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Trade-induced productivity gains reduce incentives to impose strategic tariffs

Michael Hübler[a,b,*], Frank Pothen[a,b]

[a] Leibniz Universität Hannover, Königsworther Platz 1, 30167 Hannover, Germany
[b] Centre for European Economic Research (ZEW), Mannheim, Germany

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ABSTRACT

Strategic tariffs, which raise an economy's welfare by restricting trade and improving the terms of trade, can create an obstacle to free trade. We evaluate how far trade-induced productivity gains (technology spillovers) reduce or remove this obstacle, because more intensive trade enhances these potential gains. Based on theory and the World Input-Output Database (WIOD) we estimate stronger import-induced than export-induced productivity gains. We feed the theory and the estimates into a global Computable General Equilibrium (CGE) model calibrated to WIOD. We find that the USA's, China's and the EU's optimal tariffs are reduced by less than 20%, Russia's and India's by around 25% and Brazil's by 40% when taking endogenous trade-induced productivity gains into account. Nonetheless, incentives for single economies to impose strategic tariffs persist. Particularly large, trade-intensive downstream sectors producing distinct goods incentivize high sectoral optimal tariffs. A global free trade agreement could overcome such incentives and maximize the trade-induced productivity gains.

1. Introduction

Classic trade theory based on the Ricardian model of comparative advantages argues that economies benefit from international trade via *specialization*. Given that technology-related knowledge and ideas are embodied in traded goods, trade additionally fosters technology *imitation* and *technology spillovers* across firms (Grossman and Helpman, 1991). Furthermore, trade implies enhanced competition and on average more efficient production via the *self-selection of heterogeneous firms* (Melitz, 2003). Additionally, *learning by exporting* can enhance exporters' productivity (Yang and Mallick, 2014). Via these channels, international trade is supposed to create a positive externality in the form of productivity and welfare gains on top of classic gains from trade. Significant welfare gains in turn create an incentive to reduce trade barriers in order to enhance trade and the resulting productivity gains in the home economy. To shed light on this issue, this paper studies how optimal tariffs (welfare-maximizing for the home economy), exogenously imposed by policymakers in the home economy, and the resulting welfare gains are affected by endogenous trade-induced productivity gains, anticipated by the policymakers. Unlike recent implementations of Melitz's theory of heterogeneous firms into numerical multi-region, multi-sector models (Balistreri et al., 2011; Akgul et al., 2016; Dixon et al., 2016) we model productivity gains in a general stylized way following the broad econometric literature; i.e., we implicitly allow for all the above-mentioned channels of productivity gains.

The insights from this study are of particular relevance for the current trade policy controversy: on the one hand the theoretical argument for *global* free trade, on the other hand the creation of regional trade agreements, such as the trans-Atlantic and trans-Pacific agreements, for political reasons (The Economist, 2015). Referring to this policy controversy, we ask the question: are trade-induced productivity gains a valid theoretical and empirical argument for the reduction or removal of import tariffs?

To answer this question, the paper first provides conceptual explanations building on classic trade theory (especially Markusen, 1975) and relating to the optimal tariff literature (Johnson, 1954; Hamilton and Whalley, 1983; Gros, 1987; Kennan and Riezman, 1988, 1990; Brown, 1987; Markusen and Wigle, 1989; Broda et al., 2008). The intuition for imposing optimal tariffs is as follows: if an economy exhibits power on international markets, it can increase domestic welfare by erecting trade barriers and thereby manipulating the terms of trade in its favor, similar to the behavior of a monopolist. The optimal tariff imposed on imports balances the marginal benefits from the improved terms of trade and the marginal losses from the resulting trade distortion. Surprisingly, it has hardly been investigated by this

* Corresponding author at: Leibniz Universität Hannover, Königsworther Platz 1, 30167 Hannover, Germany.
E-mail address: huebler@iuw.uni-hannover.de (M. Hübler).

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literature how optimal strategic trade intervention is altered in the presence of trade-induced productivity gains, in particular technology spillovers. The following paper shows that import- and export-induced productivity gains reduce optimal tariffs and the resulting welfare gains. If the strength of productivity gains is sufficiently high, the incentive to impose tariffs will vanish because the achievable productivity gains via free trade exceed the strategic gains from restricting trade. The question is whether this theoretical finding holds empirically.

Therefore, this paper then estimates trade-induced productivity gains econometrically. The econometric model is specified in a parsimonious way to keep it consistent with theory and the following CGE (Computable General Equilibrium) model implementation. The econometric estimation also uses the same recent global dataset called WIOD (World Input-Output Database; Dietzenbacher et al., 2013; Timmer et al., 2015; e.g. applied by Koopman et al., 2014)[1] as the CGE model. The main advantage of using WIOD for this analysis of dynamic productivity gains is the availability of the global input-output matrix for 15 years. This allows us to carry out panel data estimations and to vary the benchmark year in the CGE analysis. Elasticities of substitution for the production functions, estimated with WIOD as well, are taken from Koesler and Schymura (2015). In this way, the paper reconciles theory-based estimation and numerical modelling consistently using the same dataset, which is often not possible in economic modelling due to lack of suitable data and technical constraints. The econometric results indicate, in accordance with the literature (summarized by Saggi, 2002; Keller, 2004), that statistically and economically significant import- as well as export-related productivity gains are measurable. Import-induced productivity gains appear to be larger than export-induced ones.

