansion arises from the combination of labour and capital released from the Y-sector. Where will such expansions occur? Since the increase in the productive capacity of the X-sector must involve new production units, given our assumption of randomness in the selection of plant locations, the distribution of new plants producing this additional X-sector output will also be random. Thus, a priori, given the assumptions of our model, this longer-run adjustment conveys no necess-
ary **dynamic** gain (corresponding to the ICM period) to existing locations, i.e., creates no spatial bias in favour of existing locations. Indeed since the capital being used to expand the X-sector is owned by individuals in the Y-sector, it might equally well be argued that the expansion in X-sector output will take place at the existing Y-sector locations rather than the existing X-sector locations. We discuss this question further in Section 3.

We can summarize this analysis of the effects of a tariff on the spatial pattern of development by saying that even in a standard, highly neo-classical model, with production exhibiting constant returns to scale in both sectors, and with the process of location selection of plants being perfectly random, the introduction of a tariff will create a *static* bias in favour of existing production locations of the tariff-protected good, to a greater extent the larger is the expansion of that sector's output when capital is sector-specific. However, the expansion of output of the tariff-protected sector, if and when capital becomes intersectorally mobile must have a random spatial distribution, so that, ceteris paribus, the net effect of the tariff will still be a bias in favour of the original pre-tariff locations of the tariff-protected goods.

### 2.7 Output Subsidies and the Sectoral Pattern of Development

The effects of an output (production) subsidy to one sector on the sectoral pattern of development, when revenue has been raised to finance the subsidy in a non-distortionary, or at least minimum-distortionary, manner is identical to the case of a tariff considered above when there are no consumption effects (see Corden (1974), chapter 2 for a discussion). Thus while the effective price of the output of producers in say, the X-sector rises when the subsidy is imposed, the prices facing the workers and owners of capital in both sectors are unchanged. In particular the introduction of the subsidy does

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1Note that since total factor supplies in this model are fixed (i.e. there is no growth per se), the use of the terms static and dynamic, to refer to short-run and long-run gains to locations in this comparative static analysis, is unambiguous.
not affect the wage constraint imposed by trade-unions in the X-sector. Because the analysis is broadly similar to that of the tariff, when the wage rigidity is defined in terms of the good whose price is unchanged (Y), we need only describe the adjustment process briefly.

2.7.1 Sector Specific Capital

When the subsidy is granted, the higher price of output facing producers in the X-sector leads to an effective increase in the value marginal products of both factors in the X-sector, for given factor stocks. Given SSC, producers in the X-sector can expand output only by employing additional labour on the existing capital stock. They will employ additional labour up to the point where the \( VMP_{LX} \) at the post-subsidy effective producer prices are equated to the minimum wage in the X-sector. If the percentage subsidy increases the effective price of the X-good by the same percentage as the tariff, then the production effects of a subsidy are identical to those of the tariff discussed in Section 2.5, when the wage rigidity was defined in terms of the Y-good. The real wage in the X-sector will be unchanged, while the effective return to capital will rise in terms of both goods. The rental in the Y-sector will fall and the wage in the Y-sector rise in terms of both goods, as less labour will be employed in the Y-sector for a given amount of capital. In this case the immediate effect of the subsidy is a gain to capital in the X-sector and labour in the Y-sector, no change for labour in the X-sector and a loss to capital in the Y-sector. Thus while the output effects of a tariff are identical to those of an output subsidy, the factor-return effects are different, primarily because the effects of financing the subsidy are ignored. However, as long as tariffs are not the minimum-distortionary method of financing the subsidy (and they are unlikely to be unless collection costs are very high, since the optimal tariff for a small open economy is zero), the impact on factor returns will not be identical to that of a tariff, as the costs of the subsidy will generally be spread more evenly (see Corden, chapters 2 to 4).
2.7.2 Intersectoral Capital Mobility

As capital becomes mobile, the X-sector will expand its output at the same capital-labour ratio as obtained following the adjustment when capital was sector-specific. (The expansion will always take place at a lower capital-labour ratio than at the pre-subsidy effective prices.) This will lead, as discussed above, to an equal expansion of output when the effect of the subsidy on prices is identical to that of the tariff, given the wage rigidity defined in terms of the Y-good. The wage in the X-sector remains unchanged, while the rental in the Y-sector will rise to equal that in the X-sector following the SSC adjustment period. (Because of the continuing wage rigidity, when capital eventually becomes mobile, the return to capital as well as the wage in the X-sector will remain unchanged, irrespective of the government policy which disturbed the initial equilibrium.) Hence the economy-wide rental will be unambiguously higher in terms of both goods in equilibrium. The wage in the Y-sector, having risen in the SSC adjustment period will fall as capital moves out of the Y-sector, and at the completion of the adjustment process, the wage will be unambiguously lower. In the short run, labour employed in the Y-sector gains but it loses once capital is free to move into the X-sector in response to the higher effective rental. Thus capital gains as a result of the subsidy, while labour in the X-sector is unaffected, and labour in the Y-sector loses, thus widening the gap between X- and Y-sector wages. These results are independent of the consumption bundles of workers or owners of capital.

2.8 Output Subsidies and the Spatial Pattern of Development

As one might expect from paragraphs 38 and 39, the spatial impact of the sector output subsidy is rather similar to that of a tariff, although the results are less ambiguous in the case of the output subsidy for both the SSC and ICM cases.
2.8.1 Sector Specific Capital

When the government offers a subsidy on X-sector output, as long as capital is sector-specific, only current owners of X-sector capital can avail of the subsidy by expanding output. Additional workers are employed at the going minimum wage in the X-sector, while the owners of X-sector capital gain from the higher effective prices which obtain for their output (both existing and expansionary) and from the rise in the productivity of X-sector capital, as additional labour is employed on the given stock of capital. Locations in which X-sector plants are situated will have a larger concentration of high-wage labour, although each X-sector worker's real wage will be identical to the pre-subsidy wage. Furthermore, to the extent that the owners of X-sector capital reside in the same location as their plants, then the double gain to them from the subsidy will accrue to that same location. Thus once again we see how the relative fostering of one sector will lead to static gains to the locations in which the protected sector's plants are situated, to a greater extent the larger the number of high-wage jobs which are offered at these plants, and the greater the number of shareholders and bondholders of that sector, who reside in the same location as the plant. This static gain is at the expense of locations of the non-protected sector, the owners of whose capital have lost income and whose workers, although earning a higher wage are fewer in number.

2.8.2 Intersectoral Capital Mobility

As capital becomes intersectorally mobile, existing producers have no incentive to change their factor proportions in production (because of the rigid-wage assumption) so that all the increase in output arises from the combination of new investment, and additional labour (transferring from the Y-sector) in the X-sector, leaving factor proportions unchanged in the sector. On the basis of our assumption of randomness, there is no expectation that the new X-sector investment will take place at existing X-sector locations, i.e., there is no dynamic bias in favour of existing locations.
2.9 Capital Subsidies and the Sectoral Pattern of Development

Although tariffs are probably the most popular class of policy used to foster the development of a given sector in developing countries, the payment of capital subsidies, directly or indirectly, is probably the next most important. While the arguments generally given in support of capital subsidies is that they will increase the supply of much needed capital to the sector in question, the policy is often implicitly or explicitly directed towards increasing the total stock of capital in the economy, through encouraging increased savings or foreign investment. Neither of these objectives can be allowed for in our model, which assumes an exogenously given fixed stock of capital, although another argument often used in support of capital subsidies can be, namely, that producers have a preference for capital subsidies over output or labour subsidies. Once again we distinguish between the case where capital is sector-specific, although the argument for giving a capital subsidy if capital is sector-specific for any length is clearly spurious, as the subsidy amounts to a lump-sum transfer to owners of the subsidized capital.

2.9.1 Sector Specific Capital

The effect of a capital subsidy when capital is sector-specific is to reduce the cost of capital to the X-sector producer, so that he has an incentive to employ more capital and increase his output. However, in the short run there is no extra capital available and, as he has no incentive to employ more labour, output remains unchanged. As a result of the subsidy the effective return on X-sector capital has increased, while the wage in both sectors and the rental in the Y-sector remains unchanged.

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1 This model is not appropriate to analyzing the case where increased foreign investment occurs as a result of the capital study. However, we can say generally that in any situation in which there is direct foreign investment, there may be an additional spatial effect generated if the selection of industrial locations by foreigners differs from that by domestic entrepreneurs. See Neary (1980), Ruane and Neary (1981), and Jones, Neary and Ruane (1981) for a discussion of modelling foreign investment flows which are policy-induced.
2.9.2 Intersectoral Capital Mobility

As soon as capital becomes mobile, output of the X-sector expands. However, once more, because of the wage rigidity in the X-sector, the X-sector producers have no incentive to adjust factor proportions as the labour-intensive sector contracts, so that the X-sector expands at the pre-subsidy capital-labour ratio. If the capital-labour ratio in the X-sector were to increase above the initial level, then it would always be profitable to employ more labour, as the $VMP_{LX}$ would exceed the minimum wage. The economy is in equilibrium following the introduction of the subsidy, when output expands so that the $VMP_{LX}$ is equal to the minimum wage, and the rental on capital in the Y-sector has risen to equal the post-subsidy rate of return in the X-sector. The long-run effect of the subsidy is to raise the return to capital throughout the economy by the full extent of the subsidy (i.e., the subsidy amounts to a lump-sum for owners of capital), to leave the wage in the X-sector unchanged while the wage in the Y-sector falls. The combination of perfectly-competitive markets and the wage rigidity in the X-sector ensures that the use of a capital subsidy in the capital-intensive sector will be reflected in increased output only and not in any changes in factor proportions (i.e., no substitution effect in favour of capital).  

1 The effect of a capital subsidy to the capital-intensive sector when there is no rigidity leads to even more paradoxical results, namely a substitution effect in favour of labour rather than capital! See Neary (1978a).
2.10 Capital Subsidies and the Spatial Pattern of Development

We turn now to examine briefly the spatial effects of a capital subsidy to the capital-intensive X-sector, which effects turn out to be rather similar to one of the cases already discussed.

2.10.1 Sector Specific Capital

In the short run output of existing plants, as in the case of a tariff when the wage in the X-sector is rigid in terms of its own output, does not expand. Nonetheless the effect of the subsidy is to give a lump-sum transfer to the owners of capital in the X-sector; to the extent that they reside in the same location as the plant is situated, the effect of the subsidy, by increasing their incomes once-and-for-all, is to favour the existing plant locations. There can be no other spatial effects as output levels and all other factor returns in the economy are unchanged.

