Journal of Urban Economics 74 (2013) 47–58

Contents lists available at SciVerse ScienceDirect

Journal of Urban Economics

www.elsevier.com/locate/jue

Home market effects with endogenous costs of production

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ARTICLE INFO

Article history:
Received 17 March 2010
Revised 26 September 2012
Available online 17 October 2012

JEL classification:
F12
L13
O31
R3

Keywords:
Home market effects
Oligopoly
R&D investment
Endogenous asymmetric firms
Spatial equilibrium

ABSTRACT

In a standard imperfect competition model, we endogenize the costs of production of firms in the increasing returns sector (IRS) via process R&D. We show that firms in the larger region in terms of demand invest more in R&D (i.e.: they are bigger in size and have lower marginal costs) than firms in the smaller region, since the former exploit larger economies of scale in production to pay for the costs of R&D. As a result, when the return on R&D is high, the larger region does not employ disproportionately more labor nor attracts a disproportionately larger share of firms in the IRS in relation to share of demand it hosts, i.e.: negative home market effects (HMEs) in employment and in the number of firms. When this occurs, only partial agglomeration of the IRS in the larger region is sustainable in equilibrium. Even so, the larger region always runs trade surplus in the IRS, i.e.: HME in trade patterns.

1. Introduction

In 2008, Paul Krugman won the Nobel Memorial Prize in Economics for his contributions to the "new" trade theory and to the "new" economic geography (Krugman, 1980, 1991). Central to both of these theories are the so-called "home market effects" (HMEs). In a two-region economy, the HMEs predict that the larger region in terms of demand, in comparison to the smaller region: (i) attracts a disproportionately higher share of firms in the increasing returns sector (IRS) in relation to the share of demand it hosts (HME in the number of firms); (ii) uses disproportionately more factors of production in the IRS in relation to the share of demand it hosts (HME in employment); and (iii) runs trade surplus in the IRS (HME in trade patterns).

A central assumption in Krugman (1980) is that the costs of production are exogenous.[1] We check the robustness of Krugman (1980) HMEs when the costs of production are endogenous. Costs of production are endogenized via process R&D investment that reduces marginal costs but increases fixed costs. In this set-up, we show that when the return on R&D is high, the larger region, relatively to the smaller region, does not disproportionately employs more labor nor attracts a disproportionately larger share of firms in the IRS in relation to share of demand it hosts (negative HMEs in the number of firms and in employment), but even so it always runs a trade surplus in the IRS (HME in trade patterns). In other words, while we continue to have a HME in trade patterns, we find negative HMEs in the number of firms and in employment, given that an increase in the market size of the larger region triggers a less than proportional increase in the number of local firms and factor employment.

Our paper then contributes to the theoretical and the empirical literature on HMEs. We contribute to the theoretical literature on HMEs, since we check the robustness of one of the assumptions in Krugman (1980): exogenous costs of production. Standard imperfect competition models (Krugman, 1980; Brander, 1981 and Ottaviano et al., 2002) assume exogenous costs of production for analytical convenience. However, as we all know, the empirical evidence demonstrates that the costs of production are endogenous (Gustavsson et al., 1999; Aw et al., 2008; Glaeser et al., 2010). But further than just adding more realism to

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[1] In Krugman (1980) there are two countries (home and foreign), two sectors (increasing returns and constant returns to scale) and one factor of production (labor). The constant returns sector (CRS) produces a homogeneous good under perfect competition. The IRS produces a set of differentiated goods under monopolistic competition. The IRS goods are subject to iceberg trade costs, while the CRS good is freely traded across countries. Preferences are Cobb–Douglas across the two goods. For the IRS goods, preferences are of the CES type and each variety enters symmetrically in the utility function of a representative consumer. Firms in the IRS incur marginal and fixed costs of production, which are constant, exogenous and equal across countries.

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http://dx.doi.org/10.1016/j.jue.2012.10.001

trade-geography models, our results point out that the assumption of exogenous costs of production is not innocuous.

In this way, we follow the theoretical literature on the robustness of HMEs. For instance, Head et al. (2002) show that HMEs are robust to market structure and preferences (see also Feenstra et al., 2001; Helpman, 1990; Yu, 2005).[2] However, HMEs can be canceled if the constant returns good is also subject to trade costs (Davis, 1998; Crozet and Trionfetti, 2008), if there are many regions in the world economy with very similar factor endowments (Behrens et al., 2009), and if the IRS consists of non-traded goods (Behrens, 2005).

We also contribute to the empirical literature on HMEs, since our results provide some guidelines for the empirical tests on HMEs. In fact, the empirical literature on HMEs is inconclusive in what respects the existence of HMEs. For example, while Lundbäck and Torstensson (1998), Davis and Weinstein (1999, 2003), and Brülhart and Trionfetti (2009) find support for HMEs; the contrary occurs in Davis and Weinstein (1996), Feenstra et al. (2001), and Head and Ries (2001).

Our paper sheds light on these conflicting results. To see this, note that the reason why in our set-up HMEs in the number of firms and in employment do not necessarily emerge, while the same is not the case with HME in trade patterns, is that when the costs of production are endogenous, firms become endogenously asymmetric across regions. When firms in one region have lower marginal costs and are bigger in size than firms in the other region, the number of firms and the employment of factors of production in the former are reduced. Though, firms from this region still export more than foreign rivals, due to their higher cost competitiveness, i.e.: in a set-up with endogenous costs of production there is no direct link between the three HMEs.

