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Optimal tariffs, retaliation, and the welfare loss from tariff wars in the Melitz model☆

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ABSTRACT

This paper characterizes analytically the optimal tariff of a large one-sector economy with monopolistic competition and firm heterogeneity in general equilibrium, thereby extending the small-country results of Demidova and Rodríguez-Clare (JIE, 2009) and the homogeneous firms framework of Gros (JIE, 1987). The optimal tariff internalizes a mark-up distortion, an entry distortion, and a terms-of-trade externality. It is larger when the dispersion of firm-level productivities is higher, and the country's relative size or relative average productivity is bigger. Furthermore, in the two-country Nash equilibrium, tariffs turn out to be strategic substitutes. Small or poor economies set lower Nash tariffs than large or rich ones. Lower transportation costs or smaller fixed market entry costs induce higher equilibrium tariffs and larger welfare losses relative to the case of zero tariffs. Similarly, cross-country productivity or size convergence, and higher firm-level productivity dispersion increase the global welfare loss due to non-cooperative tariff policies. These results suggest that post WWII trends have increased the relative merits of the WTO.

1. Introduction

This paper provides an analytical characterization of non-cooperative tariff policy in an asymmetric one-sector two-country Melitz (2003) model, thereby generalizing and extending results that have been derived in the Krugman (1980) model for homogeneous firms. In that framework, there are three different rationales for the existence of a strictly positive optimal tariff. First, Flam and Helpman (1987) show that tariffs correct for a mark-up distortion due to monopoly pricing. Second, Venables (1987) argues that a tariff can induce welfare-enhancing additional entry. Third, as in other trade models, there is a terms-of-trade rationale for import tariffs; see Gros (1987). Demidova and Rodríguez-Clare (2009) have extended the first mechanism to a small-economy Melitz model and Ossa (2011a) has generalized the second one in the context of a Melitz model with a linear outside sector. The present paper generalizes the Gros (1987) model to heterogeneous firms and extends the Demidova and Rodríguez-Clare argument to the case of two large countries. Both models are special cases of ours.

When firms differ with respect to their levels of productivity, unilateral import tariffs tend to lower average productivity of domestic firms as less efficient domestic producers remain operative. However, the least efficient foreign producers do no longer find it profitable to export to the domestic market, so that their average productivity rises. As shown by Arkolakis et al. (2008) in the context of a Melitz (2003) model with Pareto distributed productivities and with import barriers modeled as iceberg trade costs, these two mechanisms have exactly off-setting welfare effects. We demonstrate that with non-wasteful tariffs, Melitz-type selection effects – and hence productivity dispersion – have an effect on welfare and on optimal tariff policy. The optimal tariff is larger when the degree of dispersion in the firm-level productivity distribution is stronger. Moreover, the optimal tariff is larger when "selection is inactive" (i.e., in the Gros–Krugman case).[1]

Understanding the incentives of governments to use commercial policy is important for any assessment of the potential welfare gains due to

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[1] The distinction between "selection" and "heterogeneity" is due to Burstein and Vogel (2011). Selection is related to the presence of fixed market entry costs and is required for heterogeneity to matter. Shutting down the selection channel, the Melitz (2003) model converges to the Krugman (1980) setup.

an institution such as the World Trade Organization (WTO). With this objective, the present paper studies non-cooperative tariff policy, retaliation, and welfare in a heterogeneous firms trade model of the Melitz (2003) type where trade is due to product differentiation, producers operate under conditions of monopolistic competition and increasing returns to scale, and international trade is subject to transportation costs. Bernard et al. (2007a) provide firm-level evidence for this setup. It allows assessing the role of important exogenous secular trends – falling natural trade barriers, country size convergence, and increasing dispersion of the firm-level sales distribution – on the relative welfare benefits of the WTO.

More specifically, we present the following analytical results. (i) The optimal tariff formula is composed of a mark-up distortion, an entry distortion, and a terms-of-trade effect. While the former two interact, the latter enters additively. However, the importance of relative market size for the terms-of-trade effect is magnified by the mark-up and entry distortions which are not present in the standard trade model. (ii) The optimal tariff increases in relative effective market size (i.e., productivity and trade-cost weighted population size) and in the degree of productivity dispersion; relative market size matters more strongly when productivity is more dispersed. (iii) The optimal tariff formula nests the Gros (1987) homogeneous firms model when the selection channel is muted, and collapses to the Demidova and Rodríguez-Clare (2009) expression when the domestic economy's relative effective market size converges to zero. (iv) Countries' reaction functions are negatively sloped, i.e., tariffs are strategic substitutes. Retaliation leads to a new equilibrium tariff that is lower than the optimal tariff of a country in the non-retaliation case. (v) The Nash tariff is increasing in relative country size, relative average productivity, the degree of productivity dispersion and falling in variable trade costs.

