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The Summary and Analysis of 'Domestic Trade Frictions and Agriculture' Research Paper: A Review

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ABSTRACT

This paper assessed the research study carried out by Sebastian Sotelo which is entitled 'Domestic Trade Frictions and Agriculture'. This paper summarized and analysed the process, steps and approach Sotelo utilised to formulate his model to investigate the association among trade, productivity as well as the welfare in the Peruvian agriculture sector. The paper reviews Sotelo's paper entitled 'Domestic Trade Frictions and Agriculture' by first summarising and then analysing his study. The review finds that Sotelo's model is academic and not applicable in real life. The weaknesses and gaps identified in Sotelo's study are highlighted and include: the assumption that agricultural inputs are all imported from other foreign countries which is not the case in some developing countries; the utilisation of quantitative method and secondary data; the reliance on the estimates; the use of data that is outdated in some cases; the utilisation of the condemned trade cost (iceberg) formula; the assumption that farmers are homo economicus which recent studies have proved to be wrong and; application and adoption of constant return to scale which some economists have condemned. This paper concludes and recommends that future studies should take advantage of the identified weaknesses and gaps this paper has identified and then explore further to cover the gaps by employing different research methods.

Key words: Critique, Merits, Recommendation.

The "Domestic Trade Frictions and Agriculture" study conducted by Sotelo in Peru focuses on how trade frictions affect agricultural productivity. Sotelo explored the association among trade, productivity and welfare using a model he developed of trade, agricultural, specialization and productivity on the heterogenous land while bearing in his mind that livelihoods of the majority poor people are tied to subsistence agriculture that is mostly affected by trade barriers such as the weak infrastructure, adverse geography and spatial dispersion characteristic of the rural populations.

The major parameters of the model where to ascertain barriers to trade, the heterogeneity, as well as the consumption substitutability. In order to approximate the parameters, Sotelo constructed data set on agriculture of Peru on yields, prices of crops, freight rates, household expenditure and allocations. The analysis included 20 crops that were trending in the period between 2008 and 2011 by the national wide value of production in hundred and ninety-four (194) provinces of Peru. To measure production and consumption, he combined the following data set: (1) The National statistics on agriculture, whose data is gathered by Peru's Ministry of Agriculture at a disaggregated geographic level and contains data on physical land yields, farm-gate prices and land use for each crop and region; (2) National Household Survey, whose data indicate Peru's main living standards collected annually by Instituto Nacional de Estadistica e Informatica and contains information on consumption quantities, household expenditures and unit values and is disaggregated by commodities and regions; (3) Global Agro-Ecological zones project, whose data estimate the attainable yields provided all land in a five arc minute cell is utilized in a particular crop; (4) Geography and transportation, whose data came from the Peruvian Ministry of Transport and includes data on roads length, location, quality *etc*. In quantifying the theory, Sotelo used government statistics on prices, production and land allocation to estimate crop specific land quality for all regions (across and within regions). To estimate within-country trade frictions, he used a complete data set of Peruvian transportation system and in estimating the elasticity of substitution across crops in consumption, he used household survey data that was disaggregated.

In connecting the model to data on revenue shares, land shares and yields across crops, Sotelo explored the two assumptions which yield the simple results for farmer's behaviour. The two assumptions are that: (1) technology to grow a specific crop at a constant return to scale and combine labour, intermediate input and land; (2) quality for producing different crops in a region is independent and identically distributed. Sotelo, formulated estimable equations for location of land and revenue shares across crops based on

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the assumptions of land being heterogenous and land quality. He modelled trade costs using iceberg formular which does not specify details of the transportation sector.