In standard trade models, on the contrary, there is a direct link between the three HMEs, since firms are symmetric in cost competitiveness and size. In other words, if a region hosts more firms, it also employs more factors of production and runs a trade surplus in the IRSs. Due to this direct link between the three HMEs when the costs of production are exogenous, the empirical literature on HMEs just focus in one type of HME, in particular, in either the number of local firms (Davis and Weinstein, 1996, 1999, 2003) or in the balance of trade in IRSs (Lundbäck and Torstensson, 1998; Feenstra et al., 2001).[3]

Our paper then indicates that to focus in only one HME can be misleading, since the direct link between the three HMEs does not necessarily always arise. When this is the case, the existence of one HME might not translate into the existence of the others. For example, an empirical paper that fails to find HME in the number of firms can end up dismissing HMEs in general, when in fact the HME in trade patterns are present. In this sense, our results point out that the empirical literature on HMEs needs to develop tests that simultaneously check for the three HMEs and to take into account cost competitiveness and size asymmetries between firms in different regions.[4]

An interesting aspect of the asymmetries between firms generated in our model endogenously is that they result from a spatial dimension that is absent in standard imperfect competition models. In fact, when the costs of production are endogenous, outputs and prices depend not only on the spatial distribution of firms (as in standard imperfect competition models), but also on the spatial distribution of demand.[5] In particular, firms located in larger markets invest more in R&D and therefore achieve lower marginal costs than firms in smaller markets.

In addition, the relationship between R&D and the number of local firms is non-monotonic: while an increase in the number of firms in a market with a small industry promotes local firms' R&D, the contrary occurs in a market with a large industry. In this way, our paper is in accordance with the empirical work of Aghion et al. (2005, 2009). They show that innovation is shaped by the number of local firms and that the relation is non-linear.

The consequence of the spatial dimension in our model is that the location equilibrium involves stable partial agglomeration equilibriums when the return on R&D is high, even when a region hosts a relatively higher share of the world demand. In standard imperfect competition models when regions differ greatly in market size, partial agglomeration equilibriums are unstable and total agglomeration always emerges as the only stable equilibrium (see Krugman, 1991). This is an interesting result, given that, as argued by Baldwin et al. (2003), partial agglomeration configurations are more realistic than total agglomeration ones. In this sense, we also introduce a new motive for partial agglomeration: endogenous costs of production.[6]

The remainder of the paper is organized as follows: In Section 2, we present an imperfect competition trade model that encompasses both the exogenous and the endogenous costs of production cases. In Section 3 and 4, we analyze the exogenous and the endogenous costs of production cases in terms of HMEs and spatial equilibrium. In Section 5, we conclude.

2. The model

We adopt the framework in Krugman (1980), which is the standard set-up for deriving HMEs. The objective is to make our model as similar as possible to those in the literature on the HMEs.

2.1. Basic structure

The model considers one factor of production, two regions, and two sectors. The sectors are the constant returns sector (*CRS*) and the increasing returns sector (*IRS*). The two regions are home (H) and foreign (F). Preferences and underlying technologies are the same in both regions. The only factor of production is labor, which is internationally immobile. We denote M as the world endowment of labor and w_H and w_F as the labor wages at H and F, respectively. In turn, r represents the share of the world endowment of M located at home (with $r \in (0,1)$). Therefore, r is the home share of the world expenditure and $rM = m_H$ is the number of consumers at home (and for the foreign country $(1-r)M = m_F$). Since the model is symmetric, in the following, we concentrate our attention in the home region. Equations for foreign apply by symmetry.

The *CRS* produces a homogenous good under perfect competition. The *CRS* -good is freely traded between regions. The *CRS* is kept in the background and its role is to represent the "rest of

[2] In particular, HMEs are also present in oligopolist models, like Brander (1981), or in monopolistic competition models with linear demand, such as Ottaviano et al. (2002). Since Krugman (1980), Brander (1981), and Ottaviano et al. (2002) are then very similar in terms of HMEs, we label them as standard imperfect competition models.

[3] To the best of our knowledge, we are not aware of any paper that tests for HMEs in employment. This is in part due to data limitations and reverse causation issues.

[4] With the exception of Davis and Weinstein (1996, 1999, 2003), the empirical papers develop different measures of HMEs. This makes it difficult to evaluate the different contributions. However if, as we suggest, the empirical literature derives tests that encompass the three HMEs, the comparison between the different contributions becomes more direct.

[5] The empirical literature on agglomeration and efficiency support our results in that they highlight the importance of both the local levels of demand and of competition on firms' productivity. See for instance Mitra (1999), Paul and Siegel (1999), Henderson (2003), Cohen and Paul (2005), and Andersson and Lööf (2011).

[6] Other reasons pointed out for partial agglomeration are: non-traded goods (Helpman, 1998); decreasing returns (Puga, 1999); limited factor mobility (Ludema and Wooton, 1999); and the absence of income effects (Pflüger, 2004).