2.10.2 Intersectoral Capital Mobility

The increase in X-sector output which takes place when capital becomes intersectorally mobile will, according to our assumptions, be randomly distributed throughout the economy and cause no additional spatial bias.

2.11 Labour Subsidies and the Sectoral Pattern of Development

Although developing countries rarely offer labour subsidies, as a method of assisting the expansion of the high-wage sector, for a variety of reasons - more often political and administrative rather than economic - it is important to examine the effects of a labour subsidy since it is the policy suggested by normative welfare economics. We assume that the subsidy paid to labour in the X-sector is not suff-
icient to remove the wage distortion in that sector, i.e., the rigid wage less the subsidy is still greater than the equilibrium wage in the economy.

2.11.1 Sector Specific Capital

The effect of a wage subsidy on producers in the X-sector is to reduce their effective costs of employing labour, thereby increasing their demand for labour. Since capital is sector-specific, producers have an incentive to employ more labour up to the point where the \( VMP_{LX} \) is equal to the minimum wage less the subsidy. Thus by contrast with the capital subsidy just described with SSC, the labour subsidy has both output and substitution effects, leading to a fall in the capital-labour ratio in the capital-intensive sector. The effects of the subsidy are firstly to raise the return to owners of capital in the X-sector by increasing the volume of labour employed on a given stock of capital; secondly, to increase the wage in the Y-sector, as less workers are employed there on a given stock of capital, while leaving the wage in the X-sector unchanged (assuming that labour in the X-sector does not bid up its price by the full extent of the subsidy); and thirdly, to reduce the rental earned by capital in the Y-sector. Thus the effect of the subsidy in the short run is to reduce the difference between the wages paid to labour in the two sectors and create a differential between capital returns in the two sectors.

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1 The argument that a wage subsidy will lead trade unions to raise their minimum wage demands is frequently made by policy makers in support of using non-labour subsidies to deal with labour market distortions of this type. There is some evidence of this trade union behaviour in the UK in the 1960s when the government introduced a Regional Employment Premium to increase employment in rigid-wage industries in the Development Areas.
2.11.2 Intersectoral Capital Mobility

When capital becomes mobile, it shifts into the X-sector in response to the higher rate of return in that sector. The X-sector expands employing capital and labour from the Y-sector in the same factor proportions as already exist in the X-sector, in order to maintain equilibrium in the labour market. (The wage rigidity prevents any further substitution in favour of labour, despite the continuing decline in the wage in the Y-sector). The X-sector continues to expand as the post-subsidy capital-labour ratio up to the point where the rental in the Y-sector rises to that in the X-sector, at which time both capital and labour markets are in equilibrium. Thus with ICM the effect of the labour subsidy to the capital-intensive sector is to raise the return to all capital in the economy, to leave the wage paid to labour in the high-wage capital-intensive sector unchanged (assuming trade unions to not respond to the labour subsidy by pushing for higher wages) and to reduce the wage paid to labour employed in the contracting labour-intensive sector. (Note the contrast between this result and the SSC result, where labour in the contracting sector benefits from the wage subsidy).

2.12 Labour Subsidies and the Spatial Pattern of Development

As before we now consider the spatial effects of government intervention, in this case in the form of a subsidy to X-sector labour, firstly, when capital is sector-specific and secondly, when it is intersectorally mobile.

2.12.1 Sector Specific Capital

The effect of the wage subsidy is to induce existing producers to expand production by employing additional labour on their existing capital stock, up to the point where the $VMP_{LX}$ is equal to the minimum
wage demanded by unions in the X-sector, less the subsidy. The spatial effect of this policy is to create more high-wage jobs in existing locations of X-sector plants and to raise the return to owners of X-sector capital resident in these locations, at the expense of locations in which the owners of Y-sector capital reside. Thus once again we have the static gain to existing locations of the sector being fostered, in the form of greater high-wage employment and high incomes of any share- and bond-holders of that sector's capital resident in these locations.

2.12.2 Intersectoral Capital Mobility

The further increase in the output of the X-sector which takes place when capital become mobile will be produced, according to our assumptions, at random locations throughout the economy. The only circumstances in which existing X-sector firms would have an advantage is if we allow for the case ruled out above, namely, that the subsidy be large enough to remove the trade-union distortion completely; in that case, the X-sector would expand further at a lower capital-labour ratio, with each existing plant enjoying an additional expansion. In general however we would not expect such a large subsidy, so that only the static gain described above would result from the labour subsidy.
2.13 Summary and Conclusions

The purpose of this section has been to show, for four broad categories of policies used to foster the growth of the X-sector, which is assumed to be relatively capital-intensive and face a sectoral minimum-wage distortion, how a spatial bias can be induced by these ostensibly non-spatial policies. The model used is highly simplified and the version presented very terse in order to illustrate the generality of the result, namely, that there will always be a static bias in favour of the existing locations of plants in the subsidized sector. The extent of the gain to these locations will vary depending on the form of subsidy, and in particular, whether or not the subsidy serves to relax the constraint on re-allocation imposed by the rigid wage. In general the gain will be larger when the subsidy is to output or labour, or takes the form of a tariff when the wage rigidity is defined in terms of the other sector's output, compared with a capital subsidy or a tariff when the wage rigidity is defined in terms of the sector's own output. Furthermore, while these locations are benefiting compared with the no-policy situation, the locations with Y-sector plants are, in any case where labour transfers to the X-sector in the short run, losing. Thus the gap between X- and Y-sector locations is greater than the gain to the X-sector locations compared with the pre-subsidy situation.

The second major result of our analysis, which has been stated explicitly several times above, but which is worth repeating again, is that without some assumptions other than randomness about the process of selecting plant locations, there is no dynamic bias implied by these national economic policies. To the extent that the selection process is non-random, we would expect a spatial bias to arise during the long-run sectoral adjustment, which would reinforce the static spatial bias. Before turning to consider such cases in further detail in Section 3, it is useful to consider two interpretations of the simple two-sector model just analysed.
2.14 Some Possible Interpretations

57 While the model just analyzed is undoubtedly rather barren as a description of a developing economy, it is useful to examine it briefly, for two different interpretations of the X- and Y-sectors, and the three different dimensions of the spatial concept: urban-rural, inter-urban and inter-regional.

58 The obvious interpretation of X and Y are that they are the manufacturing (industrial) and agricultural (traditional) sectors respectively. The government's policy is to foster the development of the manufacturing sector, drawing resources from agriculture. In such a case, it is highly plausible that labour is immediately mobile in response to high-wage jobs becoming available in the manufacturing sector, while agricultural-sector capital, much of which is in the form of land, is not immediately if at all transferable into manufacturing production. The effect of all four policies considered is to raise the return to capital in manufacturing, and, in the case where agricultural capital is mobile (i.e., can be allowed to depreciate as landowners pursue agricultural policies which exploit its value without any replacement), the return to land is also raised. Labour in the manufacturing sector gains or is unaffected by the various policies, while labour still employed in agriculture will usually, but not always, loses.

59 What about the spatial dimension of these policies given this interpretation of X and Y? If we call all the randomly chosen areas where existing manufacturing plants are located 'urban areas' and all the areas where agricultural plants (farm units) are located 'rural areas' then the effect of the policies is to give a once-and-for-all boost to the urban areas at the expense of the rural areas. This static bias in favour of urban centres (we assume that all urban centres have some manufacturing industry) will be greater the higher the proportion of shareholders in the manufacturing sector who reside in urban areas. Thus measured in urban-rural terms the introduction of a policy to foster the manufacturing sector will always have an implicit spatial
bias in favour of urban areas. Since all parts of the manufacturing sector are equally subsidized, none of the policies analyzed will create an inter-urban bias (i.e., cause one urban centre to gain proportionately more from the policy than any other); furthermore, since plants in both sectors are distributed randomly, there can be no expectation that a policy to foster the manufacturing sector will cause an inter-regional bias, i.e., the gains and losses to different locations within the region will cancel. Finally, when capital becomes mobile, new manufacturing plants will be established with the same capital-labour ratios as existing manufacturing sector plants. Given our assumption of randomness, these plants could equally well be located in rural areas as in existing urban centres, so that no dynamic bias will result from any of the policies considered.

60 An alternative interpretation of X and Y is that they are two subsectors of the manufacturing sector, say chemicals and textiles. (In this case we ignore any interaction between the manufacturing sector and the rest of the economy). We suppose that the government wishes to expand the chemical industry, which is the high-wage, relatively capital-intensive industry, by drawing resources from the textile industry. To encourage the expansion of the chemical industry the government offers incentives which are specific to that industry, e.g., tariffs, output or input subsidies. The expansion of the chemical industry, because it is capital-intensive, will benefit the owners of capital in both industries, leaving the wage unchanged in the chemical industry while workers in the labour-intensive textile industry earn lower wages.

61 What are the spatial effects of promoting one section of the manufacturing sector at the expense of the other? We assume that all plants are located in urban areas, that labour is instantly mobile between the two industries and that capital becomes mobile in the longer run. In this case there is no urban-rural dimension, but rather we are concerned with the inter-urban effects of the policies used to promote the chemical industry. Plants of both industries are assumed to be distributed randomly across urban areas, with each urban area having plants of one
or other or both sub-sectors of manufacturing. Any location which has some chemical industry plants will incur a static gain whichever policy is introduced to promote the chemical industry; the bias in favour of such locations will be greater when the wage rigidity is defined in terms of textiles and the shareholders and bondholders in the chemical industry reside in these same locations. Clearly, the higher the proportion of an urban centre's labour force and capital that is employed in the expanding chemical industry, the greater will be the gain to that centre. In the extreme case where the chemical and textile plants are located in different urban centres, the static gain to the centres with chemical plants will be matched by a static loss to centres with textile plants. As before, we can only assume that the dynamic gains to the chemical industry are distributed randomly throughout urban centres.