Sotelo developed his quantitative model of specialization and trade where farmers can grow different crops on land of varying quality based on four facts of Peruvian agriculture. These facts guided his modelling choices and include: (1) dispersion of substantial price across regions; (2) allocation of land to many crops within a region; (3) average variation of revenue per unit of land across crops and; (4) variation in quality of roads throughout Peru. The price differences in crops across regions especially the urban and rural areas according to Sotelo (2020) clearly indicates a variation in consumer prices of Peru's main export 'coffee' with respect to the location. Sotelo's paper also shows that the more the distance increases from the capital Lima or port, the more the price decline. The second fact is on the tendency by regions to grow many crops in a plot, indicating a land quality heterogeneity (Sotelo, 2020). Sotelo (2020) analysis based on his paper shows that Peruvian regions have a tendency of allocating large amount of land crops that are few and use small portion of land to grown several crops. The third fact on variation in revenue per unit land across crops suggest that crops utilize land with different intensities (Sotelo, 2020). Sotelos' analysis shows residual log revenues per hectare of two distributions of across regions and crops. The fourth fact on the differences in trade costs is due to road quality variations according to Sotelo (Sotelo, 2020, p.2702). He further presents that the area along the coast and few jungles and highlands are connected through roads that are paved while most of other locations are not paved.

Findings

According to Sotelo, comparative advantage was a driving pattern of specialization across regions and triggered trade with the rest of the world and across regions. He also found that trade was costly across all regions and with the rest of foreign countries and that for farmers to grow crops, they incurred costs with respect to land, labour and imported inputs hence impeding productivity. Sotelo also explains that areas farther from the major ports have diminishing productivity because of less utilization of intermediate inputs due to high prices of inputs in those areas.

When he attempted to understand and quantify how welfare and productivity are affected by changes in trade opportunities in the imperfect regional integration context using the information from Peruvian Ministry of Transport and World bank scenario based on effects of Doha trade talks, he found that the initial allocations of production and consumption govern the extent to which price change translate into changes in productivity and welfare. He also found that the interaction of comparative advantage and market access drive these allocations. Sotelo explains the key to assess the welfare and productivity effects on trade opportunity improvements, such as road infrastructure, is to first understand how individual farmers and consumers react to policy improvements (opportunities) and how their choices interact in aggregate. Sotelo added further by explaining that the equilibrium prices endogenously respond and transmit across region.

Sotelo's model equations shows that the increase in revenue of a certain crop corresponds with the increase in use of the amount of land and that of rest of crops. Sotelo's model findings led him to conclude that regions trade because of the differences in land productivity as well as the relative factor abundance. Therefore, when a region is relatively abundant in land, it tends to specialize in goods that use that land very intensively.

Sotelo claims that his model is capable of replicating his motivating facts of his approach and that his model accounts for data that is untargeted including sample of patterns of intermediate input use, domestic trade flows and shares of net exports through various ports. The model was also designed to accommodate a situation where there is zero trade flow for any crop between regions. The model according to Sotelo's findings captures the pattern of specialization across region and crops and that it also predicts somehow a high specialization relative to the data which is vital. He also argues that land allocation is one of the main determinants of welfare and productivity effects of shocks. On the other hand, Sotelo intuitively, acknowledges that his model does not fit perfectly the agricultural data due to the usage of variation in prices and land shares to choose only some parameters. He also admits that he chose only half as many parameters as observations.

The region differences in revenues per unit of land according to Sotelo's findings are due to land intensity and that having both variations in revenue shares is critical since both govern the relevance of shocks to each region.

In order to gain an understanding on the effects of market access improvement, Sotelo considered the scenario of paving all the unpaved highway in Peruvian High way system and also the scenario of building roads that were not existing which were part of plan of Peruvian Ministry of Transport. This led him to find that the effect was asymmetrical and that trade costs that were low initially were unaffected as they were created by trans versing high quality highway roads and that not all regions benefits equally.

In an attempt to understand how improved transportation directly impacts productivity and welfare of farmers, Sotelo found that when access to the markets is very costly, high prices are paid by farmers for the purchases and they collect low prices for what they sale. Sotelo also found that farmers specialize according to comparative advantage and increase the use of imported intermediate imported inputs whenever there is a cost reduction in accessing foreign and domestic markets through better roads.

