1 Introduction

In this work we extend the standard Economic Geography model by Krugman [6] in two ways: (1) we introduce potential interregional technological differences in productivity levels of skilled workers employed in the modern sector, and (2) we describe these differences as a function of skilled workers regional density and, therefore, of their migration processes.

First, we show that Krugman's results [6] are enriched by the consideration of potential international differences in productivity development levels, because in this way, we can give a more complete description of centripetal and centrifugal forces which, by means of their interactions, determine equilibrium stability properties. Moreover, we suggest a sufficiently simple way to evaluate the "intensity" of agglomeration and dispersion forces when full agglomeration equilibria are considered; an evaluation that has so far been considered rather complex if referred to these particular equilibria. This difficulty is lesser when we analyze the symmetric equilibrium, which corresponds to a uniform distribution of the economic activity. In fact, Baldwin et al. ([1], p. 45), state that "the CP [Core Periphery] model is astoundingly difficult to manipulate since the nominal wages are determined by equations that cannot be solved analytically" and that "at the symmetric equilibrium this difficulty is much attenuated. Due to the symmetry, all effects are equal and opposite". In this work, we still have the difficulties mentioned by Baldwin et. al. [1], but we suggest a sufficiently simple way to evaluate how different parameters concur to determine the intensity of centripetal and centrifugal forces. These forces will be distinguished between "fixed-technology", or pecuniary externality forces, and "variable-technology" forces.[1] While the former are the ones traditionally considered in Economic Geography models, the latter are not always taken into account in these models, and are so-called because they derive from regional productivity differentials.

This is not the first paper in which interregional technological differences are introduced in

[1] The distinction of fixed-technology and variable-technology forces has been introduced by Nocco [11].

economic geography models in manufacturing goods production. Indeed, they have already been introduced by Ricci [13], Forslid and Wooton [3], Venables [15] and Nocco [11]. In particular, Ricci [13], who compares Ricardian comparative advantages with absolute advantage, introduces interregional technological differences by considering interregional relative differences in variable amounts required to produce only two varieties of modern goods. However, Ricci [13] does not study how economic integration affects the results of the model with labour mobility. Forslid and Wooton [3] depart from the standard core-periphery model by Krugman [6] introducing interregional technological differences in fixed costs sustained by firms in the modern sector. Moreover, they consider also differences in the production costs of different varieties within each region. Venables [15] uses the framework he and Krugman developed in 1996 [10] with backward and forward linkages between upstream and downstream firms to study the interaction between comparative advantages and pecuniary externalities with different manufacturing sectors. Nocco [11] introduces interregional technological differences in total factor productivities in Puga's work [12] and considers interregional knowledge spillovers that act through trade, only when regions are sufficiently integrated and the technological gap is not too high relatively to learning capabilities of lagging countries. In the present work, we introduce interregional technological differences in Krugman's model [6].

In this paper we allow for technological differences in productivity levels of skilled workers employed in the modern sector, while there are no interregional differences in the production of the traditional or agricultural good. As a consequence, the more productive region in the manufacturing sector has a comparative advantage in manufacturing, while the other in agriculture. Forslid and Wooton [3] write that "comparative advantage will be a force that strengthens the tendencies for all manufacturing to agglomerate in one region". However, we show that not always this region is the right one, that is the region in which firms agglomerate may be the one with a comparative disadvantage in manufacturing.

Moreover, we introduce an additional agglomeration force, because we analyze how stabil-

ity properties of equilibria may be affected when regional productivity levels depend upon skilled workers concentration (or density), and therefore upon their interregional movements. More specifically, in the paper we assume that a higher skilled workers density may give rise to higher regional manufacturing productivity levels. In this assumption we follow Krugman [8] and Ciccone and Hall [2]. In particular, Ciccone and Hall ([2], p. 68) find that: "increasing returns to density play a crucial role for explaining the large differences in average labor productivity across U.S. states. We estimate that doubling employment density in a county increases average labor productivity by 6 percent. This degree of locally increasing returns can explain more than half of the variation in labor productivity across U.S. states."[2]

This kind of relationship describes a positive externality of technological and geographically localized nature.[3] Introducing this externality in Krugman's model [6], we show that firms and workers' spatial distribution are influenced not only by the degree of economic integration between the two considered regions, but also by the size of the above mentioned geographical technological externality, which influences regional productivity levels.

The work is organized as follows. Section 2 introduces the model with potential interregional productivity differences in the modern, or manufacturing, sector. Section 3 presents the results for the sustainability of the symmetric equilibrium and introduces the indexes that may be used in this case to evaluate "intensities" of centripetal and centrifugal forces, distinguished between fixed-technology and variable-technology forces. Section 4 discusses symmetric equilibrium stability properties, and shows how these properties are modified when the positive relationship between skilled workers density and productivity levels exists. Conclusions are drawn in section 5.

[2] Ciccone and Hall [2] explain the large differences in labor productivity across U.S. states by estimating the relationship between county employment density and productivity at the state level. In particular, they derive this relation from two models: "one based on local geographical externalities and the other on the diversity of local intermediate services" [2].

[3] See Scitovsky [14] for a classification of pecuniary and technological externalities.