62 These two applications of our simple model show how an urban-rural or inter-urban bias can result from policies introduced to foster the relative expansion of the manufacturing sector or a sub-sector or manufacturing respectively, even when the process of selecting plant locations is completely random. These two cases amount to partial studies of the more usual case where the manufacturing sector is promoted at the expense of the agricultural sector, and certain sub-sectors within manufacturing are promoted relative to others. Given our assumption of randomness, in neither case will an inter-regional bias be observed, as the spatial effects on locations within each region will cancel.
Section 3

THE NATURE OF THE SPATIAL BIAS: SOME EXTENSIONS
OF THE SIMPLE MODEL

3.1 Introduction

63 In this section we specify alternative location-selection procedures for individual plants in the protected sector and relax some of the assumptions of the model discussed in Section 2. In general, the effects of relaxing the assumptions of our simple model, so as to bring them closer to conditions which obtain in developing countries is to strengthen the results of the previous section. We find that locations which have plants in the protected sector may enjoy dynamic gains when the policies are introduced, in addition to the inevitable static gains which we discussed in Section 2.

64 There are two assumptions which were used throughout Section 2 which we shall not attempt to relax: firstly, that the economy can be represented adequately by two sectors and two factors, and secondly, that firms exhibit constant returns to scale. As is well known, the rigorous extension of the above two-sector, two-factor analysis to the case of many sectors and factors does not yield analytical results of the same clarity. However, it may be reasonably argued that the principles examined in the simple model analysed will continue to apply in more 'realistic' models and that the simple model helps us to focus clearly on the adjustment processes which are present but obscured in more general models.

65 Relaxation of the assumption of constant returns to scale creates serious problems for our analysis, for, as has been widely discussed, even in a two-sector model, if one sector enjoys increasing returns to scale, there is no stable competitive equilibrium. However, we can suggest how a relaxation of the assumption may influence the adjustment process. Let us suppose that one sector enjoys increasing returns to scale over a certain range (as long as it eventually reaches the stage where returns to scale are constant, a competitive equilib-
rium is feasible), during which period it is protected by government policy. In the short run with SSC, plants in the protected sector will not be able to achieve scale economies as they expand, so that their behaviour will not differ from that of firms enjoying constant returns, as discussed in the previous section, and the locations in which these plants are situated will enjoy a static gain from the introduction of the protective government policy. In the long run however, with ICM, firms expanding will enjoy increasing returns to both factors. If scale economies accrue at the level of the individual plant, the expansion of the sector in the longer run will take the form of increasing output and employment at existing plant locations. The extent to which this expansion at existing locations may be correctly described as a dynamic bias resulting from the introduction of government policies to foster the increasing-returns-to-scale sector depends on the extent to which that sector would have expanded even in the absence of such policies in order to realize higher returns to scale.

66 We now turn to consider the effects of relaxing the assumption of randomness of location selection made throughout the last section, and examine how labour migration tends to reinforce such spatial biases as may be indirectly generated through national economic policies.

3.2 Non-Random Location Selection

67 In lieu of the assumption of randomness made throughout the last section, we consider here two alternative assumptions about location selection in the X-sector. (We continue to assume for convenience that location selection in the Y-sector is completely random, but we shall relax this assumption later.) Firstly we consider the case where the location pattern of X-sector plants before the introduction of any
policy to foster the X-sector is non-random, and rather reflects the cost advantages of the locations chosen in terms of transport, infrastructure, etc., at the early stage of economic development. These advantages however are now historical in the sense that there are various other locations at which X-sector plants can operate as efficiently as in these original centres, so that, effectively, the choice of new locations is random.

68 Now, with the introduction of one of the various policies described above, there will be a static gain to locations with existing X-sector plants similar to those described in the last section. However, in this case, the gains will not be distributed randomly across the country as the X-sector plants may be concentrated in one region or sub-region; here we have the possibility of an inter-regional bias in addition to an urban-rural or inter-urban bias, depending on our interpretations of X and Y. In particular, if all existing X-sector plants are located in the capital city, this static gain will accrue solely to the capital city at the expense of the rest of the economy. This interpretation is particularly important as it serves to illustrate how, even if the current locational pattern is completely random, the existing historical pattern will be reinforced if the industries supported by government policy are located in a limited range of large centres. Finally, in this case there will be no dynamic bias, as expansion of the X-sector with additional capital will take place by assumption, at random locations.

69 An alternative to this simple case is that neither the current nor historical pattern of location of X-sector plants is random, that is, certain locations are continually preferred to others by producers in the X-sector. This preference may arise for a variety of technical and/or financial reasons which make it more profitable to produce the X-good at particular locations. The actual reasons are irrelevant here - what matters is that the X-sector plants face a limited range of location possibilities. (Technical reasons might include infrastructural advantages at some locations, or indeed, the absence of
of basic infra-structure - roads, water, power - at other locations; financial reasons might be high transport or development costs associated with new locations or agglomeration economies associated with existing centres. We discuss these further in Section 3.3.) In the absence of government intervention we would expect the X-sector to be concentrated in particular centres, while the Y-sector plants are assumed to be randomly distributed.

70 As before, all existing X-sector plant locations enjoy a static gain from the introduction of policies fostering the X-sector. Furthermore, if in the extreme case, X-sector projects can only locate at these existing centres, then all of the expansion of the X-sector, following capital's becoming mobile takes place at these locations. Thus there is a dynamic spatial bias in favour of these locations which reinforces the initial static bias. In such cases, protection of the X-sector essentially amounts to protection of the locations of all existing X-sector production units. Therefore, if, for example, the government protects an industry which for economic or technical reasons will only locate in the capital city, then protection of that industry amounts to protection of the capital city, and conveys benefits only to the capital at the expense of the rest of the economy. This illustrates that the crucial determinant of any dynamic bias is the extent to which projects in the protected sector are location-specific at the one extreme or completely footloose (as we assumed of all projects in Section 2, and continue to assume about Y-sector projects here) at the other extreme. In practice there will usually be many intermediate cases in, say, the manufacturing sector with perhaps two or three existing locations and a further few potential locations. In such cases, the static bias will favour the existing locations relative to all others in the economy, while the dynamic bias will favour existing and potential locations relative to all others (locations with no X-sector activities).

71 From this section we see that if the range of locations at which a particular sector or industry can operate profitably is limited, then
a policy which supports this sector or industry relative to all others in the economy, will bias the spatial pattern of development in favour of these profitable locations. Thus if X and Y represent industry and agriculture, and both are exclusively located in the urban and rural areas respectively, then expansion of the X-sector, assuming that capital is eventually mobile, brings about a static and dynamic gain to urban at the expense of rural areas. This urban bias may also involve a regional bias if urban areas tend to be concentrated in particular regions (e.g., close to ports). Alternatively, we may consider the second interpretation discussed above, namely, that X and Y are the chemical and textile industries within the manufacturing sector. In this case, if the chemical industry can only be located in a small number of centres, while the textile industry is completely footloose, then increased relative protection for the chemical industry compared with the textile industry will bias industrial development in favour of those locations which can support a chemical industry. Therefore if government policy promotes industries which are by nature location-specific relative to other, more footloose industries, it encourages a dynamic bias in favour of those locations at which the protected, location-specific industries can successfully operate. Furthermore, since these location-specific industries will usually be located at the larger centres (perhaps close to ports and other infra-structural facilities), such that the spatial gain from these national policies will reinforce the existing spatial pattern, biasing development in favour of larger centres at the expense of smaller ones.

The tendency for faster growth of particular locations in the presence of complex systems of trade and industrial policies may be evidence of an implicit dynamic spatial bias in these policies. However, we must be extremely wary of concluding that such a changing pattern of development is due solely to these policies. The extent to which the national policies create spatial biases depends not only on the degree of footlooseness or location-specificity of X-sector (industry) plants, but also on the degree of location-specificity of Y-sector (industry) plants. Above we assumed these latter plants to be
completely footloose, but if at the extreme these are equally location-specific as the X-sector plants, then the extent of the bias depends crucially on whether Y-sector plants are specific to the same or different locations as the X-sector plants. If X- and Y-plants are specific to the same locations, then the faster growth of these locations does not reflect any implicit bias in the national policies, but rather reflects the comparative cost advantages of these locations over all others in the economy for all types of production. If on the other hand Y-sector plants are specific to different locations, then any policy which favours the X-sector at the expense of the Y-sector causes a strong spatial bias in favour of the locations to which X-sector plants are specific, and vice versa.

3.3 Location-Specific or Footloose?

73 From Section 3.2 it is clear that the extent to which a spatial bias results from policies used to foster one sector of the economy depends on the degree of location-specificity of both the protected and non-protected sectors. In this section we concentrate on the manufacturing sector and examine the conditions whereby the favouring of certain industries relative to others in manufacturing will bias the spatial pattern of development.

74 In Paragraph 69 we discussed how there were a variety of technical and financial reasons why industries might choose to locate plants in certain areas compared to others. We assume that when there are technical constraints, location in certain centres is simply not feasible for some producers (i.e., cannot be overcome by individual producers paying higher prices, because for indivisibility reasons infra-structure can only be provided by the government), while with financial constraints costs are such that certain locations will always be preferred by profit maximizing producers to others.
As long as revenue available in developing countries for investment in basic infrastructure is very limited, there will always be locations whose infrastructure is inadequate to handle certain types of industries. In general, for given types of industries, these technical constraints will be more serious the smaller the location considered; larger centres will face no or few limitations on the range of products which technically can be located in such centres. If, for a given infrastructure, government policy favours relatively industries within the manufacturing sector which require infrastructure available only in larger centres, over industries whose infrastructural requirements are few, then it creates a bias in the spatial pattern of development towards larger centres over smaller ones, leading to these centres enjoying a larger share of the fruits of development. In our analysis in Section 2 we assumed that the sectors or industries relatively protected are capital-intensive. This assumption has well-documented empirical support: government development policies favour large-scale, capital-intensive projects (the steel-mill examples are notorious), often requiring very special technology, etc. Such industries are usually those most restricted in terms of choice of location for technical reasons, so that even if other costs were identical between centres, these plants would have to locate in the larger centres.

However, over time, the extent to which these technical constraints bind depends directly on government policy with regard to infrastructural investment. If government policy is oriented towards improving the infrastructure of existing centres, then, the feasibility constraint will continue to bind indefinitely. If on the other hand policy is directed towards improving the infrastructure of smaller centres (or even an equal distribution across centres), then many smaller centres will eventually become potential locations for a larger number of industries, and the extent of the implied spatial bias will be reduced.

