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Trade Agreements and Trade Flows: Estimating the Effect of Free Trade Agreements on Trade Flows with an Application to the European Union - Gulf Cooperation Council Free Trade Agreement

by

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Abstract

The enlargement of the European Union's economic area has two dimensions: (1) increases in the number of members of the European Union (EU), and (2) proliferation of preferential and free trade agreements with numerous other countries and regions. One proposed free trade agreement (FTA) is an agreement between member countries of the EU and the Gulf Cooperation Council (GCC) – which includes Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. This paper has two goals. First, most *ex ante* economic analyses of potential FTAs use computable general, or partial, equilibrium models. However, such models have been criticized over the years as "theory with numbers" since they assume important parameter values in order to quantify expected trade creation and trade diversion effects of an FTA. By contrast, a majority of *ex post* analyses of FTAs use some form of the empirically-based "gravity equation," which compares actual post-FTA trade flows against the "natural" level of trade suggested by an empirically-estimated gravity equation combined with data. One purpose of this paper is to enhance the methodology behind the empirically-based gravity equation to show how one might use the equation *ex ante* to predict the potential trade creation and trade diversion associated with a proposed FTA. Second, the only computable general or partial equilibrium (numerical) economic analysis of the proposed EU-GCC FTA (to our knowledge) is Price Waterhouse Coopers (2004). Our approach complements that study by applying the methodology discussed in the first part of our study to generate a complementary set of estimates of the potential trade creation and trade diversion effects of the proposed EU-GCC FTA.

1. Introduction

One of the most profound economic events over the past decade and a half has been the proliferation of international economic integration agreements around the world. The term "international economic integration agreement" is used to incorporate the varying dimensions of integration. While no two agreements are identical, a certain "classification" structure has surfaced. As has evolved in the economics literature, the common categories include – in perceived increasing order of integration – preferential free trade agreements (PTAs), free trade agreements (FTAs), customs unions (CUs), common markets (CMs), and economic unions (EUNs). Of 240 international economic integration agreements that have been notified to the World Trade Organization since 1948 (World Bank, 2000), half of these notifications were made in just the past 15 years. The proliferation of economic integration agreements in this period – often termed the "growth of regionalism" – has altered dramatically the structure of the world trading system.

Of course, the European Union (EU) is the *foremost* international economic integration agreement of the post-WWII period and is generally viewed as an economic success. It is "foremost" in three dimensions: (1) the *oldest* post-WWII major agreement; (2) the *broadest* effective agreement (in terms of number of members); and (3) the *deepest* agreement (an economic union). Success can, of course, be measured at different levels and in different manners; there is no unambiguous measure of economic success. At one level, success may be defined in terms of the effect that the formation of the agreement has had on international trade creation, holding constant all other factors that may have increased or decreased trade in the absence of such an agreement. At a deeper level, success may be defined in terms of the effect of such induced trade on raising either standards of living (or per capita incomes) – an observable economic measure – or even the "utility" of the representative consumers in a region – an unobservable economic measure.[1]

Enlargement of the EU, however, has basically two dimensions. First, enlargement has been along the lines of adding member states to the economic union. On May 1, 2004, 10 states were officially added, bringing the total to 25 members. Numerous criteria needed to be met by countries in order to become members of this union. However, the enlargement of the EU is not limited to only adding new "union" members, which is the deepest form of economic integration. A second dimension of enlargement of the "trading area" of the EU is an increase in the number of FTAs (and, in some cases, PTAs) between the EU and various other countries (e.g., Mexico) or regions (e.g., MERCOSUR or the Gulf Cooperation Council).

This paper has two goals. First, we intend to provide a transparent method for evaluating the effects of the formation of FTAs on trade (and potentially economic welfare) based upon empirical evidence. Second, we will apply this methodology to evaluating the potential economic benefits of the proposed FTA between the European Union and the Gulf Cooperation

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[1]For an excellent review of the recent literature on the effects of trade openness on standards of living, see Waelde and Wood (2004).

Council (EU-GCC FTA).

Regarding the first issue, quantifying the trade effects of FTAs has generally followed two paths in the international trade literature (cf., Frankel, 1997; Pomfret, 1997). One path is the use of computable general equilibrium (CGE) models; in some cases, the numerical models are partial equilibrium in nature (CPE). CGE (and CPE) models are typically tied to an explicit theoretical model, and thus can more appropriately estimate *ex ante* welfare gains (generally measured as a percentage change in GDP). Baldwin and Venables (1995) provide a useful summary of the utilization of CGE models in analyzing important impending free trade agreements (at that time, EU and NAFTA), which can be categorized into "first-," "second-," and "third-generation" models. Price Waterhouse Coopers, or PWC, (2004) provides quantification of the expected effects of an EU-GCC FTA in particular, using a "first-generation" computable partial equilibrium model. The other path has been the use of empirically-based econometric gravity equations.

While useful, CGE models have long been criticized over the years for two reasons. First, as Baldwin and Venables (1995) state, CGE models are "theory with numbers."[2] In order to generate numerical results, CGE models choose parameters in an *ad hoc* manner (typically from various earlier unrelated empirical analyses) to estimate the impact of trade-policy changes on consumption, production, and trade. This has long been a concern; different parameter choices lead to vastly different inferences. Second, *ex post* CGE models seem to have tended to considerably under-predict the trade volume impacts of FTAs, and often by an "order of magnitude."

While the criticisms above regarding CGE models are generic, let me add a further concern that makes CGE models even less relevant to addressing the potential net trade benefits of an FTA between two *economically, politically, socially, culturally, and geographically different regions* such as the EU and the Persian Gulf states in the GCC. While numerical models such as PWC (2004) are useful *ex ante* toward understanding the effects of *tariff* liberalization between economic regions, they are too narrow in their structure to consider the trade effects of reducing the policy "trade costs" between two regions – where the notion of trade costs can incorporate economic, political, social, and cultural costs of international trade (and also investment), and thus should be interpreted as a broader measure of trade policy barriers. Put differently, the gains from introducing an FTA may be linked more to eliminating "non-border" (i.e., non-tariff) barriers.[3]

Policymakers need a more general, flexible, and transparent framework to analyze how

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[2]Pomfret (1997) echoes this perception of CGE models: "They are much more important as contributions to the theoretical debate, helping in the clarification of thinking by highlighting the importance of alternative market structure assumptions" (p. 209).

[3]We will try to be careful in terminology. To anticipate potential ambiguity, the reader should note that *tariffs* are often termed "border barriers," whereas non-tariff policy barriers and domestic regulations are often termed "non-border barriers."

the broader liberalization associated with an FTA – removals of non-tariff barriers, reductions in regulations, "trade facilitation" – can impact trade between members of the agreement, as well as member-nonmember trade and trade among nonmembers. An alternative approach, that has long complemented CGE modelling, has been an econometric approach using empirical data. In fact, the earliest systematic efforts to shed light on the effect of FTAs on trade were *not* applied CGE models, but rather simple reduced-form econometric models that have come to be known as "gravity equations." Such models began in the late 1950s at the Netherlands Economic Institute – in a project headed by Nobel laureate Jan Tinbergen – with the first econometric estimates of the "effect" of an FTA – the Benelux union – on international trade flows published in Tinbergen (1962).

Thus, our paper is concerned with two fundamental issues. First, we address theoretically and econometrically an alternative empirically-based approach toward evaluating the potential effects of FTAs on trade flows and provide an analytical discussion of these relationships.[4] We introduce some novel enhancements to the traditional gravity-equation framework in order to obtain more "reliable" estimates of the effects of FTAs on trade flows. Second, we estimate empirically the effect of an EU-GCC FTA on members' trade, on trade between members and nonmembers, and on trade among nonmembers, using techniques discussed in the first part. The remainder of the paper is as follows. In section 2, we briefly review traditional factors that influence the economic benefits from an FTA and address CGE approaches.[5] Section 3 discusses briefly the (Tinbergen) gravity equation in international trade. The tool has become the "workhorse" for the study of international trade patterns; an excellent recent survey of its usage and "trade costs" in general is in Anderson and van Wincoop (2004, forthcoming). Studies such as Aitken (1973), Sapir (1981), Bergstrand (1985), Baldwin (1994), Frankel (1997), and Baier and Bergstrand (2001) have employed the gravity equation prominently and provide excellent surveys and discussions of other studies themselves. Baldwin (1994) offered gravity equation estimates of the enlargement of the EU to central and eastern European countries (CEECs) on EU and CEECs' trade. Frankel (1997) estimated gravity equations to derive estimates of the impact of numerous regional economic integration agreements on trade flow levels. We use the traditional gravity equation framework to provide estimates of the "natural" level of trade of GCC members. To anticipate the findings, one result is that trade among GCC members is systematically *above* what would be expected naturally.

However, typical usage of the gravity equation to estimate the effects of FTAs on trade flows is *not* without methodological flaws. The discerning reader will find that the estimated impacts of FTAs are often *surprisingly small*, and sometimes even negative! In Section 4, we show that estimates of FTAs on trade flows are inherently biased due to the endogeneity of FTAs; that is, countries *select into* FTAs. If there are omitted unobservable variables that influence trade – and also influence the decision to form an FTA – then the estimated effects of

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[4]While we will refer generally to an "FTA," much of what we discuss applies potentially also to deeper economic integration agreements, the details of which are beyond the scope of the present paper.