Sotelo further assessed the effects of policy on measured welfare and productivity by focusing on the distributional effects across and within the region. He found that policies that reduce trade costs unlock the use of modern inputs and forces of comparative advantage thereby

increasing allocative efficiency and welfare. Sotelo also found that the very policies affect price equilibrium of crops traded domestically more and harm some producers due to increased competition. Sotelo noted that in his findings that policy induces the change in agricultural productivity as well as the average reduction in costs of trading and that there is an increase in productivity in regions that experience trade costs reduction though the impact is limited in regions where the policy does not directly affect. His model equations indicates that there is an increase in productivity whenever crops with large revenue shares becomes valuable with cheaper inputs. With respect to farmers' real incomes, he found that the increase in price of a certain crop, improves welfare when the revenue of that crop is large and the consumption share is small. The equations of his model also indicate that changes in welfare and productivity are proportional to reductions in the trade costs. The magnitude of changes in the crop and prices of input and the baseline patterns of consumption and specialization of each individual region are the key to understand effects of productivity and welfare and that comparative advantage shapes the baseline patterns of specialization. The results of the model further indicate that reduction in trade costs induced by a policy increases efficiency of domestic exchange with other countries and also increase domestic supply of crops. Therefore, Sotelo contends that an increase in crop export to other countries, results in an increase in prices of those crops exported and that an increase in supply of domestically traded crops results in price decline of prices of those crops. Sotelo also noted that the losers tend to also specialize in the same crop as winners.

According to Sotelo, comparative advantage and internal geography play an important role in the determination of prices and that the regional equilibria determine the prices of crops that contribute to largest loses. He explains that the expenditure shares for both the losing and winning region in agriculture is small, hence, income effects normally dominate the effect of consumption prices. Moreover, shocks to regional export and import prices in general equilibrium, spread through expenditure switching and land switching. The counterfactual changes in real income and productivity according to Sotelo indicate that where farmers win due to policy changes, non-agricultural real income increases substantially less than agricultural income even when non-agricultural companies (firms) experience same improvement in costs of export as farmers do.

On the policy of building new roads, Sotelo found that the regions that record an increased access to markets, usually produce large amounts of goods not traded internationally and elsewhere, moreover, agricultural prices drop due to increased supply of crops by those regions and this affect regions that do specialize in non-traded crops.

When Sotelo attempted to find out how a change to international prices of crops spreads domestically, he found that the domestic trade integration to some degree is important to understand effects of shocks. He also found that foreign shocks do not directly transmit to domestic prices, due to the fact that many regions do not directly trade these crops with other foreign countries and that the changes in international prices do affect all regions in an open small economy. Based on his findings, Sotelo elaborate that when international prices increase for some crops, regions usually tend to specialize their production of those affected crops for maximum profits. He also asserts that a shock to the foreign price of a certain crop have a direct effect on the price only when that region directly imports or export that crop. Sotelo elaborate further that workers in non-agriculture experience losses on average in real income because the shock increases the price of crops they usually consume especially to those workers near the port.

When Sotelo compared the changes in agricultural real income in baseline specification against the ones obtained upon allowing workers to sort across sectors, he found that in both scenarios, there is a positive strong association between changes in real income and that the distribution effect of the policy is weakened when worker mobility is allowed across sector. He also found that the sector of agriculture is capable of adjusting easily compared to other sector of the economy when there is a trade shock and this results in labour flowing to agriculture. In trade costs reductions, labour in agriculture tend to benefit more than land in the regions. This led to his conclusion that labour ownership benefit more than the land ownership because exported crops tend to be labour intensive.

In a nutshell, Sotelo's paper highlights the following: that trade costs domestically matters and that trade cost and competitive advantage determine agriculture regional specialization and govern the local impact of some policies that tend to improve the livelihood of some farmers in developing countries (such policies include world trade liberation and building roads); that the policy of infrastructure that reduce costs in trading improves welfare and productivity of some farmers though at the same time hurt other farmers in equilibrium; that trade frictions both across and within the national borders usually reduce productivity by increasing the price of imported intermediate inputs and impeding specialisation based on comparative advantage; that farmers that benefit most are those that have increased access to the market but those that lose or hurt are those that experience increased competition from remote suppliers; that most hurt farmers are those that are located in inland and coastal regions and specialise in crop production that are less traded; that foreign shocks have limited impact on local farmers that trade domestically; that the increase in crops internationally, tend to motivate farmers to specialise in those crops that have increased prices and that on overall, barriers to market access have a significant negative effect on productivity of farmers especially when being prevented from allocating land to its most valuable usage.