The preference of entrepreneurs for specific locations on comparative cost grounds has both production and marketing elements. On the
production side, labour costs, particularly if the industry is effectively unionized, will not vary greatly from centre to centre, while sites will be more expensive relatively in the larger centres. However, certain centres, and in particular the larger ones will provide agglomeration economies to the marginal production unit which will, in general, considerably outweigh the additional costs in terms of higher rents on industrial sites, or any negative externalities suffered by location in overcrowded centres. Location in larger centres compared with smaller ones may often provide greater marketing potential for the individual unit, although the reverse may occasionally be the case. Furthermore, location in large centres may actually lower the effective cost of capital faced by the firm; this might happen if the banking system is conservative and risk averse, so that, it charges a higher rate of interest to firms locating in new or smaller centres, because of the perceived higher risks associated with such centres, even when the expected rate of return is the same or higher than in the larger centres.

78 Thus even if projects are technically footloose, they may continue to locate in larger centres because of lower comparative costs in both production and marketing. Ironically such concentration in particular locations may be less likely when the industry or sector is highly concentrated in terms of ownership, in which case plants within an enterprise may be more diversified spatially to avail of marketing advantages. When different locations have different comparative costs, a spatial bias will arise only if the industries favoured are those which benefit more from agglomeration economies and reduced capital costs in the large centres relative to others. As noted above, the industries which benefit tend to be the large-scale, capital-intensive industries, while the small-scale, labour-intensive industries may well suffer from agglomeration diseconomies, whereby their costs are raised by locating in large centres, because of the dominance of larger producers. Thus if government favours such industries, it will create a bias in favour of the larger centres, causing them to develop at a faster rate than they would in the absence of these policies.
3.4 Labour Migration and the Spatial Pattern of Development

So far we have implicitly assumed that labour only transfers between industries when it is faced by actual job offers at higher wages. In practice, labour in low-productive, low-wage industries is willing to move out of employment in one sector in order to seek employment in another, if the wage in the alternative occupation is higher than the present wage and the probability of obtaining employment within a short period is large. This change of assumption about the behaviour of labour, namely, that it responds to expected rather than actual wages in moving from employment in one sector to join the labour force (employed plus unemployed) of another, has been discussed widely. (See Harris and Todaro (1970), Bhagwati and Srinivasan (1974), Fields (1975), Corden and Findlay (1975), etc.). The key assumption in these papers is that industrial projects can only locate in urban areas, so that the expansion of the industry sector necessarily involves movement of capital and migration of labour from rural to urban areas. The fact that government policy favours industry relative to agriculture and that industrial projects are specific to urban areas leads to large-scale migration of labour to urban areas in search of high-wage employment. (If individuals could search while remaining in employment in agriculture, then as long as their value marginal product in agriculture is non-negative, they would only move into manufacturing employment when jobs become available, and no unemployment would result. This would be possible or at least more likely if projects in the manufacturing sector were to locate in smaller centres close to rural areas rather than in a small number of large centres, inevitably far removed from most agricultural labour, and because of size, with a good internal but poor external communications network).

In this section we note how the existence of a pool of unemployed labour in urban centres may affect the degree of spatial bias towards the larger urban centres discussed above. In general, migrants seem to be attracted to the larger rather than the smaller centres because of family ties, information networks, possibility of informal sector employment while awaiting high-wage employment, larger numbers of
government projects, etc. Thus firms are attracted also to large centres where the existence of a larger pool of immediately employable labour in the vicinity of the production plant means that upon the introduction of tariffs or output subsidies expansion can take place without delay. Furthermore, to the extent that labour of different types and skills may be distinguished, the larger centres provide the possibility of poaching such skilled labour from existing industries in the same location. (Skilled workers are assumed to be able to search for new jobs in the same urban centre while still remaining employed). The attraction of labour to the larger urban centres encourages new plants to locate in these centres because of the implicit reduction in adjustment costs, thereby reinforcing the concentrated spatial pattern resulting from location-specificity and government policies.
3.6 Summary and Conclusions

Section 3 has concentrated on examining the conditions under which a dynamic spatial bias, especially of the inter-urban category (the urban-rural bias is fairly straightforward) might arise from national development policies. While the conditions for a static bias as discussed in Section 2 are quite clear cut, the question of a dynamic bias requires much more qualification. In particular we must be careful not to attribute the development of large centres and the concentration in the spatial pattern of development to these national policies, when in fact it is the comparative cost advantages of these locations which is responsible for their rapid growth. The extent to which there may or may not be a spatial bias depends on the relative locational-specificity of promoted relative to non-promoted industries, for comparative-cost or technical reasons. While our analysis stressed the two-sector, two-industry cases for exposition, the adjustment mechanisms described therein should apply to extensions which consider jointly cases where the manufacturing sector is favoured relative to agriculture, and one industry within manufacturing relative to another.

The effect of the static and dynamic biases which result from the introduction of policies to favour all or part of the manufacturing sector is to raise the level of industrial employment and investment in certain centres on a once-for-all basis, after which these centres continue on their existing growth paths. A further bias could conceivably arise if these additional industries increase the agglomeration economies to others, who are subsequently induced to locate in these centres, but this effect would be small in magnitude relative to the initial impact of the policies.
Section 4

MEASUREMENT OF THE SPATIAL BIAS IN NATIONAL
DEVELOPMENT POLICIES

4.1 Introduction

The purpose of this section to examine how we might measure the spatial bias implicit in policies used by a developing country to foster growth. As before, we concentrate on policies whose explicit aim is the expansion of the manufacturing sector, and in particular we examine the tariff system, although our measures can readily be extended to incorporate the effective subsidies arising from other policies used to promote manufacturing. (See Balassa (1978) chapter 1). As above we distinguish between the static and dynamic biases which may result from the introduction of protection for all or part of the manufacturing sector relative to the rest of the economy. While we ignored the possibility of tariffs on intermediate inputs throughout Sections 2 and 3 for analytical neatness, in deriving measures of the spatial bias, we must take account of such tariffs. We do this by using effective rates of protection to calculate the effective subsidy per unit arising from the tariff. Finally in interpreting our measure of the bias we consider all three concepts of the spatial bias listed above: urban-rural, inter-urban and inter-regional.
4.2 The Static Bias

We recall that this bias arises naturally from the gains to existing locations of the protected-sector(s) plants, and takes the form of additional income to the owners of capital in the protected sector, and, depending on our assumptions about the wage rigidity of trade unions, of increased employment at a given nominal wage or increased nominal income for those already employed. To illustrate the static gain for an individual sector we make use of Diagram 1.

In this diagram the value marginal product of labour in the protected sector (assumed as before to be the X-sector) before the introduction of the tariff is given by \( VMP_{LX}^0 \). It is drawn with respect to the pre-tariff price of the X-good, \( P_X^0 \) and the initial allocation of capital to the X-industry. Employment of labour in the X-industry is determined by the profit-maximizing behaviour of X-industry producers, who equate \( VMP_{LX} \) to the union fixed wage \( \bar{w}^0 \) in the X-industry, resulting in employment \( L_X^0 \). The effect of the tariff, by raising \( P_X \), is to shift the value marginal product of labour curve rightwards from \( VMP_{LX}^0 \) to \( VMP_{LX}^1 \), that is, the value of all X-industry output is inflated by the extent of the per-unit effective tariff. Assuming for exposition that no tariffs are placed on the inputs used in producing the X-good, we can measure the immediate gain to the X-industry by the difference between the \( VMP_{LX} \) schedules, before and after the introduction of the tariff, for the given labour force employed in the X-industry. This is given by the shaded area ABCD.

The short-run effects of the tariffs on locations with X-sector plants depends crucially on the response of producers to the tariff, which in turn depends on the terms in which the wage in the X-industry is held rigid by the trade unions. If the wage is rigid in terms of the X-good only, trade unions will push the nominal wage from \( \bar{w}^0 \) to \( \bar{w}^1 \), giving producers in the X-sector no incentive to expand employment. In this case the immediate gain to the X-industry is the total gain (as long as capital remains fixed), and it is shared by employees and the owners of capital in the X-industry. If on the other hand trade
unions do not change their nominal wage demands in response to a change in $P_X$ (say because $X$ is not a consumption good), then facing a given nominal wage $w^0$, producers have an incentive to expand employment on the fixed capital stock in the X-industry up to the point where $w^0$ is equal to $VMP^1_{lx}$, yielding X-industry employment, $L^1_X$. In this case the effect of the tariff is to increase employment at locations of existing X-industry plants (increase the wage bill at these locations by $w^0 (L^1_X - L^0_X)$, and further increase the surplus transferred to owners of capital in the X-industry by BCE, which is the portion of the implicit subsidy arising from the additional output produced. (In this case all the subsidy arising from the tariffs on existing output is received by owners of capital; the gain to labour is in terms of increased employment rather than an increase in the nominal wage). Given our assumption of well-behaved production functions, BCE is at maximum 50% of the implicit subsidy in the tariff on the additional output. We can see from the diagram that when the rigid wage constraint is unchanged by the tariff, the subsidy to existing X-industry locations is given by the value of the subsidy on the exist-
ing (pre-tariff) output (ABCD), which is the difference between value-added at post-tariff and pre-tariff (world) prices, the wage bill paid to the additional labour employed on these given plants (CELx Lx), and a portion of the implicit subsidy in the tariff on the additional output produced (BCE).

On the basis of this analysis we can consider the static gain to locations with existing protected plants in two parts: firstly, the value of the subsidy implicit in the tariff on existing output, and, as adjusted, on the additional output, and secondly, the wage bill associated with any additional employment which results from the expansion of the protected plants following the introduction of the tariff. To measure the first component of this gain to existing centres, i.e., bias in favour of existing centres, we use as a base the output of protected plants at the time the tariff system is imposed. To calculate the implicit subsidy to each location, we apply the effective rate of protection to the output level of each industry in the location and aggregate, and adjust the total to take account of the fraction of benefiting owners of capital who reside in the same location as the plant is established.¹ (We assume that the introduction of the tariff system is a complete surprise, in the sense that output plans of existing plants have not been adjusted to take account of the gains which will accompany the tariff; this assumption must be examined very carefully for each country, for in the extreme case, if the introduction of the tariff is known years in advance, not only labour but capital will have moved into the relatively more favoured industries. This question is of considerable importance when firms are in a position to lobby government before introductions of, or changes in the tariff system; while the political aspects of the imposition of a tariff are beyond the scope of this paper, it should be noted that they may be highly significant, in particular, that the spatial bias which results from differential tariffs may

¹ The range of this fraction is from zero, when none of the owners of the protected-sector's capital stock reside in the same locations as their investments, to unity, when all of the owners reside in the same location.
no coincidence). This figure gives us the **immediate** gain to each location which follows the introduction of the tariff.