[5]This is a short survey of a well-established literature. The reader very familiar with the "customs union" and "economic integration" literatures in international trade may want to skip section 2.

an FTA on trade flows in the standard gravity equation are systematically biased. In Section 5, we demonstrate a technique for avoiding the "selection bias" issue and provide a method to estimate the trade creation and trade diversion effects from forming an FTA *taking into account* that such agreements potentially go beyond tariff reductions to eliminate non-tariff barriers, regulatory barriers, political barriers, and other costs to trade. In Section 6, we discuss some estimates of the potential effect of an EU-GCC FTA on their countries' trade, on these countries' trade with non-members, and on trade among non-members. Section 7 offers some final conclusions and insights regarding trade costs and the potential net gains from an EU-GCC trade arrangement.

2. Evaluating the Net Economic Gains from an Economic Integration Agreement

In reality, it is virtually impossible to estimate *ex ante* the economic gains or losses from two or more regions (or countries) forming an FTA; since we are concerned here with an EU-GCC FTA, we often use the term "region" for convenience, even though in the theoretical discussion we generally use the term "country." First, every agreement is a unique legal agreement. Thus, any generalization of the effects of a trade agreement on international trade is subject to numerous caveats. Second, economic gains or losses manifest through various economic channels, not to mention influencing endogenously political behavior. The formation of an FTA may eliminate tariffs *or* non-tariff barriers, may expand trade in goods *and possibly* services, and may or may not go beyond "trade" to include changes in investment barriers, competition policies, rules for government procurement, and trade-facilitation issues (the so-called "Singapore issues"). The effects of reductions in barriers may need to be weighted by some variable, such as a measure of bilateral or multilateral trade. Moreover, trade-policy changes cause endogenous changes in trade volumes, relative prices, relative numbers of firms and varieties of products, and economic rents, all of which may influence consumer and/or producer surplus. Also, political behavior may respond to such agreements and dynamic (growth) effects may result. It is virtually impossible to consider all these possible channels in a formal theoretical framework, much less quantify these effects with much certainty.
Conventionally, analysts have focused upon "reductions of tariffs on trade in goods" to analyze the potential impacts of trade liberalization. As one important example, PWC (2004) note:

> *Due to this (GCC data availability) constraint the quantitative economic assessment focused on the assessment of the impact of the reduction of tariffs on trade in goods. To assess the trade and welfare impacts due to changes in the trade of goods . . . a computable trade simulation model has been constructed.* (PWC, 2004, p. 21).

Throughout this paper, we will cite PWC (2004). This monograph is titled the "Sustainability Impact Assessment (SIA) of the Negotiations of the Trade Agreement between the European Community and the Countries of the Cooperation Council for the Arab States of the Gulf (GCC)." We cite this study for two reasons. First, PWC (2004) is the only study we are aware of that estimates numerically using conventional quantitative economic tools the potential impact of an EU-GCC FTA on trade and welfare of the EU and GCC. Second, we have considerable respect for the thoroughness of this study for this issue using these conventional techniques. We will see that several of the conclusions from this study are consistent with our study, most notably because both their approach and ours are based fundamentally on a (neoclassical) competitive market economy framework. However, we will approach the issue differently (e.g, PWC (2004) uses a perfectly competitive framework of analysis while we use an imperfectly competitive framework; PWC is a numerical CPE model, ours is empirical; etc.).

In the case of the EU-GCC FTA, we argue here that one possible way to interpret – or summarize – the effects of an EU-GCC FTA is how such an agreement may lower the "trade costs" of each of the regions (or countries). While the notion of trade costs – any policy-induced or natural costs associated with the transfer of goods (or services) between two regions – has been in the international trade literature for years, there has been a recent resurgence in interest in the area. Economists have largely ignored for decades many aspects of trade costs. For instance, much of the standard toolbox of models for determinants of the pattern of international trade assume transport costs are *zero*![6] Yet nothing could be further from the truth. Indeed, Anderson and van Wincoop (2004) argue that – for two representative industrialized economies – the *ad valorem* tax equivalent of trade costs may be as high as *170 percent.*

The literature on the economic benefits and costs of economic integration agreements has its roots in the classic book by Jacob Viner, *The Customs Union Issue* (1950). In this book, Viner articulates the notion of trade creation and trade diversion and addresses using a partial equilibrium framework how two members of a customs union (or FTA) may, on net, benefit or lose in economic welfare from the agreement. For instance, suppose there are three regions (or countries) – A, B, and C – all sharing positive tariff barriers. Suppose two regions – A and B – enter into an FTA. It is likely that the reduced tariff in A on B's products (in a perfectly competitive situation) will create trade between the two. If B is a more efficient producer of the product than A, the gain in consumer surplus to A will be a source of economic welfare gain. However, suppose instead that C was the most efficient world producer and was supplying A. As a result of an FTA between A and B, less efficient producer B now supplies country A, and A moves from importing from the most efficient (lowest cost) producer to a more costly producer, which causes a loss in producer surplus in A. If this producer surplus loss exceeds the consumer surplus gain, the FTA creates a *net loss in economic welfare* in A.

In the years following Viner's classic book, many refinements of the theory of customs unions by James Meade, Richard Lipsey, and others were made and a summary of these are beyond the scope of this paper. Baldwin and Venables (1995) provide an excellent synthesis of how countries' economic welfares are related systematically to various economic variables that likely change during the course of economic integration. The survey by Baldwin and Venables categorizes the impacts of an EIA into static and dynamic effects.[7] Within the static effects, the authors decompose the effects into those associated with perfect competition-constant returns to

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[6]Most Ricardian, Heckscher-Ohlin, and Helpman-Krugman type models of international trade until recently assumed zero transport costs.

[7]For a formal treatment, see Balwin and Venables (1995, pp. 1600-1601).

scale industries and those associated with imperfectly competitive-increasing returns to scale industries. While many economic channels potentially influence the net economic gains from an integration agreement, the quantification of trade creation versus trade diversion is generally focused upon.

In section A below, we survey the usual economic factors associated with static economic gains from an FTA for perfectly competitive industries with constant returns to scale in production. In section B, we survey the usual economic factors associated with static economic gains from an FTA for imperfectly competitive industries with increasing returns to scale. In section C, we discuss briefly the quantitative assessment of such gains using traditional CGE models. In section D, we briefly discuss the role of dynamic gains from FTAs. For the reader quite familiar with these concepts already, he or she may be inclined to skip the remainder of this section to move on to the methodological issues associated with this particular paper.

A. Static Gains under Perfect Competition and Constant Returns to Scale

The static gains associated with perfectly competitive industries with constant returns to scale are related potentially to three factors. The first factor is Viner's trade creation versus trade diversion discussed above. The second factor is associated with the (trade-weighted effects) of changes in domestically captured rents. The third key factor is changes in the terms of trade.

One result of the creation of an FTA is the potential effect on trade volumes. This is the most widely acknowledged source of economic benefits of an FTA and the three-country example above explains the potential for trade diversion to exceed trade diversion. In the end, estimates of trade increases with member (and perhaps nonmember) countries are evaluated against estimates of trade decreases with (usually) nonmembers. The net change – generally referred to as net trade creation – contributes, when positive, to the perception of a major source of economic benefit from an FTA. Generally, the net trade creation from an FTA is commonly focused upon in determining whether or not the FTA has been successful. As will be discussed later, the empirical evaluation of these benefits can be done using (*ex ante*) computable, or numerical, general equilibrium models or (*ex post*) econometric models. However, much of this literature can be summarized with a quote from a seminal survey of the theory of customs unions by Richard Lipsey (1960): "If one wishes to predict the welfare effects of a customs union it is necessary to predict the relative strengths of the forces causing trade creation and trade diversion" (p. 498).

A second result of the formation of an FTA is a change in domestically captured rents. Tariff liberalization has a differential effect on economic welfare than liberalization of a non-tariff barrier. When the trade barrier is a tariff, one generally assumes that the tariff revenue raised is redistributed ultimately to consumers so that the domestic "rents" are captured entirely. In this case, while the tariff causes a relative price distortion, there is no net loss in rents from removing tariffs. Consequently, an FTA that removes tariffs gains from the lower domestic consumer prices, but loses tariff revenue; there is no net gain or loss. However, if the FTA removes non-tariff barriers – whose rents are captured by countries outside the FTA – these rents are recaptured and are a source of economic gain. Traditionally, the major focus of FTAs has been the reduction of tariff barriers. This suggests that this impact on economic gains is muted. However, with several rounds of tariff reductions under the GATT, future FTAs may be increasingly associated with the reduction of non-tariff barriers. Note that, in the case of the EU and GCC, current external tariff rates are only 3 percent and 5 percent, respectively.

A third static, perfect competition effect is a change in the terms of trade for large countries. An FTA may cause a large region – such as the EU – to lower prices of goods in the ROW, which can have a beneficial effect on the larger region, and these economic effects must be taken into account. While a large region may benefit from this third channel, the resulting fall in prices worldwide will affect real incomes and much of this channel will then show up endogenously in trade responses. We address this more later.

B. Static Gains under Imperfect Competition and Increasing Returns to Scale

One of the major economic surprises following the creation of the original European Economic Community in the late 1950s was the tremendous growth in the volume and value of intra-industry trade, which is the growth in international trade in *similar products* within the same industry. Of course, *ex ante* this was not the trade that was expected to grow. In fact, at the time of the creation of the EEC, there was no theory of international intra-industry trade. It was anticipated that the volume of *inter-industry* trade would grow. And while such trade did grow, it grew considerably less than intra-industry trade. Following Baldwin and Venables (1995) again, these gains can be decomposed into three effects: (1) variety gains; (2) scale economies effects; and (3) increased economic profits.