Above all, Sotelo claims that his paper makes three (3) methodological contributions which include the following: (1) since theory interlinks with data on productivity and land

allocations, the model can solely be estimated based on agricultural and aggregate trade statistics by many countries; (2) by using data on initial land shares and consumption as well as the elasticities of supply and demand, the model approach allows analysis of the dissemination of price shocks across the regional markets; (3) an estimated simple equation for land allocation with respect to prices is obtained and it is vital for shocks adjustments.

Analysis

Merits

The author absolutely addressed the objective of his investigation. His detailed explanations addressed the aim and objective of his study. The author also clearly explained in details on the assumption that motivated him to formulate his model and also on the process and steps he took to formulate his model equations.

The facts about agricultural in Peru that guided the author of his modelling choices are not limited to Peru alone hence the application of the model with respect to those facts can be generalized and applied to other countries especially developing countries. For example Aker (2010); Kahle *et al*. (2019) and Van Campenhout *et al*. (2015) for price dispersion across regions; Allen (2014) and Adjimoti (2018) for plot/land allocation for different crops; Doti (2017) and Kobzar *et al*. (2004) for revenue variation across crops per plot/unit of land and; Faber *et al*. (2009) and Buys and Wheeler (2006) for road quality variations.

It is recommendable that the author used adequate literature that is closely related to the topic of the study. The written English in the paper was sound as there are no flaws noticed in both grammar and readability of the paper.

Despite the paper being biased toward secondary data (see my critique), the secondary data used was very adequate and from the reliable sources *i.e*., National Statistics on Agriculture, National Household Survey, Global Agro-Ecological Zones and Geography and Transportation (Sotelo, 2020).

It is also worth noting and applauding the author on the fact that he did acknowledge the weakness of his model without hiding. Sotelo did intuitively acknowledge that his model does not fit perfectly the agricultural data due to the usage of variation in land shares and prices to choose only some parameters (Sotelo, 2020). The author did admit that he chose only half as many parameters as observations. He also admits putting some values to be constant across crops and subject in his model equations leading to sampling variation. This is very rare because most researchers prefer reporting only the positive results of their study (Tourish and Craig, 2020). Sotelo fulfilled the ethical and professional standards outlined in the APA 7th edition (American Psychological Association, 2019).

Critique

Sotelo's model was designed to assume that agricultural intermediate inputs (for example fertilizer) are imported from foreign countries (Sotelo, 2020). This signifies that Sotelo's model is mainly applicable to countries that import intermediate inputs. In Africa for instance, there many companies that sell intermediate inputs. For example, Yara international company sells agricultural inputs and operates in eight African countries, ten Asian countries and other countries outside Asia and Africa (Yara International, 2021). In Zambia and Malawi subsistence farmers whom Sotelo claims to be the target majority of his study have their agricultural inputs subsidized through Farm Input Subsidy Programme (FISP) while in Tanzania it is through NAIVS programme, Zimbabwe it is through Input subsidy programs (ISPs) just to mention a few. Therefore, Sotelo's model that assume that farmers buy inputs from abroad and assuming that farmers pay for all intermediate inputs cannot be fully applied in countries that have local suppliers of agricultural inputs and have their agricultural inputs subsidized.

According to Sotelo, the poor who are the majority live in rural areas and their livelihoods are tied to subsistence agriculture (Sotelo, 2020). Now based on the fact that the model's design assumes that intermediate inputs are imported from other countries, we can conclude that Sotelo's model is applicable mainly to the commercial farmers and few subsistence farmers who can afford to purchase the foreign inputs. This means that the majority of the poor subsistence farmers Sotelo mentioned in his paper are not fully considered and represented in his model.

The author explained that in order to assess welfare and productivity effects of trade opportunity improvements, there is need to understand the reaction of individual farmers and consumers toward such improvements (Sotelo, 2020). The application of the quantitative model to gain understanding of individual farmers and consumers toward trade opportunity improvements cannot be realized in this case and fall short of what Sotelo claims. This is because data used in analysis were purely secondary with no single qualitative approach or rather survey conducted on the primary targets. Cohen *et al*. (2011) contend that the approach of quantitative research in its ontological and epistemological orientation usually regards human behaviour as an object that is capable of being controlled, thereby ignoring contributions and opinions as opposed to other approaches. The fact that the author never had an audience with the primary targets make it difficult to accept his findings based on secondary data only. Moreover, the model's design is based on estimates which Sotelo mentioned several times in his paper and agreed himself (Sotelo, 2020). Understanding matters dealing with livelihood require gathering both primary and secondary data. Some studies related to livelihood that gather both primary and secondary data presents well balanced results that are not questionable (Dutta, 2022; Ababu *et al*., 2021). Today, some practitioners refuse to accept the findings of some studies conducted by some scholars on the pretext of those findings being 'academic' only. This is supported by Denyer and Tranfield (2006) who assert that disconnection between practice and academic research is a phenomenon common in both the social and physical science discipline. Combining his quantitative approach of using secondary data with

primary data or better still qualitative approach would have been better, representative, adequate, reliable and unquestionable.