87 In the case where additional labour is employed (the wage-rigidity constraint is relaxed as a result of the tariff) while capital remains intersectorally immobile, we examine the additional gain to owners of capital in the protected industries, by applying a fraction of the effective protective rates to the increased output of these industries, in say the first and second years following the introduction of the tariff, and modifying this figure to take account of the residential pattern of owners of capital in the expanding sector. Likewise, the gain to these locations in terms of additional employment is measured by calculating the additional employment generated as a result of the tariff, at each industry's given wage. (If the industries in question are growing before the introduction of the tariff, then it is necessary to de-trend these data before attributing the growth in the expansion of employment to the newly-introduced tariff).

88 Using this method, we can calculate subsidies for each location in the economy, and group them according to which spatial concept we wish to measure. For example, we can aggregate all locations to calculate the subsidy to urban areas (assuming that all manufacturing industry is located in urban areas), or alternatively, aggregate locations distinguishing between the capital city and all other urban centres, or between large and small urban centres. However, these measures merely give us absolute amounts of subsidies which accrue to given locations as a result of the tariffs, and it is preferable to find some appropriate base against which to measure these figures. A number of possibilities immediately suggest themselves: firstly, we have the subsidy implicit in the tariff to a given location or set of locations relative to the subsidy given to all locations in the economy:

\[
\frac{\text{Subsidy to Location } i}{\sum \text{Subsidy to Location } i}
\]
89 This measure is analogous to that used by Bertrand et al. (1978) to estimate the bias in industrial and trade incentives towards large centres in Nigeria. Unfortunately, Bertrand et al. do not distinguish between the long- and short-run periods following the introduction of the tariff, and they calculate the implicit subsidy by location which is associated with the tariff using current output levels. This measure obviously assumes the complete location-specificity of all industries (i.e., that both static and dynamic gains accrue to the existing centres) and to the extent that projects are in any sense mobile, overstates the gains to particular locations arising from the tariff system. On the other hand, their measure understates the gain to existing centres by ignoring the additional employment associated with the tariff. Our measure here only attempts to estimate the static bias in the incentives, in terms of the implicit subsidy in the tariff and the additional employment generated.

90 This first measure has, however, several limitations; in particular, it takes no account of the size of the centre which obtains a high proportion of the total subsidy implicit in the tariff and industrial incentive schemes. (Thus the figure calculated by Bertrand et al. for Nigeria is not quite so high when allowance is taken for the high proportion of the population living in Lagos, although the figure is still considerable.) As an alternative, we propose the subsidy per head in each location, the subsidy per worker in each location and the subsidy per member of the labour force (employed and unemployed adults) in the location:

\[
\text{Subsidy per Head in Location } i = \frac{\text{M} \cdot \text{Subsidy per Head in Location } i}{\sum \text{Subsidy per Head in Location } i}
\]

\[
\text{Subsidy per Worker in Location } i = \frac{\text{M} \cdot \text{Subsidy per Worker in Location } i}{\sum \text{Subsidy per Worker in Location } i}
\]

\[
\text{Subsidy per Member of the Labour Force in Location } i = \frac{\text{M} \cdot \text{Subsidy per Member of the Labour Force in Location } i}{\sum \text{Subsidy per Member of the Labour Force in Location } i}
\]
91 If we assume that the manufacturing sector only is subsidized, albeit to different amounts in different industries, and that it locates exclusively in urban areas, then we can use these various statistics, aggregated over urban areas and expressed as a fraction of both urban and rural areas. Likewise we can distinguish between the capital city and other urban centres using these statistics, and in the case where urban and rural area figures are not readily available, we can use these indices to calculate the inter-regional bias.

92 While these measures capture the gain to locations at which protected plants are situated, they do not take account of the loss to other locations which result from the tariffs. This loss, we recall, arises from the fall in the real incomes of owners of capital and workers in the non-protected industries and hence assuming residence of most owners of capital in the same centres, the locations in which these industries or sectors are situated. As labour transfers into the protected industries, the nominal wage in the non-protected sectors rises (since the capital in these sectors is fixed), and the nominal return to capital in the non-protected sectors falls. Thus the gain to the protected locations relative to their pre-tariff level may understate the bias towards protected locations over non-protected locations, since the effect of the policies is to improve the return to protected capital at the expense of non-protected, and may reduce overall incomes in the non-protected sectors.
4.3 The Dynamic Bias

As Section 3 has emphasized, determination of the existence of a dynamic spatial bias is very difficult, and not surprisingly, its measurement is very problematic indeed. Perhaps the only straightforward case is when we are attempting to estimate the urban-rural bias, arising from the protection of the manufacturing sector, when manufacturing industry can only locate in urban areas. In this case the dynamic gain from the policy, in addition to the static gains, all accrue to the urban areas at the expense of the rural areas. However, even in this case it is difficult to measure the total gain to the urban areas when capital is mobile: it is the subsidy implicit in the tariff on pre-tariff output, and a portion (maximum of 50%) of the subsidy implicit in the tariff on the increase in output when labour in the first instance, and subsequently capital becomes intersectorally mobile, plus the wage bill of the additional employment in urban areas which arises from the tariff. This is calculated when all the adjustment has taken place between sectors, i.e., when the full general-equilibrium repercussions of the introduction of the tariff (and other incentive) schemes have worked through the economy.

Determining the degree of inter-urban dynamic bias is much more difficult, for it depends crucially on the degree of location-specificity of plants within each category of the manufacturing sector and the relative protection of that category implicit in the tariff scheme. In the extreme, if we assume complete location-specificity, we can calculate the dynamic and static bias as above in the urban-rural case, using the measures discussed in Section 4.2. However, in practice these will usually overestimate the bias implicit in the subsidy, since the new plants which are established when the relatively protected industries expand, will not necessarily locate at the existing urban centres. Thus we are faced with the problem of determining just how location-specific different categories in the manufacturing sector are in practice. To do this, we first examine the post-tariff pattern of location to estimate the degree of geographical concentration in each industrial category - whether plants within a partic-
ular sector or industry are distributed throughout the economy or concentrated in a small number of centres. We compare this with the pre-tariff pattern to determine the extent to which additional plants in each category have located in a diverse or concentrated manner. If the degree of concentration is higher among the more protected industry categories, both pre- and post-tariff, then there are strong grounds for supposing that the implicit subsidy in these industry categories' tariffs creates a dynamic bias in favour of existing locations of these plants. If on the other hand there is only a slight difference between the relatively high and low protected categories, then we would expect the subsidy to additional output (implicit in the tariff) when both factors are mobile to create a negligible dynamic spatial bias, although, as always, there would be a static bias in favour of the locations of existing plants.

95 An alternative approach to this question is to examine the comparative costs of different locations for each category of industry, and test the hypothesis that the industries with the highest effective protective rates are those which are least mobile on comparative cost grounds. Bertrand et al. (1978) attempted such an exercise and discovered that for many industries in Nigeria, Lagos was the preferred location choice on strict comparative cost grounds. If of course one location is preferred to all others on comparative cost grounds in all industrial categories (which is highly unlikely unless the country is very underdeveloped), then it is inevitable that all industry will locate in this centre, whether or not there are tariffs. Finally, examination and comparison of domestic and foreign plants might be fruitful, to determine whether the foreign entrepreneurs tend to be more concentrated than their domestic equivalents in different industry categories, or whether this merely reflects the industries in which multi-nationals specialize.
4.4 Summary and Conclusions

This section has suggested some ways of attempting to estimate the spatial bias in policies used to foster the expansion of the manufacturing sector in developing countries; we concentrated our discussion on the tariff system, but this approach can readily be extended to consider all other forms of incentives (although it will rarely be practical to consider ones which are unimportant in revenue terms). These are by no means the only ways of approaching the question of measurement, but they seem the most practical available; however, to ascertain just how easy or difficult such a task might prove, an individual country study would be necessary.
Section 5

RESEARCH IMPLICATIONS

5.1 Introduction

This paper has suggested that it is useful to examine the impact of trade and industrial policies on the spatial pattern of manufacturing industry. While the concepts in question are difficult to measure, it is not an impossible task to attempt such measurement, and as long as the measures used are theoretically appropriate, the rankings derived should be trustworthy indicators of the degree of bias. In particular, this approach to policies draws attention to two important effects of government intervention in promoting the manufactured sector, especially via tariff schemes: firstly, the degree of capital and labour intensity of the goods being protected, and secondly, the location-specificity of relatively-protected categories of manufacturing industry, compared with the less-protected. Following from this paper a number of possible research topics suggest themselves, and we shall discuss these briefly in the next few paragraphs.

5.2 Trade and Industrial Policies and the Spatial Pattern of Development: A Country Study

This study would use one of the countries for which analyses of their incentive and trade policies have been undertaken at a national level. These include the countries covered by Balassa (1978) and the study of Nigeria by Bertrand et al. cited on several occasions in this paper. The measurement framework outlined in Section 4 would need further refinement, both to take account of the special features of the country chosen and to achieve a more satisfactory method of handling the dynamic spatial bias. For such a study, the main data ingredients required would be time series on effective rates of protection and effective subsidies arising from all the important incentives used to
promote the manufacturing sector, as well as time series of the census of industrial production by individual urban location if possible, and if not, by region.

5.3 Trade and Industrial Policies and the Spatial Pattern of Development: An Inter-Country Comparison

This study would follow logically on a study of a single economy described in the last paragraph. Preferably, one would compare the influence of different trade regimes and industrial incentives on the sectoral and spatial patterns of development of a group of semi-industrialized countries, which are as similar as possible to one another in all other respects. Such a cross-section study would necessarily require a great deal of simplification in order to find equivalents for different policies in each country considered, but it could throw light on the spatial dimensions of these policies which have hitherto been ignored in analyses of development policies.

5.4 Foreign and Domestic Investment and the Spatial Pattern of Development

As mentioned briefly above, but not discussed at any length, the development policies used in many of the semi-industrialized countries encourage intentionally or by default direct foreign investment, as well as reallocating domestic capital into more productive forms of investment. In this context it would be worth examining two related questions: do foreign investments respond to relatively higher rates of protection, and are they concentrated by industry category? and secondly, for given industries and protective rates, do foreign investors seem to have different locational patterns to domestic investors?
5.5 Implicit and Explicit Bias in the Spatial Pattern of Development

Throughout this paper we have concentrated on those policies which influence the spatial pattern of development implicitly. Many developing countries operate policies which are explicitly directed towards altering the spatial distribution of income, and, as noted by Bertrand et al. the effects of these explicit policies on income distribution may be opposite in direction from those of the implicit policies. Thus to measure the total effects of government intervention on the spatial distribution of income, it is necessary to examine both explicit and implicit subsidy flows to estimate the net effective subsidy to each location. Such calculations would allow us to determine the relative effective importance of explicit and implicit policies in determining the spatial distribution of income.