The first effect is attributable to economic gains associated with monopolistically competitive markets. The vast bulk of increased intra-industry trade is associated with slightly differentiated manufactured goods produced under increasing returns to scale (internal to the firm). An FTA between two regions enlarges potentially the market for production, allowing firms in both countries to expand their scale and lower average production costs. The effect of this on the economy depends upon market structure. In the case of monopolistic competition, the increase in potential economic profits attracts new entrants in both countries. The major trade benefit from an FTA is then an increase in the variety of goods produced; this is a major source of gains from intra-industry trade. If variety is valued in preferences, then there are large net benefits. A recent important study that has substantiated the economic benefits from increased variety is Broda and Weinstein (2004). The authors find that increased product variety in U.S. imports over the past 30 years has been an important source of gains from trade. They demonstrate that this improvement in variety of products has an equivalent effect to increasing real GDP by 2.8 percent.

A second source of potential gains from an FTA in a world with increasing returns is a gain in productive efficiency. When products are produced under increasing returns, an FTA tends to increase the scale of production, lowering average costs, which is the source of improvement in real wage rates and economic welfare. While the "rationalization" of production associated with lower average costs has been widely cited, not all economic evidence confirms the importance of "scale effects." For instance, one prominent study, Head and Ries (1999), found that the scale effects from the Canadian-U.S. FTA in 1988 were quite small.

A third source of potential gains from an FTA would arise in a world where economic profits are not eliminated, such as in oligopolistic industries. Here, the fall in average costs may not necessarily lower prices proportionately leading to greater (or positive) economic rents. Quantification of these effects has not been addressed much, since most CGE models of the trade effect of economic integration have used either perfectly competitive or monopolistically competitive frameworks, not oligopolistic ones.

C. Quantification of Static Trade Effects Using CGE and CPE Models

We briefly summarize the literature on numerical implementation of *ex ante* general (and partial) equilibrium models of liberalization models. This is an enormous literature and we urge the reader to consult mentioned survey articles and books (Baldwin and Venables, 1995; Pomfret, 1997) to gain a richer understanding of this literature.

1. CGE Estimates of the EU and NAFTA

Baldwin and Venables (1995) provide a brief synopsis of *ex ante* numerical analyses of some CGE models that have been constructed to analyze the planned implementation of the "single market" in Europe in 1992. They also briefly discuss some *ex ante* numerical analyses of the implementation of NAFTA in 1994. An excellent pre-"1992" volume with several numerical analyses of the EC single market is Winters (1992). A thorough and more recent analysis of various numerical analyses of NAFTA can be found in Hufbauer and Goodrich (2003).

In general, CGE models find that – on net – trade is created for members of a newly-formed economic integration agreement. This is the case both for the EC Single Market and for NAFTA. However, the cumulative gains (generally measured as a percent of GDP) tend to be "small" (though this is subject to interpretation).[8] In most cases (when addressed), there is net trade diversion for nonmembers to the agreement. For instance, Baldwin and Venables (1995) found that the median net cumulative impact of the EC Single Market agreement using static CGE models was about 0.5 of 1 percent of (one year's) GDP. When dynamic effects were added, this in general added another 0.5 of 1 percent of GDP. In most cases, the gains for small countries were larger and those for large countries were smaller.

The outcomes for NAFTA are similar. Baldwin and Venables (1995) noted that the median estimate of net trade creation for the United States was only 0.2 of 1 percent of GDP. The median estimate for Canada (whose GDP is 10 percent of U.S. GDP) was 2.6 percent of

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[8]There remains considerable latitude on whether a 3 percent cumulative increase in GDP is small or large. For example, a median estimate from NAFTA CGE models of the gain in real income (as a percent of GDP) for Mexico is 2.6 percent (cf., Baldwin and Venables, 1995, p. 1630). For comparison, the entire estimated gain (in terms of GDP) over thirty years from an increase in variety of goods in the United States owing to expansion of imports is 2.8 percent of GDP.

GDP – *10 times* that of the United States. Also interesting, Mexico (whose GDP is 5 percent of that of the United States) had a median effect of 3.3 percent. Clearly, smaller countries had larger gains.

Hufbauer and Goodrich's (2003) survey of NAFTA studies yielded similar conclusions. Hufbauer and Goodrich summarized the predicted trade increases over the six years following the formation of NAFTA. The seven CGE models surveyed yielded a range of predicted (total) percentage increases in USA-Mexico trade between 5 and 24 percent, with a median estimate of 8 percent. The actual increase in trade was 115 percent. (Interestingly, the prediction from a gravity equation run by Andrew Rose of UC-Berkeley was 115 percent.)

2. CPE Estimates of an EU-GCC FTA

PWC (2004) provides the only numerical analysis of the potential trade and welfare impacts of an EU-GCC FTA. The approach of PWC (2004) is to quantify these trade and welfare effects in the context of a computable partial equilibrium model. There are essentially four sets of equations in this model. The first set is composed of import demand equations for each of 21goods (or industries). Import demand in any country i (i = 1,...,24) for good k (k= 1,...,21) is simply an exponential function of the domestic (deflator, or value-added) price of the good, where the latter is a function of the world price of the good k, adjusted for a gross tariff rate. The own price elasticity of demand varies across goods. The world price for any good k is determined in a competitive world market, and clears total demand and supply for the good by all countries. Thus, goods produced by different countries are perfect substitutes, whose prices deviate from one another only by *ad valorem* tariffs.

Export supply is also an exponential function of only the domestic deflator price of the good, which is a function of the world price of the good in the local currency. The own-price elasticity of export supply varies across goods.

The total demand and total supply of any good is maintained in equilibrium by a flexible world price of each good. Balance-of-payments equilibrium for each country is maintained by defining an endogenous capital account variable for each country that maintains a standard balance-of-payments constraint, i.e., that the current account balance plus capital account balance for each country equals zero.

We summarize some of the limitations of this model that we believe are inconsistent with empirical evidence and developments in the international trade literature. First, this model only makes sense if one *assumes* that all of the industries are *perfectly competitive*. While the world oil market is a globally competitive one, the vast bulk of goods imported by the GCC from the EU, the US, and the ROW are differentiated products; most of the products imported by GCC countries are likely differentiated (in demand) across originating countries, if not within each originating country also. Moreover, since fuel comprises 70 percent of the imports of the EU from the GCC, 30 percent of these EU imports are likely in differentiated products. Moreover, a non-trivial share of the fuel imports are likely refined and transformed products, which may be slightly differentiated goods.

There are at least three other limitations. A second limitation of this approach is that the study only considers the effects of *tariff* liberalization, as stated in the PWC appendix (p. 344). Thus, the broader liberalization of non-tariff barriers and the potential for spillover reductions in regulations and political barriers that may be important to EU-GCC trade are not incorporated in the PWC (2004) CPE study. A third limitation is that there is no role for income determination. A fourth limitation is that there is no substitutability among the 21 tradable goods.

D. Dynamic Effects

The argument has been made that the formation of an FTA could increase economic growth. If an FTA improves the marginal returns on investment, then such an agreement could spur physical, public, and human capital accumulation, which contribute further to economic growth and standards of living. One of the economically depressing events of the past decade has been the reduction in the real quantity of foreign direct investment in the Persian Gulf states.

While such economic results are potentially very important, they are beyond the scope of PWC (2004) and are beyond the scope of the present study. We will address later dynamic effects empirically in the sense of allowing lagged effects on trade creation and diversion of an EU-GCC FTA. However, we do not address the theoretical sources of these effects. We hope future studies of the EU-GCC FTA will address domestic and foreign direct investment elements of such an agreement.

E. Summary of CGE Models

We close this section noting some of the shortfalls of the CGE approach. First, methodologically, the CGE approach has been referred to as "theory with numbers," cf., Baldwin and Venables (1995, p. 1634). In order to implement such an approach, researchers have had to choose – somewhat arbitrarily – parameter values for utility functions and production functions. The numerical results are often highly sensitive to these choices. Moreover, there remains *considerable* variation in these perceived values. For instance, recent work on estimation of elasticities of substitution in consumption range plausibly from 1 (often found using time-series methods) to 10 (using cross-section methods). Such variation would alter dramatically the numerical results. Similarly, production function parameters have little consensus. For instance, it is not even yet resolved empirically whether physical capital and human capital are – on net – substitutes or complements in production.

3. An Empirical Approach to Estimating the Trade-Effects of FTAs

As surveyed in Baldwin and Venables (1995) and elsewhere, the standard alternative approach to estimating the effect of an FTA on trade flows is an empirical one. Since 1962, international trade economists have increasingly adopted a simple log-linear regression model to evaluate *ex post* the trade-creating and trade-diverting effects of an FTA (or alternative type of economic integration agreement). Since 1990, the number of studies employing the gravity equation has roughly doubled. In section A, we first briefly explain the typical gravity equation and see how it has been used traditionally to estimate empirically the effect of an agreement on trade. In section B, we discuss some flaws associated with drawing inferences about the "treatment effect" associated with the gravity-equation approach. Then later in Section 4, we address how the gravity equation approach can be improved methodologically to provide more reliable inferences about the trade-creating and trade-diverting effects of FTAs.