For the numerical policy analysis, this paper utilizes a global multi-sector, multi-region CGE model, which is a prime implementation of the model tailored for the WIOD (Koesler and Pothen, 2013). This model enables the assessment of welfare effects of import tariffs, exogenously imposed on the model regions or specific sectors under the assumption of endogenous or fixed trade-induced productivity gains. Other multi-region studies on strategic tariffs, such as Ossa (2014), utilize GTAP (Global Trade Analysis Project)[2] and do not take trade-induced productivity gains into account. As usually done in the literature, we utilize an Armington (1969) specification. After feeding the estimated productivity gains into the CGE model, we obtain optimal tariffs that range from 10 percent for Brazil to about 25 percent for the USA.[3] Based on these simulation results, we show econometrically that optimal tariffs increase in the import and export intensity, in the relative sector size[4] and the downstreamness[5] of a sector. When taking the endogeneity of trade-induced productivity gains into account, the CGE analysis suggests that optimal tariffs should be reduced by less than 20 percent in the USA, China and the EU,[6] around 25 percent in Russia and India and 40 percent in Brazil. Lower Armington elasticities representing more distinct goods drastically raise these tariffs. Overall, the results provide an argument for the reduction of trade barriers at the global level, which has been quantitatively opaque and is often overlooked in the policy debate and the trade literature.

The paper proceeds as follows. Section 2 explains the theoretical background and formulates testable hypotheses (propositions). Section 3 estimates the magnitude of trade-induced productivity gains. Section 4 applies the estimated parameter values to a CGE model and performs various region- and sector-specific trade policy experiments. Section 5 concludes with policy implications.

2. Theoretical background

This section explains the theoretical background as a basis for the following numerical analyses. We refer to the Markusen (1975) general equilibrium 2x2 trade model and the modified version by Jakob et al. (2013) who both describe trade policy in the presence of a negative trans-boundary, environmental externality created by foreign (and domestic) producers. Different to them, we assume that a *positive* productivity externality of trade occurs *within the home country* induced by imports as well as exports, albeit we do not look at productivity gains abroad induced by the home country's exports or imports. The full-fledged general equilibrium model in Section 4 will allow for simultaneous trade-induced productivity gains in all model regions.

The assumption of a positive productivity externality induced by international trade builds on a broad literature (summarized by Saggi, 2002; Keller, 2004). The classic Ricardian gains from trade occur via comparative advantages and specialization (advanced by Eaton and Kortum, 2002). In addition, trade can create productivity gains by increasing the availability of differentiated, innovative intermediate goods and, thereby, improving productivity in final good production (Ethier, 1982; Hübler, 2015).[7] In this context, imports are seen as a main source of international technology spillovers. They embody advanced knowledge that can be exploited via imitation, and they are often associated with international enterprises that exchange knowledge between their affiliates, which creates international technology spillovers. Knowledge can then spread further from foreign affiliates to local firms and create local technology spillovers.

Like importing, exporting can spur innovation and enhance knowledge exchange between firms (learning by exporting). Furthermore, productivity gains can emerge due to increased competition and firm selection triggered by trade as described by Melitz (2003)[8] and the vast literature based on this seminal work. Felbermayr et al. (2013) analyze strategic trade policy in a Melitz model. In their model, the optimal tariff addresses a mark-up distortion, an entry distortion and a terms of trade externality.

Our approach is more general than other approaches in the literature by looking at any export- as well as import-related productivity gains including technology spillovers. The following framework illustrates the core economic mechanisms and formulates testable hypotheses (propositions) for the econometric and numeric analyses.

2.1. A stylized illustration

This subsection illustrates a stylized mathematical representation of international trade with induced productivity gains that uses standard elements and specifications. We imagine a *large open economy*, called *Home*, producing two varieties, $i = \{X; Y\}$, of one tradable good in one sector, s, given a constant total factor endowment $\overline{Z}$. One variety is produced at home and exported, the other variety is imported from abroad and can also be produced at home. We do not look at the rest of the world and its strategic behavior or reaction explicitly and restrict the analysis to Home's unilateral trade policy. We neglect externalities from Home to the rest of the world and their impacts on production and trade patterns abroad, because we focus on policy-induced

[1] URL http://www.wiod.org/home (accessed Aug. 2016).
[2] URL https://www.gtap.agecon.purdue.edu (accessed Aug. 2016).
[3] The United States of America.
[4] Economy-wide sectoral output share.
[5] Sectoral output share in final consumption.
[6] European Union.

[7] Markusen et al. (2005) and Rutherford and Tarr (2008) implement Ethier (1982)'s mechanism in a CGE framework. Our strategic trade policy analysis abstracts from quality-differentiated goods and reputation spillovers (Das and DeLoach, 2003) as well as from intersectoral knowledge spillovers (Murat and Pigliaru, 1998).
[8] In the Melitz model of heterogeneous firms, trade liberalization induces the exit of low-productivity firms and the expansion of the profits and the market share of high-productivity exporting firms. This reallocation of firms increases average productivity and welfare.