5.6 Conclusions

These topics are not intended to exhaust the range of studies related to the framework outlined in this paper. They are, however, concerned with questions which are very important, and deal with an aspect of policy which hitherto has tended to be overlooked. Given the complexity of schemes used to foster development and to redistribute income in developing countries it is important to have a straightforward system whereby one can examine the interaction of policies concerned with both objectives on each of the targets.
APPENDIX

SPATIAL BIAS AND THE LOCATION
OF FOOTLOOSE INDUSTRY
1. Introduction

In recent years the growing spatial concentration of economic activities and population in developing countries has attracted the attention both of the governments of those countries and of international agencies involved in economic development programmes. In particular, attention has focussed on the rapid growth of capital cities, such as Lagos, Manila and Mexico, through large-scale immigration and high birth rates. Such extreme urban concentration is considered undesirable on social, political as well as economic grounds, as an increasing proportion of the population lives in congested and polluted industrial centres, with poor housing, inadequate sanitation, etc. Indeed, such urban poverty undermines the benefits of the high growth rates which have been achieved by many developing countries during the past two decades. The key question for governments and development agencies alike is whether or not this concentration is an inevitable consequence of the development process, or whether it results from the approach to development which has been adopted. Obviously, to the extent that industrialization is seen as essential to growth, and industrialization is an urban phenomenon, then industrial development must increase urbanization. However, the tendency for such increased urbanization to be reflected in increased urban-concentration may be avoidable, if it is generated implicitly by policies which foster certain industries relative to others, in the context of an

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1 For a discussion of these issues, see Renaud (1979).
overall programme to expand the industrial sector.

This paper attempts to explain how the spatial concentration of economic activities in developing countries may increase, as resources re-allocate between sectors in response to government sectoral policies. The starting point of our analysis is the class of simple general-equilibrium models used widely by international trade theorists, in which the adjustment of factor allocations, and the associated changes in factor rewards in response to sectoral policies have been studied in detail. With the exception of models following in the Harris-Todaro tradition, which are concerned with explaining the existence of urban unemployment in developing countries, these models have not considered the spatial implications of these sectoral adjustments. By contrast, this paper, drawing on the approach taken in these trade models, extends it to consider the spatial implications of such changes in the sectoral pattern of output. To examine these spatial effects it is necessary to specify the locational dimensions of the economy, and in this paper we adopt a particularly simple specification, in order to focus on the spatial repercussions of sectoral policies. The economy is assumed to have two classes of locations at which two types of goods are produced: firstly, location-specific goods, by which we mean goods that can only be produced at a given class of locations in the economy, and secondly, footloose goods, by

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2 For an overview of these models, see Caves and Jones (1981), and for a detailed discussion of factor-market adjustments, see Neary (1978).

3 This model of rural-urban migration was first presented in Harris and Todaro (1970); more recent papers which have analysed this model include Corden and Findlay (1975), Fields (1975), and Neary (1981).

4 In a forthcoming paper, Ruane (1982), the spatial effects of tariff policies are examined in a standard Heckscher-Ohlin-Samuelson model with two goods and two factors. In that model, the locational dimension is kept in the background, whereas in the present model, the locational dimension of factors plays as central a role as their sectoral dimension. Nonetheless, even in the other model, the spatial implications of tariff policies are evident.
which we mean goods that can potentially be produced at all (here both) classes of locations in the economy. The outline of the paper is as follows: in Sections 2 and 3 respectively, we describe the model and analyse the effects of policies used to expand both the location-specific and footloose sectors on the relative sizes of the two classes of locations. In Section 4 we consider the effects of changes in the relative factor endowments at locations on the spatial pattern of employment in the economy. Section 5 considers some possible extensions of the model used, while Section 6 examines briefly the implications of this analysis for developing countries.

2. The Model

The economy is assumed to produce three traded goods: $X_A$ and $X_B$, two location-specific goods, which are produced at the two classes of locations, A and B, respectively, and $X_F$, a footloose good, which is produced at both locations A and B. The prices of these three goods ($P_A$, $P_B$ and $P_F$ respectively) are exogenous to the model, as the economy is assumed to be small and open. Two factors are used in the production of each of these goods: one mobile (intersectorally in the short run and interlocationally in the long run) factor, namely labour (L), and one sector-specific factor. The total supply of factors to the economy is fixed, and each of the sector-specific factors is assumed to be tied down to a particular location. Thus we have sector-specific factors A and B available only at locations A and B, and used solely

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5 As will be apparent in Section 2, the production structure specified guarantees that some output of the footloose commodity is actually produced at all locations.
in the production of goods $X_A$ and $X_B$. The specific factor used in the production of $X_F$, the footloose good, is $F$, which is available in fixed supply at each location, $F_A$ and $F_B$, at locations $A$ and $B$ respectively. The sector-specific factors $F_A$ and $F_B$ are assumed to be identical, so that the returns to these factors are equated in long-run equilibrium, as production units in the footloose sector are mobile between locations $A$ and $B$ in response to differentials in factor returns. Formally our model may be written in terms of production functions and labour-supply constraints, for given quantities of the sector-specific factors:

\[ X_A = X_A(A, L_{AA}) \]  
\[ X_F = X_F(F_A, L_{FA}) \]  
\[ X_B = X_B(B, L_{BB}) \]  
\[ X_F = X_F(F_B, L_{FB}) \]  
\[ L_A = L_{AA} + L_{FA} \]  
\[ L_B = L_{BB} + L_{FB} \]  
\[ L = L_A + L_B \]

The production functions for the three commodities are given by Equations (1-4), and the labour supply constraints for each location by Equations (5) and (6), where $L_{jm}$ is the labour force employed in the production of the $j$th commodity at the $m$th location. The economy-wide labour constraint is given by Equation (7), where the total labour endowment ($L$) is assumed fixed. We can write the competitive
profit conditions (which equate the changes in the prices of each sector's output to the changes in the unit costs it faces) for the four production processes as follows:

\[ \hat{P}_A = \theta_{AA} \hat{V}_A + \theta_{LA} \hat{w} \]  
\[ \hat{P}_F = \theta_{FF} \hat{V}_{FA} + \theta_{LF} \hat{w} \]  
\[ \hat{P}_B = \theta_{BB} \hat{V}_B + \theta_{LB} \hat{w} \]  
\[ \hat{P}_B = \theta_{FF} \hat{V}_{FB} + \theta_{LF} \hat{w} \]

where a circumflex denotes a proportional rate of change (e.g., \( \hat{w} = dlmw \)), \( \theta_{ij} \) denotes the share of factor \( i \) in the value of sector \( j \)'s output, \( w \) is the wage rate and \( \hat{v}_i \) is the return to the specific-factor \( i \). (Note that in the case of the specific factor used in the footloose industry, it is necessary to denote its return by location, \( \hat{v}_{FA} \) and \( \hat{v}_{FB} \), as the returns to these factors are identical only in long-run equilibrium, when the wage rate, which is identical across sectors within a class of locations in the short run, is identical across all sectors and locations.)

The equations summarize our model which may be used to trace out the pattern of sectoral adjustment within and between two classes of locations in response to changes in relative goods prices and relative factor endowments, focusing on the path of adjustment from the short run when labour is location-specific to the long run when labour is interlocationally mobile. Before presenting the model in diagramatic form, it is perhaps useful to consider its
structure in some more detail, and relate it to existing models. In the first place, the model has much of the flavour of the sector-specific factor models considered by Jones (1971a) and Samuelson (1971), in which each sector competes with one or more sectors for one or more factors of production, each being sole employer of at least one particular factor. Indeed, if A- and B-locations are classified as separate economies the model formally becomes one of two small-open economies, with the intersectorally-mobile factor (labour) also internationally-mobile. As such our model contrasts with the usual treatment of international factor mobility in sector-specific factor models, which typically assume that the internationally mobile factor is the sector-specific factor. The structure of the present model is such that were the F-factor, rather than labour, inter-locationally mobile in the longer run, factor rewards would be identical. However, the location of production units of the footloose sector and hence the spatial pattern of production would be quite different, as we shall see below.

We now present a diagram (Figure I), analogous to that introduced by Neary (1978), which can demonstrate the intersectoral and interlocational adjustment process in this model. The upper section of Figure I shows on the horizontal axis the total labour force in the economy (L), as allocated between locations A and B, while the vertical axes measure the value marginal product of labour and the wage. Starting at the left-hand side origin, O_B, we draw

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6 Examples of this type of model include Caves (1971), Amano (1977), Burgess (1978) and Jones, Neary and Ruane (1981).
the value marginal product of labour employed in the B-sector ($V_B$), which is derived from Equation (3) and the price of B-sector output ($P_B$), given the fixed stock of the B-factor. Thus if we define $w^0$ as the equilibrium wage rate in the economy, employment in the B-sector at B-locations is $O_BL_{BB}^0$. Starting from the right-hand side origin, $O_A$, and using an analogous argument, $O_AL_{AA}^0$ is the allocation of labour to production of the A-good, given the equilibrium wage rate $w^0$. Now labour not employed in the production of $X_A$ or $X_B$ ($L_{BB}^0-L_{AA}^0$ in the diagram) must be employed in producing the footloose good. Given the equilibrium wage rate $w^0$, identical returns to the F-factor in equilibrium ($v_{FA} = v_{FB}$), and identical production functions in both locations, the allocation of footloose activities between locations A and B depends crucially on the supply of the sector-specific factor to each location, i.e., $F_A$ and $F_B$. To demonstrate this we draw an Edgeworth Bowley Box for the F-sector, given the fixed supply of the F-factor (the vertical dimension) and the supply of labour at the wage rate $w^0$ (the horizontal dimension). The assumption of identical production functions implies that production takes place along the diagonal of the Box, $O_{FB}O_{FA}$. Furthermore, production must take place along the horizontal line through the Box, which indicates the initial endowments of the F-factor to locations A and B, i.e., $F_A$ and $F_B$. Thus production takes place at the point $C^0$, which, in terms of the upper section of Figure 1, means that total employment at B-locations is $O_BL^0$, comprising employment in the B-sector $O_BL_{BB}^0$ and employment in the F-sector, $L_{BB}^0L_{BB}^0$. Similarly total employment at A-locations comprises employment in the A-sector ($O_AL_{LL}^0$) and employment in the F-sector ($L_{AA}L_{AA}^0$). Finally, using $L^0$...
as origin, we can draw value-marginal-product curves for labour employed in the footloose sector at A- and B-locations, $V_{FA}$ and $V_{FB}$, which are mirror images of the value-marginal product curves derived directly from the Box diagram. For both locations the value marginal product curves in the two sectors intersect at the equilibrium wage $w^o$.