A. The Gravity-Equation Approach

As Anderson and van Wincoop (2003) recently noted, the "gravity equation is one of the most empirically successful (tools) in economics" (p. 170). In fact, the earliest systematic efforts to estimate the effect of an FTA on trade flows were not CGE models, but rather empirically-based reduced-form gravity equations. In the late 1950s, the Netherlands Economics Institute – in a project headed by Nobel laureate Jan Tinbergen – began a systematic empirical study of bilateral world trade flows. Using ordinary least squares (OLS) regression models, Tinbergen (1962), Poyhonen (1963a,b), Pulliainen (1963), and Linnemann (1966) estimated the effects of FTAs on international trade between country pairs *ex post* holding constant economic factors conjectured to explain the "natural" pattern of trade flows between countries, such as the two countries' GDPs and bilateral distance. Tinbergen (1962) is generally acknowledged as the first paper to employ the gravity equation in international trade, the name owing to its multiplicative form and similarity to Newton's gravity formula in physics:

$$PX_{ij}^{g} = \beta_0 (GDP_i)^{\beta 1} (GDP_i)^{\beta 2} (DIST_{ij})^{\beta 3} e^{\beta 4(ADJ_{ij})} e^{\beta 5(BEN_{ij})} e^{\beta 8(BRITCOM_{ij})} \epsilon_{ij} \quad (1)$$

where PX_{ij}^{g} is the value of the merchandise trade flow imported by country j from exporter i, GDP_i (GDP_j) is the level of nominal gross domestic product in country i (j), $DIST_{ij}$ is the distance between the economic centers of countries i and j, ADJ_{ij} is a binary variable assuming the value 1 if countries i and j share a common land border and 0 otherwise, BEN_{ij} is a binary variable assuming the value 1 if countries i and j are members of the Benelux FTA and 0 otherwise, $BRITCOM_{ij}$ is a binary variable assuming the value 1 if countries i and j are members of the British Commonwealth and 0 otherwise, e is the natural logarithm base, and ϵ_{ij} is assumed to be a log-normally distributed error term. It will be useful to note now that, in Tinbergen's equation, membership in the Benelux FTA and British Commonwealth had economically insignificant effects on members trade. Membership in the Benelux FTA (British Commonwealth) increased members' trade by only *4 (5) percent*!

In the years since these early studies, the gravity equation has become the "workhorse" for studying international trade patterns, as noted in Eichengreen and Irwin (1998). Of relevance to the formation of the European Economic Community in 1958, several studies are worth citing. Aitken (1973) used the gravity equation to estimate the treatment effect of membership in the EEC and EFTA during the years 1958-1973. He found that by the 1960s the coefficient estimate on the EEC and EFTA dummies became statistically significant. His results suggested that the EEC and EFTA had significant trade-creating "treatment effects" on intra-agreement (members) trade, but trade-diverting effects on inter-agreement trade. However, a careful examination of the coefficient estimates reveals that years in which the estimated EEC average treatment effect is small, the estimated intercept is large; years in which the estimated EEC average treatment effect is large, the estimated intercept is small. One cannot infer a clear impact of the role of the agreements in fostering international trade among members as the dummy variable may be capturing much more than the effects of the trade agreement.

Similar problems have surfaced in other estimates over the years. In many cases, coefficient estimates of the dummy variables representing economic integration agreements had surprising coefficient estimates. One of the most prominent is Frankel's (1997) *Regional Trading Blocs*. After accounting for all the "natural" factors that explain trade between two countries (such as GDPs, populations, distance, and other typically included gravity-equation variables), the estimated average treatment effect (ATE) on two members' trade of the countries belonging to the EC is only *16 percent*:

> *If the data from four years – 1970, 1980, 1990, and 1992 – are pooled together, the estimated coefficient on the European Community is a smaller 0.15, implying a 16 percent effect. (P. 83)*

Such seemingly small positive estimates for the trade-creating effect of the EC are surprisingly typical. For example, Hamilton and Winters (1992) found an estimated ATE of EC membership of 0.70 but an estimated ATE of EFTA membership of zero using 1984-1986 (averaged) data. Soloaga and Winters (2001) found large and statistically significant *negative* treatment effects of EC and EFTA membership using data from the mid 1980s and mid 1990s, even as the Central American Common Market and MERCOSUR had large positive effects. Interestingly, Gulf Cooperation Council membership had a large positive treatment effect on intra-bloc trade. However, once trade diversion was accounted for, GCC membership had an economically and statistically significant *negative* effect on net trade creation. This huge variation in estimated treatment effects – not just for EC members – but across all regional FTAs causes concern over the methodology.[9]

Moreover, early work using the gravity equation in the 1960s and 1970s was rightly criticized for lacking convincing theoretical *economic* foundations. Also, even if an FTA increased members' trade (other things constant), this result does not shed clear light on whether or not the *welfare* of the members (or nonmembers) was enhanced or reduced. Both arguments were legitimate concerns. In response to the first concern, formal theoretical *economic* foundations for estimating the gravity equation surfaced by the late 1970s and have become widely accepted to justify its use, cf., Anderson (1979), Bergstrand (1985, 1989, 1990), and Helpman and Krugman (1985); for summaries, see Baldwin (1994), Frankel (1997), or Baier and Bergstrand (2001). With these theoretical developments, the gravity equation has become – in

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[9] The very influential policy study on the enlargement of the European Community to the European Economic Area and to Central and Eastern Europe by Richard Baldwin (1994), *Towards an Integrated Europe*, used the gravity-equation approach. I conjecture a similar dilemma was faced as the author only reports treatment effects for membership in the broad European Economic Area, and never provides estimates of EC effects alone. Nevertheless, his estimated ATE for membership in the EEA was about 0.6, an estimate to which we will return later in the paper.

the words of Eichengreen and Irwin (1998) – the "workhorse for empirical studies of [the effect of FTAs on the pattern of trade] to the *virtual exclusion of other approaches*" (p. 33, italics added).

B. Traditional Gravity-Equation Estimates

In this section, we provide estimates of the coefficients for a typical gravity equation using a specification similar to equation (1) above, estimated using the bilateral trade flows among 100 countries in 1995 as well as for two sub-samples using trade flows of only GCC countries (one sub-sample is GCC members' trade with the other 94 countries and one is GCC members' trade with only EU members). We make three modifications to equation (1). First, following recent authors, our left-hand-side variable is the log of the sum of two countries' bilateral trade flows; see Baier and Bergstrand (2002) for theoretical justification. The second modification relative to equation (1) is the addition of a dummy variable for a common language; the variable "Language" takes the value 1 if both countries share a common language and 0 otherwise. The third modification is having one dummy variable represent the presence or absence of an FTA; the variable FTA takes the value 1 if both countries are members of the same FTA and 0 otherwise.

Before discussing the results, we summarize the data used. For Tables 1 and 2, the bilateral trade flow data for 1995 are from Robert Feenstra's website (Center for International Data, www.internationaldata.org); see Feenstra (2000). The bilateral trade flows for panel data regressions for Tables 3 and 4 use the IMF's Direction of Trade Statistics; see IMF (2002, 2004). Gross domestic products are also in real terms and are from the World Bank's *World Development Indicators* (2003). The importance of using real trade flow and GDP data will become more apparent when we use pooled cross-section time-series (or panel) data later. Distance is measured using the great circle distances, based upon latitudes and longitudes of the economic centers of the countries using the *CIA Factbook* (online); this approach has become standard and has been used in several studies. The adjacency and language dummies were also calculated using the *CIA Factbook*. The determination of the presence or absence of an FTA was determined using data from individual government's websites, the WTO website, Frankel (1997), Bhagwati and Panagariya (1999) and Lawrence (1996).

Table 1 provides coefficient estimates for three specifications similar to equation (1) for the 4422 sums of bilateral trade flows. Note that there are 4950 potential sums of bilateral trade among 100 countries (potential number of observations = 100*99/2). Because some of the bilateral trade flow sums are zero (either actually zero or below a reporting threshold), these observations are deleted; we were left with 4422 observations.[10] Specification (1) in Table 1 provides a typical gravity equation's coefficient estimates. The coefficient estimate for the log of the product of the countries' GDPs is close to unity, as in previous findings and as theory

[10]There has been an emerging literature on how to appropriately handle the "zeros" issue. A traditional technique has been to drop them from the regressions, although some authors also use Tobit estimation. For the purposes here, we adopt the traditional approach of simply omitting the zero observations.

suggests is plausible; the reader is encouraged to see Anderson and van Wincoop (2003, 2004) or Baier and Bergstrand (2001, 2002) for complementary theoretical rationales for the gravity equation. We will discuss the theoretical foundation fairly briefly later, focusing on the most relevant issues for the paper at hand. Bilateral distance has a negative effect on trade; the closer are two countries, the more they should trade as "trade costs" are lower. Adjacent countries should trade more due to cross-border trade and similarly low trade costs. Sharing a common language more than doubles international trade, other factors held constant; this is a common finding, as a common language lowers the cost of "trading." Finally, common membership in an FTA (or any international economic integration agreement, such as a customs union or economic union) has a *negative* effect on trade, although the coefficient estimate is statistically insignificant. This result is similar to the "surprising" results noted above in Frankel (1997). He found also that – for the most part – economic integration agreements often did not have economically or statistically significant effects.

Next we re-estimate the same gravity equation specification for a sub-sample where (at least) one of the trading partners is a member of the GCC. The purpose of this regression is to gain a sense as to whether the gravity equation "fits well" for trade associated with the oil-exporting Persian Gulf states. One might argue that the gravity equation is an inappropriate econometric tool for "explaining" trade flows of the Gulf nations because – if oil is a homogeneous product traded on a (perfectly competitive) world commodity market – trade flows between Gulf nations and trading partners would not be well approximated by the gravity equation. The reason is that trade flows would be very sensitive to minor price changes, and be largely unrelated to countries' economic sizes or the distance between them.[11]

This is *not* the case. The second column in Table 1 provides the results of estimating this equation when at least one trading partner is a Persian Gulf state. Interestingly, the gravity equation applies virtually ***identically*** for a sub-sample of trade flows where one partner must be a GCC country. We note three important results. First, while Adjacency has an even stronger effect for this sub-sample of countries in terms of its coefficient estimate, it is not a statistically significant effect; the importance of oil trade surfaces. Second, trade is even more income elastic than in the broad sample; this possibly reflects the pro-cyclical role of oil in economies. Third, Language becomes unimportant in explaining trade; this factor would be more important in differentiated products, but may be less relevant for oil-based trade. Finally, note that the effect of common membership in the GCC has an economically significant (though not statistically significant) role; common GCC membership enhances trade by almost 100 percent, other things equal ($e^{0.61} = 1.84$, implying an 84 percent increase).

