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Modeling Trade Tensions: Macroeconomic and Trade Models in Different Institutions

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Introduction

Recent policy discussions have renewed interest in the effect of trade tariffs. As part of this ongoing debate, policy-making institutions are producing disparate estimates, which sometimes vary from one study to the next. What does account for those differences? Unlike typical macro policy changes, e.g. increase in monetary policy rates or taxes, tariff scenarios can vary greatly depending on the sectors or countries that are subject to the tariff, the retaliatory measures, and the persistence of the tariff increase. In addition, the analysis of tariff policies is carried out using two different frameworks.

Trade economists in some institutions mainly rely on computable general equilibrium (CGE) models with considerable sectoral disaggregation, focus on input-output relations, but less emphasis on micro-foundations and dynamic adjustments. Macroeconomists in other institutions exploit dynamic stochastic general equilibrium (DSGE) models with considerably less disaggregation but more emphasis on dynamics, stock-flow consistency, policy rules, and expectations. In this paper, we bring side to side the models used in key institutions recently involved in the quantitative analysis of trade policies.

To eliminate confusions arising from divergent tariff scenarios, we impose the same stylized policy shock in all frameworks. Initially, we focus on bilateral tariffs, and then switch to more complex policy scenarios.

In all sections, we will carry out an analysis of the main sources of differences within groups that use DSGE models and the ones that rely on CGE models and then across all models. We will show how different calibrations, pricing systems and short-term rigidities influence the main channels of transmission of tariff policies, delivering different strength of the expenditure switching and trade diversion phenomena that often accompany those policies. We will also show how incorporating some dynamic features in CGE models modify the main answer to the same policy questions and how their mechanisms compare to the DSGE, in the presence of a trade shock.

This paper relates to both the literature on macroeconomic impact of tariff policies and the trade literature. The DSGE models considered in this paper share many features with those in previous work (see for instance, Erceg et al., 2006, 2008 and 2018; Linde and Pescatori, 2017; Barbiero et al., 2017). On the other hand, CGE models analyzed here are also similar to others appearing in previous literature (Walmsley and Minor, 2017; Bekkers and Teh, 2019).

1. Brief overview of the models used by main institutions

Recent trade tensions have seen main institutions in advanced countries to spend some considerable time on estimating the impact of trade conflicts on domestic economies as well as on worldwide production. Most models are general equilibrium and feature a multi-country approach but are different in many other characteristics.

In April 2019, the main institutions from most advanced countries met to exchange notes on models features and implications for trade policy analysis. Institutions such as the International Monetary Fund (IMF), the Federal Reserve Board of Governors (Fed), the European Central Bank (ECB) and the European Commission (EC) presented analyses conducted with DSGE models. Those models feature little sectoral disaggregation but more emphasis on dynamics, stock-flow consistency, policy rules, and expectations. Other institutions, such as the World Bank, the World Trade Organization (WTO), the GTAP consortium (Purdue university) and the U.S. International Trade Commission (USITC), rely on CGE models with considerable sectoral disaggregation, focus on input-output relations, but less emphasis on micro-foundations and dynamic adjustments. In this section, we will lay down a brief description of the ingredients of each model, with a peculiar focus on the characteristics that will crucially affect the analysis of trade policies.

IMF DSGE model. The IMF's macroeconomic DSGE workhorse is the Global Integrated Monetary and Fiscal (GIMF) model. For a detailed description of the model see Kumhof et al. (2010). GIMF is a multi-country dynamic general equilibrium (DSGE) model with optimizing households and firms and with a public sector that defines fiscal and monetary policies in each country. In each region, there are two types of households, optimizing and liquidity-constrained. The optimizing agents are overlapping-generations (OLG) households with finite planning horizons a la Blanchard (1985), whose horizons embody some degree of myopia. Liquidity-constrained households consume according to the same preferences but consume only their current income since they have no access to financial markets.

A continuum of firms produces consumption and investment goods using labor and capital with a constant-return-to-scale technology and Hicksian neutral factor productivity. The model features a financial accelerator in the spirit of Bernanke, Gertler and Gilchrist (1999) and several types of nominal and real rigidities that amplify the impact of shocks and justify a role for stabilization policies.

For the purpose of the present paper, it is important to highlight the part of the model related to international trade, [described in more details in Appendix B.]. Each country or region is populated by households who have preferences for a variety of goods from different provenience (Armington, 1965). All bilateral trade flows are explicitly modeled, as are the relative prices for each region.

There are no disaggregated sectors, only two broad types: tradable and non-tradable sectors. Dynamic coherence in the model is not only insured by movements of quantities and prices but also by a nominal exchange rate. The short-run dynamics is then characterized by several nominal and real rigidities and (monetary and fiscal) policy reaction functions.

Specifically for the external sector in the model, adjustment costs on investment and imports and the possibility to account for different types of currency invoicing (and exchange rate pass-through) shape macroeconomic variables' reaction functions.