Sotelo's model assumes that farmers are homo economicus and always aim to realise maximum profits (Sotelo, 2020). It is well known fact that the main motive of farming for subsistence farmers whom Sotelo claims to cover much in his model is consumption which differs to commercial farmers. On the other hand, his profit maximization assumption is consistent with the classical economists of theory of maximum utilization and expected theory but inconsistent with most studies that have proved that human beings are not homo economicus and their decisions are not predictable. For example, a study conducted by Kahneman and Tversky (2013), proved that in reality a person is not homo economicus as assumed by some classical economists and that the decision made by humans are not always based on maximizing their profits. We can therefore conclude that Sotelo's model is academic and cannot be applied in reality, as it assumes that a human being (for instance a farmer) is homo economicus which some studies especially in the new discipline of neuroeconomics have proved to be very wrong.

Despite the paper having no paucity of data some data used were too outdated. For example, in an attempt to find out the crop in which Peru shares the largest world production, Sotelo used the Food and Agriculture Organization Corporate Statistical Database of 2008 (Sotelo, 2020, Note 15, p.2705). The period he chose was even the time when there was a global financial crisis which makes it difficult to ascertain the actual position of what he was investigation in a world without global crisis. It is not known exactly if there was a good reason why outdated data was picked because the author never mentioned it in his paper.

Sotelo's model is inconsistent with most economists that argue that constant return to scale is not feasible in reality unless the application of diminishing return (Hill, 2008). This is based on the fact that the model is designed to assume a constant return to scale on agricultural technologies (Sotelo, 2020). Therefore, we can conclude that Sotelo's model is academic and not practical in reality.

The use of iceberg trade costs (Sotelo, 2020, pp. 2703-2704) in the model makes the model unreliable and not applicable in reality. The iceberg trade cost has been popular and a key component of modern international/domestic trade and economic geography models, but most studies carried out in different sectors have shown that the iceberg trade cost is not practical when transferred from theory to reality (Behrens *et al*., 2003; McCann, 2005; Schroeder and Sorensen, 2011; Bosker and Buringh, 2020). The study of iceberg transport costs by Bosker and Buringh (2020) recommends that models should incorporate more realistic features of the transport sector and not be entirely dependent on the iceberg cost assumptions. However, it is unfortunate to note that Sotelo incorporated iceberg costs into his model even though he was aware of the avoidance of specifying details of the transport sector (Sotelo, 2020, p. 2703). However, it is worth noting that different studies use different costs (Meena *et al*., 2023; Dinani *et al*., 2021; Kolwate *et al*., 2021).

Discussions

It is very evident from the critical analysis that there is a disconnect between the practice and academic research gap in Sotelo's paper. However, the development of Sotelo's quantitative model is an important milestone that makes it easy for researchers (academics and practitioners) to further bridge the gaps and areas identified in this paper. Once the identified gaps (weaknesses) in the model are addressed through further diverse research approaches (qualitative and quantitative), Sotelo's model would be one of the greatest models to achieve practical relevance and academic rigour. The model would also be very useful and applicable in the real world, not only in Peru but also in other countries.

CONCLUSION

The review concludes that Sotelo's model is academic and not applicable in real life. Sotelo's paper contributes to the literature on trade frictions (barriers) and agricultural productivity in academic research. Based on the critical analysis, we can conclude that Sotelo's study is good but descriptive and not of practical use. However, it should be noted that his contribution is a very important milestone that would go a long way, provided that the identified gaps are filled. The future studies should take advantage of the weaknesses and gaps identified in this paper and then further explore to fill the gaps using different research methods.

Conflict of interest: None.

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