We also considered an even narrower sub-sample of trade between EU countries and GCC countries (including 12 observations for intra-GCC trade, but excluding intra-EU trade). Again, the gravity equation has slightly different, but still standard, coefficient estimates. Most importantly, the (log of the) sum of bilateral trade flows is positively related to the product of the

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[11] As Anderson and van Wincoop (2004) note, the pattern of bilateral trade would be indeterminate if the elasticity of substitution between trade flows was infinite. The successful estimation of a gravity-equation relationship for GCC countries suggests a finite elasticity between trade flows in this section.

countries' GDPs, with a coefficient nearly identical to that for the full sample of flows among 100 countries. Trade is negatively related to distance, as found in general. It is not surprising to find that the effect of a 1 percent increase in distance has less of an effect on EU-GCC trade than trade flows in general, as trade tends to fall off sharply with greater distance.

Most importantly, examine now the coefficient estimate for the binary variable representing common membership in the GCC. A coefficient of 2.36 suggests that two GCC members trade *10 times* as much with each other as with an EU country ($e^{2.36} = 10.6$). This suggests that there is a very high *border effect* between GCC and EU countries, which an FTA potentially can erode. This effect appears very similar to that detailed in the "border puzzle" identified in McCallum (1995), and subsequently addressed successfully in Anderson and van Wincoop (2003) and explored further in Feenstra (2004). This suggests a strong argument for large potential economic welfare gains from liberalizing policy borders between EU and GCC members.

Finally, Table 2 includes the actual sum of bilateral trade *among* GCC countries as well as the predicted sum of bilateral trade. These predictions are based upon the regression results using the full sample (specification 1 in Table 1); consequently, the effect of having a customs union on their predicted trade is muted (since the *FTA* coefficient estimate is economically and statistically significant). Counter to some conventional wisdom that the GCC countries do not trade extensively among themselves because much of their exports are oil, the GCC countries tend to trade *more than what is considered natural*, based upon a standard gravity equation to predict the "natural" amount of bilateral trade. Hence, it is not surprising in specification 2 in Table 1 that membership in the GCC has an economically significant effect on trade. The coefficient estimate of 0.61 in specification (2) suggests that two GCC member countries on average trade 84 percent more than two otherwise similar countries (at a similar distance). The border effect estimate of 2.36 in specification (3) suggests that two GCC members trade on average *960 percent* more than two otherwise similar countries at a similar distance.[12]

In summary, the coefficient estimates from these regressions suggest that the economic variables explaining the pattern of trade between GCC countries and countries in the ROW (even just the EU countries) are *very similar* to those explaining international trade flows *in general.* This is the *first* study to our knowledge that has estimated the pattern of international trade flows for the GCC countries. Most importantly, these results suggest that – in considering the impact of an FTA between GCC countries and other countries – the analytical and empirical framework used can be fundamentally the same one used to analyze *standard* international trade patterns.

4. Methodological Shortcomings of the Traditional Gravity-Equation Approach for Estimating the Trade Impacts of FTAs

Despite its widespread use in cross-section studies, usage of the gravity equation to

[12]For 1995, we did not have bilateral trade data for the pairs Saudi Arabia-Qatar, Saudi Arabia-UAE, and Qatar-UAE. The only country pair (using available data) for which the actual trade fell short of predicted trade was Saudi Arabia-Kuwait.

estimate the "average treatment effects" (ATEs) of economic integration agreements has likely been flawed. Moreover, an underlying theoretical model would help to suggest an appropriate specification of the gravity equation. This section has two parts. In the first part, we discuss a theoretical framework that incorporates the features discussed in section 2 above and yields a gravity equation very similar to that in equation (1), with some notable modifications. In the second part, we address some econometric issues that suggest typical estimates of the gravity equation such as reported in Table 1 may be systematically biased.

A. A Conceptual Framework

Formal theoretical economic foundations for applying the gravity equation to international trade flows surfaced with Anderson (1979). Anderson constructed a general equilibrium model using the properties of linear expenditure systems along with explicit transaction costs to motivate the multiplicative relationship between trade flows, GDPs, and gross "trade costs" using the Armington assumption that products are (arbitrarily) differentiated by origin country. Bergstrand (1985) developed a theoretical foundation for the gravity equation with trade costs emphasizing the importance of multilateral price – or (as Anderson and van Wincoop denote) "multilateral resistance" – terms in the reduced-form model. Bergstrand (1989) extended this theory to account for two factors and two sectors in an N-country world to demonstrate that the gravity equation can explain bilateral trade flows in a world with monopolistically competitive firms producing slightly differentiated products under economies of scale but "nested" in a Heckscher-Ohlin world of inter-industry trade. In this regard, this work extended the Helpman and Krugman (1985) framework, which showed how the gravity equation arises in a frictionless world with monopolistically competitive firms producing slightly differentiated goods under increasing returns to scale.

The purpose of this section is to describe analytically, within the context of a theoretical general equilibrium model of international trade, how the formation of an FTA should influence trade flows, trade creation, and trade diversion. While formal theoretical foundations for the gravity model have existed for twenty years, only recently have the models focused more on FTAs and trade-creation and trade-diversion effects. We only briefly summarize here the underlying theoretical model to emphasize the importance of *multilateral price resistance* terms in influencing trade-creation and trade-diversion effects of an FTA, factors re-emphasized recently in Anderson and van Wincoop (2003, 2004).

Because the bulk of international trade appears to be inter-industry trade driven by relative factor abundance and intra-industry trade in differentiated goods in imperfectly competitive markets, we consider a model of world trade with two industries, two factors, differentiated goods produced under increasing returns to scale, and multiple countries on multiple continents with explicit intra-continental trade costs and inter-continental trade costs. While much international trade is also intra-firm, modeling multinational firm behavior is beyond the scope of this paper, but is addressed in Bergstrand and Egger (2004). International trade within each of the two monopolistically-competitive sectors is generated by the interaction of consumers having tastes for diversity and production being characterized by economies of scale. We assume two factors of production, capital and labor, each perfectly mobile between sectors within a country but each immobile internationally. We label the two sectors goods and services. The full model is described in Baier and Bergstrand (2002, 2004a). As shown in Baier and Bergstrand (2002), the model can be solved for a simple multiplicative relationship between the sum of the bilateral trade flows between two countries and various economic factors:

$$SPX_{ij}^{g} = \left[\gamma / GDP_{W}^{g} \phi^{g} \left(o^{g} - 1\right)\right] GDP_{i} GDP_{j} \left(1 + c_{ij}^{g}\right)^{-(\sigma g - 1)} \left(1 + t_{ij}\right)^{-\sigma g} \left(P_{i}^{g*} P_{j}^{g*}\right)^{\sigma g - 1} \tag{2}$$

Comparison of empirical gravity equation (1) with theoretical gravity equation (2) reveals that the latter provides an interpretation for estimating the former using OLS. The first term on the RHS of (2) can be interpreted as the constant. The negative intercept value typically found empirically represents a scalar-adjusted inverse of world real GDP (a constant across country pairs for a given year). GDPs of the exporting and importing countries are expected to have coefficient estimates not statistically different from unity. The variable $\left(1 + c_{ij}^{g}\right)$ represents the gross transport cost factor and is typically proxied by bilateral distance. Distance is generally interpreted as "transportation" costs. However, distance may represent more pragmatically *all* types of resource-consuming costs to undergoing trade (i.e., information barriers, etc.); we are implicitly assuming that distance between two countries "consumes" resources. Variable $\left(1 + t_{ij}\right)$ represents not just the gross tariff rate but all policy-induced (artificial) barriers to trade and is generally proxied by a dummy variable representing the presence or absence of an economic integration agreement. The elasticity for $\left(1 + t_{ij}\right)$ differs from that for $\left(1 + c_{ij}^{g}\right)$; in the case of tariffs, consumers benefit from governments redistributing tariff revenue to them. However, if the bulk of trade liberalization associated with forming an FTA is the elimination of non-tariff barriers and national regulations that "consume resources" like transport costs, then the effect of trade liberalization is similar to that of reducing distance, and these two variables would have the same elasticity, $-\left(\sigma^{g} - 1\right)$. In some cases, authors have used estimates of actual (aggregate) tariff rates, but such measures are difficult to estimate; Baier and Bergstrand (2001) used growth rates of aggregate tariff levels in a study of sources of the growth of post-WWII trade. Let σ denote the elasticity of substitution among goods; the g superscript denotes a good. Typically, *no* RHS variable is included to capture the influence of $\left(P_{i}^{g*} P_{j}^{g*}\right)$; some exceptions are Bergstrand (1985) in the context of a cross-section study of bilateral trade levels, Baier and Bergstrand (2001) in the context of determinants of the growth of world trade, and Anderson and van Wincoop (2003) in the context of explaining the "border puzzle."