The magnitude of the trade linkages is the main determinant of spillover effects from shocks in one region to other regions in the world.¹ However, linkages also relate to the dynamics of global savings. Savings and investment in each region pin down net foreign asset positions and the real interest rate. Preferences and relative prices pin down the scale of the international linkages.² In the initial steady state, we solve for a zero trade balance, and therefore zero foreign asset position. However, the presence of multiple regions allows to generate bilateral trade deficits. To equate imports and exports, each country bilateral position is just rescaled. While asymmetric positions are muted by this process, the relative intensity of trade links among partners of each region/country remain unaltered.

In GIMF, tariffs introduce a dynamic distortion. They affect the relative price of imported goods, which affects both household consumption goods and firm's investment goods in the country changing tariffs. If a country raises tariffs, the prices of import components of consumption and investment bundles increase generating a negative impulse on the domestic demand and pressure on inflation and interest rates, for a given policy reaction function. At the same time, the goods of the affected trade partners are less competitive and their exports fall. Absent any exchange rate dynamics, the net export position of the country imposing the tariff may improve putting pressure on asset markets. To restore consistency of the overall external balance with the intertemporal conditions for asset holdings, the currency of the country imposing the tariff appreciates.

[Other DSGE models' descriptions.] Other DSGE models share similar ingredients. They feature multiple regions, non-Ricardian households, real and nominal rigidities, different currency invoicing, dynamic consistency.

[CGE models' descriptions.] All models are a complex system of equations, with multiple regions, rich sectoral disaggregation, and an input/output structure. Some are just solved in terms of comparative statics and some also features a dynamic solution. In most cases, factors of production are in net fixed supply at the level of each region and fully employed.

1. The main experiment

To compare results across different frameworks, we design very simple experiments. We initially focus on bilateral tariffs. We simulate a 10 percentage point increase in tariffs, across

¹ The model also allows for technological spillovers in that an improvement in the technology of one country not only leads to a lower cost in that country, but also to a higher demand for the respective goods and lower costs in all trading partners.

² Bias parameters are also used to calibrate the model to replicate the scale of the trade relationships present in the data.

the board, on all U.S. imports from China. We assume that China retaliates in kind. We will then increase the number of countries involved in the trade conflict.

To tackle issues of frameworks' comparison, we will highlight the importance of key ingredients and different parameter values in the determination of results' magnitude. We will then perform the same experiments but using the same key parameter value (e.g. elasticity of substitution).

1.1. Results in DSGE frameworks

The response of all the DSGE models to 10 percentage point increase in bilateral tariffs between China and the U.S. point at negative outcomes for both countries involved in the trade conflict. However, in the short run, the results display a large range across the institutions. In the long run, results appear to be mostly aligned.

This is because the short-run dynamics of these models are crucially determined by several ingredients and parameters: currency invoicing (rigidities in pricing: LCP vs PCP); deep and policy parameters; degree of nominal and real rigidities; elasticities of substitution; how the revenue from tariffs is used.

To highlight why those features matter when analyzing tariff policies, it is important to identify the key blocks of the models that are influenced by a tariff increase.

Those are: (i) relative demand for foreign varieties; (ii) the balance of payments; (iii) only indirectly, the intertemporal conditions for bond holdings (the UIP condition). Tariffs generate an impact a change in the blocks (i) and (ii). The shock on import demand and on the individual country's balance of payments and world trade is determined by crucial parameters, including elasticities, relative size of the country and preference or bias parameters in the Armington aggregation. Given the first impulse to internal consumption and investment, the monetary and fiscal policy rules and internal rigidities will determine different impacts on interest rates and prices. Those are influenced by price and import rigidities and in particular by whether import prices are rigid in destination rather than producer currencies. All those responses will determine how large are the trade imbalances and the pressures on the asset markets. To preserve intertemporal consistency in the asset markets (block (iii)), the exchange rate jumps. In the long run, results are less dissimilar across institutions/models. The increase in tariffs represents a distortion on prices and production costs and affects investment. The exchange rate movement will provide additional dynamics to the one generated by the distortion, hurting or supporting exports. Absent rigidities or other frictions, those two channels have quite comparable impact on GDP across all models.

1.2. Results in CGE frameworks

In CGE models, tariffs introduce a wedge in relative prices and sectors more exposed to trade lose competitiveness. This generates a contraction of production factor demand and pressure on regional supply and employment of those factors. However, in most cases, the hard constraint of fixed stock of production factors prevents supply to fall in equilibrium therefore factor prices have to decrease to support full employment, given higher tariffs.

In sectors less exposed to trade, demand might experience a boost. The input/output structure governs the propagation of this impulse. In addition to this demand switch lower factor prices

will help sectoral reallocation of resource within each region. However, imperfect substitutability will determine a fall in total regional output, to signal some form of inefficiency introduced by the tariff.

Results across models depend crucially on whether the full employment closure is binding and on the elasticity of substitution of domestic relative to foreign goods, as well as on other demand and technology parameters.