The diagram provides us with a natural vehicle for analysing the effects of different policies on the sectoral composition of output and the distribution of employment between locations A and B, starting from this initial equilibrium. The analysis which follows is centred on this diagram, while the corresponding formal algebraic expressions are presented but not derived.

3. Changes in Relative Prices and the Interlocational Distribution of Employment

In this section we examine the sectoral-output responses and associated interlocational adjustments to changes in relative good's prices, brought about by some sector-specific policy, such as the imposition of tariffs. We consider two tariff-induced relative price changes: firstly, when the price of one of the location-specific goods, $X_A$ and $X_B$, is raised relative to the price of the other location-specific good and the footloose good, and secondly, when the price of the footloose good is raised relative to both location-specific goods.

The immediate effect of a rise in the price of one of the location-specific goods, say $X_B$, is, in terms of geometry, to shift the $V_B$-curve upwards and to the right to $V'_B$ as in Figure II. The
labour market at B-locations is now in disequilibrium, for with the allocation of labour $O_B^0 L_B^0$ to the B-sector labour's value marginal product in that sector exceeds that in the F-sector. The labour-market equilibrium at A-locations on the other hand is unaffected by the tariff. The upward pressure on the wage rate at B-locations, as the B-sector draws labour from the F-sector, continues until eventually at the higher wage rate $w'$ and the new labour allocations $O_B^B'$ and $L_B^B$, a new equilibrium emerges in the labour-market. (As both other factors used at B-locations are sector-specific, they have to accept any change favourable or unfavourable in factor rewards resulting from the relative change in commodity prices.) Thus in the short run, when labour is interlocationally immobile, there is equilibrium with the wage rate at B-locations ($w'$) higher than that at A-locations ($w^0$), and with the B-sector now employing a larger share of the labour force at B-locations. We can see the immediate effect of the expansion of the B-sector on the F-sector by noting that its endowment Box (in the lower segment of Figure II) has shrunk on the left-hand side from $O_FB$ to $O_FB'$. (The broken line now indicates the effective Box dimensions on this side.) The F-sector taken as a whole is clearly not in long-run equilibrium, for the diagonal joining $O_FB'$ and $O_FA$ intersects the F-factor endowment ratio to the right of $C^0$, namely at $C'$. Since the intersectoral labour allocation is fixed in the short run at $L^0$, production in the F-sector at B-locations is clearly less labour intensive than production at A-locations, so that, ceteris paribus, the return to the F-factor is higher at A-locations compared with B-locations.

7 In this case the return to the F-factor at B-locations has been squeezed by the higher wage prevailing as a result of the tariff.
What happens in the longer run when labour becomes inter-locationally mobile? Clearly the higher wage rate at B-locations attracts labour to move to these locations, which movement, by putting downward pressure on the wage rate, brings about a further expansion of the B-sector (output expands along $V'_B$). Output in the F-sector at B locations also expands, while output in both sectors at A-locations continues to fall (as labour leaves these locations) until eventually the wage rate is equalised across all sectors and locations at a new equilibrium level, between $w^0$ and $w'$. (It is not possible to draw in this final solution in Figure II in a non-arbitrary manner, as the labour allocation line between the two classes of locations and hence the origin for drawing $V_{FA}$ and $V_{FB}$ is no longer fixed.) Given that the B-sector has unambiguously expanded, while the F-sector at B-locations may have expanded or contracted compared with its initial, pre-tariff size, what can we say has happened to the volume of employment at B- relative to A-locations as a result of the tariff on $X_B$?

The expression for the change in employment at B-locations ($L_B$) is given by the following equation:

$$\frac{L_B}{L} = \lambda L_{BB} \sigma_B \left\{ \frac{\lambda L_{AA} \sigma_A}{\sigma_{AA}} + \lambda L_{FA} \frac{\sigma_F}{\sigma_{FF}} \right\}^2_B$$

(12)

where $\lambda L_{jm}$ is the square of the total labour force employed in industry $j$ at location $m$, and $\sigma_j$ is the elasticity of substitution between the mobile and sector-specific factors in the production of commodity $j$.

Clearly the sign of the right-hand side of Equation 12 is positive, i.e., if the price of $X_B$ is raised by a tariff, then total employment at
B-locations expands. The expansion is larger the higher are the elasticities of labour demand in the A- and F-sectors \( \sigma_A/\theta_A \) and \( \sigma_F/\theta_F \) respectively). This result is hardly surprising, as protection of a location-specific product may be expected to benefit the location at which the production takes place. By contrast, however, if the F-factor rather than labour is interlocationally mobile, then the benefit to the location of the protected sector is less clear. (Of course, in this case we cannot measure the benefit to the location in terms of increased employment, since employment is now fixed.) In this case, protection of the B-sector would, by squeezing the return to the F-factor employed at B-locations, generate an incentive for it to move to A-locations, where, with the lower relative wage, its return is greater. Long-run equilibrium would be realised when sufficient of the F-factor had been transferred to equalise its returns and the wage in all sectors, across all locations. With this long-run adjustment mechanism expansion of the location-specific sector can only be achieved if the footloose sector at these locations contracts both because of the increase in the wage and because of the exodus of the F-factor.\(^8\)

The second and more interesting relative price change which we consider is the imposition of a tariff on the footloose commodity which immediately disturbs the labour-market equilibrium at both locations. Figure III illustrates the rise in \( P_F \), by equiproportional shifts in \( V_{FB} \) and \( V_{FA} \) to \( V'_{FB} \) and \( V'_{FA} \) respectively. In the

\(^8\) That the protection of one sector leads to pressure on factor outflow from the other sector results from the assumption of factor-specificity in production. See Caves (1971).
short run, when labour is intersectorally immobile, the F-sector at both locations expands, drawing labour from the location-specific sectors. At both locations the wage rate rises as the F-sector expands, drawing labour from the location-specific sectors, to the level necessary to bring about labour-market equilibrium. In this case, the extent of the rise in the wage rate at each location depends crucially on the relative size of the F-sector at the two locations and the elasticity of labour demand in the location-specific sectors (the elasticities of $V_B$ and $V_A$). Formally we can express the relationship between the short-run equilibrium wage rates at the two locations as:

$$\hat{w}_B - \hat{w}_A = \frac{\sigma_F}{\theta_{FF}} \left\{ \frac{\lambda_{LFB} \lambda_{LAA} \sigma_A}{\theta_{AA}} - \frac{\lambda_{LFA} \lambda_{LBB} \sigma_B}{\theta_{BB}} \right\} \hat{F}$$

(13)

where

$$\Delta_B = \lambda_{LBB} \frac{\sigma_B}{\theta_{BB}} + \lambda_{LFB} \frac{\sigma_F}{\theta_{FF}}$$

(14)

$$\Delta_A = \lambda_{LAA} \frac{\sigma_A}{\theta_{AA}} + \lambda_{LFA} \frac{\sigma_F}{\theta_{FFA}}$$

(15)

For the increase in the wage rate at the two locations to be identical, the expression within the brackets in Equation (13) must be zero, i.e. the elasticity of labour demand in the A-sector, weighted by both the shares of the total labour force employed in that sector and in the footloose sector at B-locations must match exactly the elasticity of labour demand in the B-sector weighted by both the share of the total
labour force in that sector and in the footloose sector at A-locations. Since there is no presumption that such a perfect matching occurs in practice, we would expect the wage rates at the two locations to differ at the end of the short-run adjustment period. Figure III shows the case where the elasticity of labour demand is higher in the A-sector compared with the B-sector ($v_B$ is more steeply sloped than $v_A$), so that, in effect, the A-sector is more willing to release labour to the expanding F-sector than is the B-sector. In this case, assuming to begin with that the share of labour in both location-specific sectors and in the two sections of the footloose sector are identical, i.e., $\lambda_{LFB} = \lambda_{LAA}$, $\lambda_{LFA} = \lambda_{LBB}$, the wage rate at B-locations rises by more than the wage rate at A-locations ($w_B - w_A > 0$). The effect of differences in the adjustments at the two locations to the expansion of the F-sector is clear from the production Box for the footloose sector in Figure III: the Box expands to a much greater extent at the O$_{FA}$ origin compared with the O$_{FB}$ origin, so that in short-run equilibrium, F-sector production at B-locations is less labour-intensive than at A-locations (the diagonal through the new box (O$_{FB}$ O$_{FA}$') cuts the F-factor allocations line at C' to the right of the initial equilibrium point C$^0$).

What happens when labour becomes interlocationaly mobile? Clearly labour moves to those locations at which there is a higher wage rate, or, in terms of our analysis, from A- to B-locations. The expression for the long-run change in employment at B-locations in to the introduction of a tariff on the footloose good is given by Equation (16):
Comparison of Equations (13) and (16) shows that the condition for the sign of the long-run change in employment at B-locations to be positive is identical to that for the short-run change in relative wage rates between locations A and B. This result is not surprising: the location with the higher relative wage rate when labour is immobile can be expected to expand when labour becomes interlocationaly mobile. What can we say generally about the condition for employment at B-locations to expand at the expense of employment at A-locations, when the footloose good is protected by a tariff? From Equation (16) we see that employment at B-locations is more likely to expand the higher is the elasticity of labour demand in the A-sector (i.e., the more easily can the A-sector substitute between labour and the specific factor in response to a rise in the wage rate), the larger is the share of the total labour force employed in the A-sector (i.e., the more labour the A-sector can supply to the expanding footloose sector), and the larger is the share of the total labour force employed in the footloose sector at B-locations (i.e., the larger is the relative endowment of the F-factor to B-locations).  

\[ \Delta = \Delta_B + \Delta_A \]  

We return to the question of the reason why some locations

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9 If employment at B-locations is high initially because of the large F-factor endowment at these locations, the expansion in employment at B-locations is greater.
might be more likely to expand relative to others below. For the present we simply note the main result of this analysis: a policy which encourages the expansion of the footloose sector is not spatially neutral; its spatial impact depends on the spatial distribution of the footloose factor and on the scale and structure of production in the non-footloose sectors.