Careful examination of equation (2) reveals that, in contrast to conventional wisdom, it is not a *reduced-form* equation. The variable $\left(P_{i}^{g*} P_{j}^{g*}\right)$ represents a "multilateral (price) resistance" term. The issue of such terms was raised in Anderson (1979) and was a main issue in Bergstrand (1985), which first emphasized that the absence of country-specific price terms may create an omitted variables bias in coefficient estimates of the gravity equation. Anderson and van Wincoop (2003), however, insightfully refined and sharpened these concepts, using their theoretical refinements of the gravity equation to explain the "border puzzle" in international trade, cf., Feenstra (2004, Ch. 5). It is shown in Anderson and van Wincoop (2003) for a one-industry model and in Baier and Bergstrand (2002) for two industries that:

$$\mathrm{P}_{\mathrm{i}}^{g*} = \left\{ \sum_{k=1}^{N} \left(\frac{GDP_k^g}{GDP_w^g} \right) \left[\frac{\left(1+c_{ik}^g\right)\left(1+t_{ik}^g\right)}{\mathrm{P}_k^{g*}} \right]^{1-\sigma g} \right\}^{1/(1-\sigma g)} \tag{3}$$

$$\mathrm{P}_{\mathrm{j}}^{g*} = \left\{ \sum_{k=1}^{N} \left(\frac{GDP_k^g}{GDP_w^g} \right) \left[\frac{\left(1+c_{jk}^g\right)\left(1+t_{jk}^g\right)}{\mathrm{P}_k^{g*}} \right]^{1-\sigma g} \right\}^{1/(1-\sigma g)} \tag{4}$$

Equations (2)-(4) have the following interpretation. Equations (2)-(4) form a system of equations (along with income-determination equations) to describe determinants of world trade flows. Most importantly, to avoid omitted variables bias in the estimation of equation (2) one must account for variation in $\left(P_i^{g*} P_j^{g*}\right)$.

In reality, *few* of the right-hand-side (RHS) variables are likely *exogenous* econometrically. In the context of the theoretical model, GDPs of countries $\left(GDP_i GDP_j\right)$, as well as the multilateral price terms $\left(P_i^{g*} P_j^{g*}\right)$, are endogenous; even world *GDP* $\left(GDP_W^g\right)$ is endogenous. Incomes as well as prices are determined in the model, given its general equilibrium structure; this is an element omitted in the computable partial equilibrium model of EU-GCC trade in PWC (2004). Because there are two industries with flexible relative prices, substitutability occurs between sectors in our model; again, this is an element precluded in PWC (2004). Since prices are fully adjustable, multilateral price resistance terms are endogenous; we elaborate on these shortly.

Moreover, trade policies are determined by policymakers that may be setting decisions incorporating economic welfare (but not limited to it), and thus are endogenous as well; see Goldberg and Maggi (1999) on the empirical importance of consumer welfare for dominating trade policy decisions. For instance, it is widely believed that governments set trade policy as a weighted function of governments' own self-interests as well as consumer welfare. To the extent that consumers' economic welfare is included in the government's policymaking function, then utility of consumers enters the trade policy decision. However, given the utility function, the net change in the representative consumer's utility from introducing an FTA is influenced by the trade created from the FTA (enhancing consumer welfare) less the trade diverted by the agreement (reducing consumer welfare). Moreover, countries outside a new FTA suffer trade diversion that potentially reduces their welfare and, by implication, rest-of-world (ROW) welfare.

Equations (2)-(4) are useful to evaluate the effects of an FTA on both members' *and nonmembers'* welfare for two reasons. First, equation (2) provides a theoretical foundation for applying the gravity equation to explain international trade flows. Second, equation (2) will allow the policymaker to evaluate the effect on the bilateral trade flow of any pair of countries in the data set of the introduction of an FTA. However, specification (1) – the traditional gravity equation – is flawed econometrically. Incomes, multilateral price resistance terms, and trade policies are all likely *endogenous* right-hand-side variables. As we will show next, two modifications to the standard gravity equation's estimation need to be pursued to offer potentially unbiased estimates of the effects of FTAs on trade flows.

B. Econometric Issues

Endogeneity bias arises in a regression equation whenever any of the RHS variables is correlated with the error term in the regression. For instance, suppose there are unobservable factors influencing trade flows that show up in the error term. Suppose trade flows affect GDPs, trade policies, and multilateral resistance terms, given the general equilibrium model of world trade flows. Then unobservable factors influencing trade will influence these RHS variables, and cause a potential endogeneity bias in traditional gravity equation coefficient estimates because the trade flow error term will be correlated with the RHS variables. This is endogeneity bias.

1. Incomes

In the context of world trade, GDPs, trade policies and multilateral resistance terms are potentially endogenous variables. How should this endogeneity be accounted for? First, researchers have explored the potential endogeneity bias created by including GDPs on the RHS. Two studies have addressed this, finding that the use of GDPs creates virtually no endogeneity problem. The most widely cited study addressing this is Frankel (1997).

2. Trade Policies

Countries' governments might choose to enter into an FTA based upon an *expected gain* in economic welfare of consumers from potential (net) trade creation. As in the labor economics literature on treatment effects, actual participation in an FTA is voluntary. Consequently, the FTA dummy variable may be endogenous by being correlated with (omitted) unobservable variables that are correlated also with the decision to trade. For example, suppose two countries have intense domestic regulations (e.g., internal shipping regulations) that inhibit trade (causing ϵ_{ij} to be negative). The likelihood of the two countries' governments selecting into an FTA may be high if there is a large expected welfare gain from potential bilateral trade creation if the FTA deepens liberalization well beyond tariff barriers into domestic regulations. Thus, *FTA* and the intensity of domestic regulations may be positively correlated, but the gravity equation error term ϵ and the intensity of domestic regulations may be negatively correlated. This reason suggests that *FTA* and ϵ are negatively correlated, and the *FTA* coefficient will tend to be underestimated.

In support of this argument, numerous authors have noted that one of the major benefits of increased regionalism is the potential for "deeper integration." Lawrence (1996, p. xvii) distinguishes between "international policies" that deal with border barriers, such as tariffs, and "domestic policies" that are concerned with everything "behind the nation's borders, such as competition and antitrust rules, corporate governance, product standards, worker safety, regulation and supervision of financial institutions, environmental protection, tax codes ..." and other national issues. The GATT and WTO have been remarkably effective in the postwar era reducing border barriers. However, these institutions have been much less effective in liberalizing the domestic policies just itemized. As Lawrence states it, "Once tariffs are removed, complex problems remain because of differing regulatory policies among nations" (p. 7). He argues that in many cases, free trade "agreements are also meant to achieve deeper integration of international competition and investment" (p. 7). Gilpin (2000) echos this argument: "Yet, the inability to agree on international rules or to increase international cooperation in this area has contributed to the development of both managed trade *and regional arrangements*" (p. 108; italics added). Preeg (1998) concludes:

> *[Free] trade agreements over time, however, have tended to include a broader and broader scope of other trade-related policies. This trend is a reflection, in part, of the fact that as border restrictions [tariffs] are reduced or eliminated, other policies become relatively more important in influencing trade flows and thus need to be assimilated in the trade relationship (p. 50).*

In considering the potential benefits of an EU-GCC FTA, such considerations seem especially relevant. The economic security of Western Europe depends upon the stability of economic activity – and thus upon the economic development – of regions on its economic and geographic periphery. While the array of products that will be made available to the EU from the GCC under an FTA may not be as extensive as that from other parts of the world, the potential for deeper integration to enhance political and economic stability is a potential "import" created for the EU by an EU-GCC FTA. As we will see, the potential array of products that would be made available to the GCC countries from the EU would be extensive, and likely would contribute substantive trade creation to the benefit of GCC members.

Two conventional methods to address endogeneity bias are using *fixed effects* or to *difference* the economic data over time, if pooled cross-section time-series data exists. If an unobservable factor is suppressing trade but is positively correlated with the likelihood of an FTA, the resulting negative correlation between the FTA dummy and the gravity equation error term is referred to as unobserved heterogeneity bias. Including a bilateral "fixed effect" term will hold constant all time-invariant unobserved variables that might be simultaneously affecting trade flows and the likelihood of an FTA being formed between two regions by policymakers, cf., Wooldridge (2000, Chapter 13). Another method of removing this time-invariant unobserved heterogeneity is to "difference" the data, cf., Wooldridge (2000, Chapter 13). Fortunately, data is now available for all of our variables to provide a panel of trade flows, incomes, and FTA dummies for 5-year intervals dating from 1960 to 2000 to examine the impact of FTAs on trade flows to avoid endogeneity bias.

3. *Multilateral Price Resistance Terms*

As discussed above, proper econometric specification of the gravity equation necessitates inclusion of the multilateral price resistance terms. Anderson and van Wincoop 2003) employed a customized nonlinear program in order to estimate the system of equations (2)-(4) to show their solution to the "border puzzle." Feenstra (2004) shows that one can consistently estimate the coefficient estimates of a cross-section gravity equation using a fixed-effects approach; however, if multilateral price resistance terms vary over time – as they surely do – fixed effects estimation or differencing the data will remove the bias introduced by time-invariant unobserved heterogeneity, but will not remove in a panel the bias introduced by omitting *time-varying* multilateral price resistance terms. Moreover, Feenstra's approach precludes estimating the effects of multilateral price resistance terms (cf., Feenstra, 2004); his approach only allows estimation of the "average" border effect. Estimation of the multilateral price resistance terms is necessary to address trade diversion.

Our approach will use simple OLS to estimate the effects of multilateral resistance price terms. This will provide a transparent and simple method to calculate the effects of FTAs on trade flows, along with estimates of trade creation and trade diversion, that are readily usable by policymakers and founded upon a general equilibrium model of trade referred to earlier. The technical details of the estimation procedure are beyond the scope of this paper and are provided in Baier and Bergstrand (2004b), but we provide a summary of the procedure using equations (2)-(4) described earlier.