Using a stylized yet conventional calibration of the model, we find that the interaction between firm-level heterogeneity and relative market size is quantitatively important. Moreover, we compare welfare levels of countries under Nash tariffs with a free trade scenario. Increased productivity dispersion (as documented by Poschke (2011)), lower natural trade barriers, and convergence of country sizes or average productivities lead to higher tariff-induced world welfare losses relative to free trade. Hence, the Melitz (2003) framework suggests that a multilateral trade agreement such as the WTO has become more important in avoiding the welfare damages due to tariff wars as productivity distributions have become more dispersed, the world has become more symmetric, and natural trade barriers have fallen.[2]

Our research is related to at least three important strands of literature. The first deals with the endogenous determination of trade policy. The literature distinguishes between two general motives for commercial policy: to protect the interests of special lobbying groups, see Grossman and Helpman (1994), or to maximize national welfare. Following Johnson (1953), Gros (1987), Syropoulos (2002), and the ensuing literature, in the present paper, we choose the second option and characterize the ad valorem tariff that maximizes Home's welfare. Maggi and Goldberg (1999) find that the weight of welfare in the government's objective function is many times more important than the weight of special interests, so that our approach seems sensible. It is also consistent with the empirical evidence presented by Broda et al. (2008) who show that countries use tariffs to exploit their market power on international markets.[3]

Venables (1987) and, more recently, Ossa (2011a) have discussed an alternative motivation for import tariffs when a homogeneous-firms/differentiated-goods sector is complemented by a numeraire sector with costless transportation of goods, perfect competition, and linear technology. In such a framework, wage rates are fixed by technology. Import tariffs allow the country to attract additional firms into the sector afflicted by trade costs. If this tariff-induced *delocation effect* dominates the direct effect of the tariff on the price index, consumers benefit.[4] However, in our single-sector setup, additional entry of firms bids up the wage rate, counteracting the delocation effect.

Second, our paper relates to research on the role of country size for the outcomes of trade wars. Kennan and Riezman (1988) analyze the outcomes of trade wars as a function of countries' endowments. Syropoulos (2002) provides the key theoretical results on the role of relative country size in general neoclassical trade models. He characterizes situations in which a large country can actually be better off under a trade war than under free trade. We show that firm-level heterogeneity matters for the effect of relative country size on the optimal tariff. We also compare countries' welfare levels in the non-cooperative Nash equilibrium with the situation of free trade and interpret the difference as the maximum welfare gains due to the WTO.[5] We simulate simple scenarios that are motivated by real-world trends such as increased productivity dispersion, lower transportation costs, or the convergence of GDPs across countries in order to understand how those trends affect countries' incentives to use tariffs.

Third, our paper relates to research on asymmetric versions of the Melitz (2003) model. Arkolakis et al. (2012) provide a general characterization of the gains from trade in Melitz-type environments. If three crucial macro-restrictions hold, a change in welfare in both the Krugman and the Melitz model can be written as a function of the observed degree of endogenous openness of a country and the trade elasticity as measured by a standard gravity equation. Across models, the same change in openness leads to the same change in welfare; there are no additional gains based on selection and firm-level heterogeneity. We prove that knowing the trade openness and the trade elasticity alone does not suffice to determine the optimal tariff. The reason is that tariffs redistribute income across countries and this gives extra leverage to Melitz-type selection effects.[6]

The remainder of the paper is structured as follows. Section 2 introduces the model — essentially a version of the Melitz (2003) model with two asymmetric countries and Pareto-distributed firm-level productivities. Section 3 studies the effects of a given tariff on model outcomes. Section 4 characterizes the optimal tariff given the other country's tariff rates. Section 5 analyzes the outcome of a non-cooperative Nash game between tariff-setting countries and contains our quantitative analysis. Section 6 concludes. Analytical details are relegated to the Appendix A.

2. Model setup

We consider a world with two countries that may differ with respect to their labor forces and average productivities. Each worker inelastically supplies one unit of labor and spends income on

[2] Our results on import tariffs carry over to policy measures such as the provision of subsidies on the consumption of domestic varieties or *ad valorem* export taxes. The first policy measure is hard to implement in practice, and the second is rarely observed. Given the overwhelming empirical relevance of import tariffs, we focus on them in the subsequent analysis. Details of the derivation of optimal consumption subsidies and export taxes are available upon request. Recent literature also considers optimal fixed cost subsidies. Pflüger and Suedekum (2009) focus on optimal entry fixed subsidies in a model with two large countries and two sectors. Jung (2012) derives optimal entry and operating fixed cost subsidies in a small open economy setting with a single differentiated good sector.

[3] Recent literature also addresses different incentives for government interventions. Antràs and Staiger (in press) focus on international cost-shifting incentives in a framework with offshoring and contractual imperfections. Mrázová (2011) considers profit shifting in a world with oligopolistic competition.

[4] See Bagwell and Staiger (2009) for a more general discussion of the delocation argument.

[5] See Rose (2004), Subramanian and Wei (2007), and Tomz et al. (2007). Bagwell and Staiger (2010) survey recent theoretical and empirical literature on the functioning of the WTO.

[6] Our model differs from the Arkolakis et al. (2012) setup with respect to a second point: in line with Melitz (2003) and following Demidova and Rodríguez-Clare (2009), we write foreign market access costs in terms of domestic labor. We show in a supplement appendix, which is available upon request, that this choice has no implications for the results.