4. Endowments of Location-Specific Factors and the Spatial Distribution of Employment.

In this section we examine how the spatial distribution of employment between A- and B-locations is affected by changes in relative factor endowments at the two classes of locations. We consider two relative endowment changes: firstly, an increase in the endowment of the specific factor used in the footloose industry at B-locations (F_B), which might be expected to lead to a relative expansion of employment at B-locations; and secondly, an equiproportional change in the endowment of the F-factor at both A- and B-locations, which might be presumed to be neutral in its effects on employment at both classes of locations. Figure IV is used to illustrate both sets of endowment changes.

The increase in the endowment of the F-factor at B-locations is represented by an expansion of the factor-endowment Box so that O'_{FB} becomes the new origin for F-sector production at B-locations.

While we model the endowment changes as exogenous, once-and-for-all increases in stocks, such changes are equivalent to a first order approximation.
The value marginal product of labour employed in the F-sector at B-locations increases with the additional F-factor, thereby shifting the $V_B^F$ curve parallel to $V_B^F$. Labour moves from the B-sector into the F-sector until labour market equilibrium at B-locations is reached at the higher wage rate, $w'$. When labour becomes interlocationally mobile, it moves from A- to B-locations, in response to the higher wage rate, leading to downward pressure on the wage rate at B-locations, so that both sectors at B-locations expand. Equation (18) expresses formally the induced movement of labour from A- to B-locations in terms of the negative effect of increasing $F_B$ on employment at A-location.

\[
\frac{L_A}{L} = \frac{-\lambda_{FB}}{\Delta} \left\{ \lambda LFA \frac{\sigma F}{\theta_{FF}} + (1-\lambda_{LFA}) \frac{\sigma A}{\theta_{AA}} \right\} F_B
\]

This result is hardly surprising, as the higher relative endowments at B-locations would be expected to draw labour from A-locations. In the final long-run equilibrium, output of the F-sector at the two classes of locations is in proportion to the new ratio of factor endowments, i.e., $X_{FB}' / X_{FA}' = F_B' / F_A'$. The effect of the equiproportional increases in $F_A$ and $F_B$ is represented in Figure IV by the expansion of the F-sector endowment from $0_{FB} \rightarrow 0_{FB}'$, with the ratio of the F-factors at the two sets of locations remaining constant, i.e., $F_B' / F_A' = F_B' / F_A'$. The expansion in endowments leads to labour at both sets of locations being drawn into the F-sector, putting upward pressure on the wage rate. The condition for
the wage rate change at B-locations to exceed that at A-locations is identical to that given by Equation (13), namely,
\[ \lambda_{LFB} \lambda_{LAA} \frac{\sigma_A}{\sigma_{AA}} > \lambda_{LFA} \lambda_{LBB} \frac{\sigma_B}{\sigma_{BB}} \]
which is exactly the condition for the long-run change in employment at B-locations to be positive:
\[
\frac{L_B}{L} = \lambda_{LFB} \lambda_{LAA} \frac{\sigma_A}{\sigma_{AA}} - \lambda_{LFA} \lambda_{LBB} \frac{\sigma_B}{\sigma_{BB}} \quad (19)
\]

From Equation (19) it is clear that an equiproportional increase in the endowment of the F-factor to both locations in general alters the distribution of employment between the two classes of locations. The equiproportional endowment change is not spatially neutral for the same reason as the tariff on the F-commodity analysed above proved to be non-neutral: the scale and structure of production in the location-specific sectors affect the equilibrium in the local (short-run) labour market, and hence the extent of interlocational labour movement in the longer run.

5. Extensions to the Model

In the model used in this paper both the sectoral- and spatial-dimensions of the factors of production are specified. It is clear that the locational-specificity of some factors can explain why sectoral policies may have strong spatial repercussions, even when the sector being protected is footloose. In this section we consider
briefly some extensions to the basic model, which further our understanding of why urban concentration tends to accompany industrial development.

If, in place of the assumption that labour markets within locations in the short run and across all locations in the longer run clear at a uniform wage, we allow for some degree of wage rigidity, then the spatial effects of sectoral policies may be increased or reduced. Two kinds of wage rigidity can be considered: firstly, sector-specific rigidity (where labour in a particular location-specific sector receives a wage in excess of the equilibrium wage), and secondly, location-specific rigidity (where labour employed in all sectors at a particular class of locations receives a wage higher than the equilibrium wage). In terms of the above analysis, a tariff on the B-good, when that sector faces a rigid-wage constraint, immediately increases B-sector employment and hence the wage earned by F-sector employees at B-locations. In the long run with interlocational labour mobility, employment in the F-sector at B-locations expands until wages across all flex-wage sectors are equalized. From Equation (12) we see that, ceteris paribus, the overall increase in employment at B-locations is less with than without the wage-rigidity, as the effective elasticity of labour demand is smaller taken over the two periods.

By contrast, the employment effect at B-locations is

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11 It is assumed that the tariff reduces but does not abolish the difference between wages across sectors and locations. If there were no reduction, the tariff would not generate any sectoral and hence spatial effect, while if the difference were abolished, the results would be analogous to those derived in Section 3.

12 Employment in the B-sector does not expand in the longer run because of the wage constraint, which implies a zero elasticity of labour demand.
greater when there is a tariff imposed on the footloose commodity, with the same rigid wage constraint in the B-sector. There are no short-run employment effects at B-locations (the wage constraint prevents the B-sector from releasing labour to the F-sector) while F-sector employment expands at A-locations. When labour becomes interlocationally mobile, employment at B-locations unambiguously increases, since the wage-rigidity implies a zero elasticity of labour demand in the B-sector. From Equation (16) it is clear that \textit{ceteris paribus}, the concentration of employment at B-locations following the imposition of a tariff on the footloose commodity is greater with the B-sector wage rigidity than without. This result is very intuitive, as the full burden of restoring equilibrium at B-locations is borne by inter- rather than intralocational movement of labour.

When the wage rigidity is location- rather than sector-specific, any policy which expands either the location-specific or footloose sector at that location, increases equally the wage in both sectors at the location in the short run. (This short-run effect is exactly the same as that when there is no wage rigidity in the economy, as described above.) In the longer run, as labour becomes interlocationally mobile, it continues to move into both sectors at the rigid-wage locations, until the wage constraint binds. Thus the case with the location-specific wage constraint more closely resembles the case with no wage constraint (in Section 2), than it does the case with a sector-specific wage constraint. Employment at the locations with the rigid-wage constraint must increase following an expansion of either its footloose or location-specific sectors. However, as long as some wage constraint continues to bind in a long-run equilibrium, the extent of
the increase in employment depends only on the elasticity of labour 
demand in the rigid wage locations.

As mentioned above, the only models in development economics 
which take account of the spatial dimensions of an economy are those 
following in the Harris-Todaro tradition. These models explain how 
labour rationally chooses to be temporarily unemployed at certain 
locations, because of the possibility of eventually obtaining high-
wage jobs at these locations. It is often not fully appreciated that 
the location specificity of jobs drives these models, in which location-
specific unemployment is an equilibrium phenomenon, and interlocational 
movement of labour, the equilibrating mechanism. In the context of the 
analysis in this paper, the addition of the assumption that labour is 
interlocationally mobile in response to the probability rather than 
the certainty of obtaining high wage jobs, increases the spatial impact 
of any sectoral policy which expands high-wage employment, as the value 
of labour movement exceeds the number of new jobs created. Thus the 
model specified here provides a natural vehicle for extending the original 
Harris-Todaro model.

In this paper we have considered two polar classes of factors, 
namely, those which are both location- and sector-specific and those 
which are both intersectorally and interlocationally mobile in the 
long run. An obvious intermediate class of factors would be those 
which are location-specific but intersectorally-mobile in the longer 
run. Such a factor would increase the intersectoral links at any 
given class of locations, as each commodity would be produced by one
sector-specific factor. In this case the employment effects of any given sectoral policy would be more complex, depending on the elasticities of substitution in production between the three factors. Ceteris paribus, the greater the degree of substitutability between the interlocationally-mobile factor, labour, and the location-specific, intersectorally-mobile factor, the smaller is the interlocational movement of labour induced by a given sector-specific policy.

Finally, while the structure of our model in its simple or extended version, shows how increased urban-concentration is likely to accompany industrial development, unless there is uniform growth of all subsectors, it obviously lacks one key determinant of the degree of urban concentration, namely, agglomeration economies. Such agglomeration effects would reinforce any tendency for policy-induced expansion of sectors at particular locations, as costs of production decline with increases in output. These agglomeration economies could be built into the framework of this paper via the introduction of a public good used in the production of all sectors at a particular location. Indeed the sectorally-mobile, location-specific factor discussed above could be modelled in this manner.

6. Footloose Industries, Sector-Specific Factors and Spatial Concentration in Developing Countries.

The purpose of this section is to draw out the implications of the above analysis for developing economies. It is argued that the specification of the model, and the focus on the locational dimension in development is particularly relevant to countries at an early
The distinction between industries which are location-specific and those which are footloose focuses on a key characteristic feature of many developing economies, namely, that the state of economic and social development itself effectively precludes the production of particular goods, or classes of goods, outside a tiny number of locations in an economy. Indeed, in certain instances, production of certain industrial goods is limited to the capital city. The manner in which this paper captures these limitations on production across locations is through the specification of factors, both by activity and by space. This approach points to the fact that the degree of location-specificity in production is rarely fixed in the long run. In particular, the key limiting factor may well be some kind of urban service, whose supply is a choice variable for the government in the long run. Furthermore, it may well turn out that governments have to trade-off between resources devoted to sectoral expansion in the short run, and improving urban services (roads, telecommunications, housing, etc.) in the longer run. Thus while there may be a short-run constraint imposed on the spatial pattern of economic activity, many such limitations can be relaxed eventually, if government infrastructural policies are designed appropriately. Of course, in certain exceptional cases, location specificity may be absolute (e.g., deep-water ports), and consequently, even in very developed economies, sectoral policies may continue to have non-neutral spatial effects.
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Figure 1
Figure II
BIBLIOGRAPHY