To see the procedure's essence, we assume our world economy described by equations (2)-(4) is initially in a "free trade" equilibrium, i.e., there are zero trade costs. Then we conduct a comparative static analysis of introducing a trade barrier (t_{ij}) between a pair of countries (i, j) among N countries (i, j = 1,...,N). First, consider equation (3), the multilateral price term for country i. Omitting for brevity the apostrophes and the g superscript, we can rewrite equation (3) as:

$$P_i^{1-\sigma} = \sum_{k=1}^{N} \theta_k P_k^{\sigma-1} C_{ik}^{1-\sigma} T_{ik}^{1-\sigma} \tag{5}$$

where $\theta_k \equiv GDP_k/GDP_W$, $C_{ik} \equiv (1 + c_{ik})$, and $T_{ik} \equiv (1 + t_{ik})$, for convenience. Differentiating this expression yields:

$$\begin{aligned} P_i^{-\sigma}(1-\sigma)dP_i = &\sum_{k=1}^{N} \theta_k C_{ik}^{1-\sigma} T_{ik}^{1-\sigma} P_{jk}^{\sigma-2}(\sigma-1)dP_k \\ &+ \sum_{k=1}^{N} P_k^{\sigma-1}\theta_k C_{ik}^{-\sigma}(1-\sigma)dC_{ik} \\ &+ \sum_{k=1}^{N} P_k^{\sigma-1}\theta_k T_{ik}^{-\sigma}(1-\sigma)dT_{ik} \\ &+ \sum_{k=1}^{N} P_k^{\sigma-1} C_{ik}^{1-\sigma} T_{ik}^{1-\sigma} d\theta_k \end{aligned} \tag{6}$$

Obviously, comparative static effects will depend upon initial levels of several variables. For analytical purposes upon which to derive a comparative static effect of a change in a *bilateral-pair-specific* barrier, we will assume, as in Anderson and van Wincoop (2003), a "free trade" initial equilibrium with $C_{ij} = T_{ij} = 1$ (for all i, j = 1,...,N). In this initial frictionless equilibrium, $P_i = 1$ (for all i = 1,...,N). Starting at this initial equilibrium, then equation (6) simplifies to:

$$(1-\sigma)dP_i = (\sigma-1)\sum_{k=1}^{N}\theta_k dP_k + (1-\sigma)\sum_{k=1}^{N}\theta_k dC_{ik} + (1-\sigma)\sum_{k=1}^{N}\theta_k dT_{ik} + \sum_{k=1}^{N} d\theta_k \tag{7}$$

Assuming no changes in non-policy related trade costs ($dC_{ik} = 0$), dividing through both sides by 1-σ, and noting that any changes in GDP shares ($d\theta_k$) must logically sum to zero yields:

$$dP_i\left(\sum_{k=1}^{N}\theta_k dP_k\right) + \sum_{k=1}^{N}\theta_k dT_{ik} \tag{8}$$

To derive the comparative static effect of a bilateral-pair-specific trade barrier, dT_{ij}, multiply both sides of equation (8) by θ_i and sum over i = 1,...,N to yield:

$$\sum_{i=1}^{N}\theta_i dP_i = \sum_{i=1}^{N}\theta_i\sum_{k=1}^{N}\theta_k dP_k + \sum_{i=1}^{N}\theta_i\sum_{k=1}^{N}\theta_k dT_{ik}$$

$$= -\sum_{k=1}^{N}\theta_k dP_k + \sum_{i=1}^{N}\sum_{k=1}^{N}\theta_i\theta_k dT_{ik} \tag{9}$$

since the sum of θ_i over i=1,...,N equals 1. Moreover, since $\sum_{k=1}^{N}\theta_k dP_k = \sum_{i=1}^{N}\theta_i dP_i$, then equation (9) simplifies to:

$$2\left(\sum_{k=1}^{N}\theta_k dP_k\right) = \sum_{i=1}^{N}\sum_{k=1}^{N}\theta_i\theta_k dT_{ik}$$

or (10)

$$\left(\sum_{k=1}^{N}\theta_k dP_k\right) = 0.5\left(\sum_{i=1}^{N}\sum_{k=1}^{N}\theta_i\theta_k dT_{ik}\right)$$

Substituting equation (10) into the RHS of equation (8) yields:

$$dP_i = \sum_{k=1}^{N}\theta_k dT_{ik} - 0.5\sum_{i=1}^{N}\sum_{k=1}^{N}\theta_i\theta_k dT_{ik} \tag{11}$$

Hence, the effect of a unit increase in T_{ij} on P_i is:

$$dP_i = \theta_j dT_{ij} - 0.5\theta_i\theta_j dT_{ij} \tag{12}$$

Consequently, if we examine the impact of the introduction of an FTA between countries i and j (dummy variable FTA_{ij} changes from 0 to 1, which reduces T_{ij} by 100*α percent), then:

$$dP_i = (\theta_j - 0.5\theta_i\theta_j) = \theta_j(1 - 0.5\theta_i) < 0 \tag{13}$$

$$dP_j = -(\theta_i - 0.5\theta_i\theta_j) = \theta_i(1 - 0.5\theta_j) < 0 \tag{14}$$

$$d(SPX_{ij}/GDP_iGDP_j) = \alpha(\sigma - 1)[1 - (\theta_j + \theta_i - 0.5\theta_i\theta_j)] > 0 \tag{15}$$

Equations (13) - (15) have the following economic interpretations. In equation (15), the introduction of an FTA has a trade-creating effect of 100*α(σ-1) percent. The parameter α translates the *FTA* dummy variable into an *ad valorem* equivalent of the inverse of a tariff rate; a change in *FTA* from 0 to 1 represents a reduction in the *ad valorem* trade barrier by 100*α percent. The parameter σ is the elasticity of substitution, which determines how much trade flows respond to a change in relative prices. The trade-creating effect is always positive.

As shown in equations (13) and (14), the introduction of an FTA will lower (on net) the multilateral price-resistance terms P_i and P_j. In the context of the theory, the change in region i's multilateral resistance term is determined largely by the relative economic size of region j. The larger is region j, the more region i trades with j, and the more the multilateral resistance of region i will be lowered by an FTA with j, tending to increase trade with all countries – but reducing (ceteris paribus) trade between i and j. Similarly, in equation (14) region j's multilateral resistance will tend to be lowered more with an FTA between i and j the larger is region i. However, as shown in equation (15), the larger the values of θ_i and θ_j, the *less* the net trade creation between i and j from an FTA between i and j.

In the context of the potential EU-GCC FTA, net trade creation between the EU and GCC countries will tend to be dampened by the relatively large size of the EU. Trade creation tends to be larger the smaller the regions involved; this partly explains the large coefficient estimate for the GCC dummy variable in specification (3) in Table 1.

Finally, equations (13) - (15) also help us to understand the potential trade diversion that will be created by FTAs with respect to trade between member and nonmember countries and among nonmember countries. This trade diversion can be transparently traced to the changes in every country's multilateral price-resistance term P_k (k = 1,...,N). Since *every* country's P will be influenced by an FTA between *any two regions* (i, j), then every trade flow (SPX_{mn}) will be affected by FTA_{ij} since P_m and P_n will be affected (m,n = 1,...,N). We will estimate these effects in Section 6 below for an EU-GCC FTA.

5. A Panel-Data Approach to Address Endogeneity Bias

We have now determined two key issues that need to be addressed econometrically to estimate consistently the trade-creating and trade-diverting effects on bilateral trade flows of an FTA between any two economic regions. One issue is that we need to account for the potential *endogeneity* of the right-hand-side variables, such as the measure of trade policy (e.g., FTA_{ij}) and measures of GDP. The second issue is that estimates of the effects of *FTA* need to account for the multilateral price-resistance terms (P_i, P_j).

A. Fixed-Effects Estimation

As discussed in Wooldridge (2000) and other notable econometrics textbooks, in the presence of pooled cross-section time-series data, one can readily estimate consistently the effects of trade policy using fixed-effects estimation. In estimating the effects of determinants of bilateral trade cross-sectionally, there are numerous factors which the econometrician cannot observe, but which are likely highly correlated with the error term. Consequently, as discussed earlier, coefficient estimates – especially average treatment effect (ATE) estimates of the trade effects of an FTA – are biased. Using data for every five years from 1960 to 2000, we estimated the gravity equation using four different specifications. We note that in all cases we excluded multilateral price-resistance terms, assuming such factors were fixed and potentially subsumed in the country-pair fixed effects. The results are shown in Table 3.

Specification (1) provides the basic gravity equation results using the traditional specification. Using a panel of 47,081 (non-zero) observations for 100 countries' gross bilateral trade flows for every five years from 1960 to 2000, the gravity equation coefficient estimates for a standard specification are typical: income elasticities close to unity, a distance coefficient estimate close to -1, economically and statistically significant coefficient estimates for Adjacency and Language, and an economically insignificant effect of membership in an FTA. Specification (2) introduces fixed time effects (dummy variables) for each year. Specification (3) introduces fixed country-pair effects. Finally, specification (4) combines time and country-pair fixed effects. In this final specification, note the much larger effect of an FTA. In specification (1) using OLS, an FTA increases trade only 13 percent. By contrast, in specification (4) using time and country-pair fixed effects, an FTA increases trade by almost *100 percent* ($e^{0.68} = 1.97$, implying a 97 percent increase). Thus, when accounting for endogeneity bias using fixed-effects estimation, the coefficient estimate of an FTA increases by an order of 7; that is, OLS estimation of the trade effects of an FTA underestimates the treatment effect by *80 percent* (0.13/0.68 = 0.19).

B. Differencing the Data

While fixed effects estimation should yield consistent coefficient estimates, this approach assumes that the multilateral price-resistance terms are *constant* over time; this may not be the case. However, an alternative approach – also raised in Wooldridge (2000) – is to *difference* the data. Differencing the data would also eliminate the endogeneity bias introduced by country-pair specific *fixed* effects. However, it would not eliminate the endogeneity bias introduced by *time-varying* multilateral-resistance (MR) terms. Rather, we would need to adjust for time-varying MR terms using either Anderson and van Wincoop's (2003) customized nonlinear estimation procedure or find a simpler alternative.

While the Anderson-van Wincoop procedure is plausible, a simpler econometric technique is explored in Baier and Bergstrand (2004b). That paper discusses the use of a log-linear Taylor-series expansion method to generate a simple OLS *linear* estimation technique to account for the effects of the MR terms which – based upon the empirical findings in Section 3 – may be very important in estimating the effect of border-barrier reductions between EU and GCC countries. Baier and Bergstrand (2004b) illustrate analytically that reliable estimates of the effects of an FTA on the bilateral trade between two countries can be obtained by estimating equation (16) below using OLS:[13]

$$\begin{aligned}\Delta \ln PX_{ijt} &= \beta_0 + \left(\Delta \ln Y_{it} + \Delta \ln Y_{jt}\right) \\ &- \alpha(\sigma - 1)\Delta\left(1 - FTA_{ijt}\right) \\ &+ \alpha(\sigma - 1)\Delta\left[\frac{1}{N}\sum_{i=1}^{N}\left(1 - FTA_{ijt}\right) + \frac{1}{N}\sum_{j=1}^{N}\left(1 - FTA_{ijt}\right) - \frac{1}{N^2}\sum_{i=1}^{N}\sum_{j=1}^{N}\left(1 - FTA_{ijt}\right)\right]\end{aligned} \tag{16}$$

Typically, the FTA dummy variable is defined as equal to 1 when two countries have an FTA ($FTA = 1$), and $FTA = 0$ when no FTA is present. In equation (16), the FTA variable is defined

[13]By "reliable" estimates, we refer to the following methodology. Using actual data on real GDPs, bilateral distances, etc., we simulated bilateral trade flows, using a calibrated version of the underlying theoretical model. These were generated using 5000 Monte Carlo simulations of the model. We found that estimation of the parameters in eq. (16) using this linear approximation yielded parameter estimates very close to the "true" values. Parameter estimates were within a 95 percent confidence interval 95 percent of the time.

as $CHGNoFTA = \Delta(1-FTA_{ijt})$. *CHGNoFTA* denotes that the formation of an FTA during a 5-year period causes the variable to change from 1 to 0 (when *FTA* changes from 0 to 1).[14] The last term on the right hand side of equation (16) – representing the (combined) multilateral resistance terms – will be referred to as *CHGMR*.

Table 4 provides estimates of the gravity equation coefficients using differenced data. The first two specifications provide evidence that FTAs have an economically and statistically significant effect on trade flows. Note that specifications (1a) and (1b) intentionally omit the multilateral price resistance terms. Also, specification (1a) excludes time dummies and specification (1b) includes time dummies; all coefficient estimates of time dummies in specifications (1b)-(3b) are omitted for brevity. Specifications (2a) and (2b) introduce the combined multilateral resistance term in difference form, *CHGMR*. Specifications (2a) and (2b) show that the effects of forming an FTA stand *even after accounting for time-varying multilateral-resistance (MR) terms*. Note that, without time dummies, the coefficient estimate for the MR term (*CHGMR*) is approximately equal to (and, as expected, oppositely signed from) the *CHGNoFTA* coefficient estimate.

Specification (2a) will subsequently be referred to as the "Restricted Model." The coefficient estimates for *CHGNoFTA* and for *CHGMR* are approximately equal and oppositely signed as theory (in eq. 16) suggests; a statistical test of their equality yields that the null hypothesis of equality cannot be rejected at conventional levels. Specification (2a) excludes time dummies and no lagged effects of either *CHGNoFTA* or *CHGMR* on trade flow changes.

However, in reality, the effects of FTA formations on both trade flows likely takes time; the effects are likely not captured entirely by contemporaneous changes in FTA terms and in MR terms. Specifications (3a) and (3b) append to the previous specifications (2a and 2b, respectively) two lagged changes for each variable (*CHGNoFTA* and *CHGMR*). These specifications allow that FTAs formed in the previous two five-year periods can still have lagged impacts on the current five-year period's trade flows. In fact, by allowing lagged effects, the trade-creating effects of forming FTAs are considerably larger empirically than the effects of changes in MR terms. Hence, these specifications suggest considerably more *net* trade creation than (2a) or (2b). While contemporaneous changes in *CHGMR* have the expected positive effects on SPX_{ij}, the lagged effects of changes in *CHGMR* tend to *offset* the contemporaneous effects. We will term specification (3b) subsequently the "Unrestricted Model."

In summary, we have found a range of estimates of the trade-creating and trade-diverting effects of FTAs. In order to provide some numerical estimates of an EU-GCC agreements, we will choose two representative sets of estimates, those from specification (2a) and from specification (3b). The estimates from specification (2a) – the Restricted Model – are useful because they are consistent with the "theoretically pure" model; the coefficient estimate for *CHGNoFTA* is equal and oppositely-signed from that for *CHGMR*. Also the economic impacts are obtained for the concurrent period only (no lagged changes in FTA or MR terms), and there are no *ad hoc* time dummies introduced. The estimates from specification (3b) – the

[14]Consequently, the coefficient for $\alpha * CHGNoFTA_{ijt}$ is identical to that for $(1+t_{ijt})$ in theoretical equation (2); $CHGNoFTA_{ijt}$ and $(1+t_{ijt})$ are positively correlated theoretically.

Unrestricted Model – are useful because they include statistically significant time dummies, the coefficient estimates allow for economically and statistically significant lagged effects of FTA and MR changes on trade flows, and the coefficient estimates for *CHGNoFTA* and *CHGMR* need not be quantitatively identical (in absolute values). For specification 2a, the results suggest an average treatment effect (ATE) of forming an FTA on bilateral trade [estimate of $\alpha(\sigma-1)$] of 0.33 (in absolute terms) and a *CHGMR* effect of 0.36. For specification 3b, the results suggest that an ATE of approximately 0.65, after 15 years. This is calculated from the absolute value of the sum of the coefficient estimates from specification (3b) in Table 4. On the other hand, the cumulative estimated effect of the change in the MR term is 0.02. This is calculated also by summing the coefficient estimates from specification (3b) for the three *CHGMR* terms. Specification (3b)'s estimates suggest much larger potential trade-creating effects from an FTA relative to the potential trade-diverting effects. We use both sets of estimates in the next section to calculate the trade-creation and trade-diversion effects discussed earlier.

6. Estimating the Effects on Trade Creation and Trade Diversion of an EU-GCC FTA

There are several advantages of estimating the trade effects of an FTA between the EU and the GCC – or between potentially any trading partners – using the approach here. First, since the focus is on bilateral trade flows, we can potentially identify the trade-creation and trade-diversion effects of an FTA by each bilateral flow. Second, we estimate the "average treatment effect" of an FTA on trade in a manner that likely provides unbiased estimates. Third, by estimating the ATE using a dummy variable, the underlying policy change need not be interpreted *narrowly* as just a reduction in tariffs; the dummy variable reflects a general change in the *border barrier*. Fourth, every trade flow is adjusted for multilateral resistance (MR) term changes based upon relative economic sizes of economic regions. Fifth, the estimated impacts on trade creation and trade diversion are quite transparent.

We now apply this method to estimate the effects of a EU-GCC FTA on the trade between numerous trading partners. First, we consider the potential impacts on EU-GCC trade. However, we will also consider the effects on trade between the GCC and the ROW, the EU with the ROW, and even the EU or GCC with the USA. In the context of the model, the trade creation effect – *in percentage terms* – is identical across all country pairs and all time periods; this is simply the average treatment effect (FTA coefficient estimate) derived from the OLS estimation in the previous section. Using the Unrestricted Model with MR terms, time dummies, and lagged effects of FTAs and MR terms on trade, the estimated gross trade creation (GTC) effect is 0.65, or **65 percent**. Using the Restricted Model, the estimated GTC is 0.33, or **33 percent**.

However, for every bilateral pair of countries, the MR terms change as a result of an FTA, causing trade diversion for each member country. In order to determine the size of the effects, we need relative economic sizes of the various regions. Based upon year 2000 data from PWC (2004) and *World Development Indicators*, the share of the GCC's GDP in world GDP is about 1.5 percent. The EU's share of world GDP is about 20 percent. The USA's share is about 20 percent. This leaves a remaining ROW share of 48.5 percent. We will use these figures to derive the trade diversion effects. We will use θ to denote a country's share of world GDP. In the context of the Unrestricted Model, for any pair of countries the gross trade diversion (GTD) effect is:

$$\Delta \ln GTD_{ij} = -0.02\ \Delta \ln MR_{ij} = -0.02\ \{\theta_i\ \Delta(1\text{-}FTA_{ij}) + \theta_j\ \Delta(1\text{-}FTA_{ij}) - \theta_i\ \theta_j\ \Delta(1\text{-}FTA_{ij})\}$$

Consequently, in percentage terms, the net trade creation (NTC) effect is:

$$\begin{aligned} \Delta \ln NTC_{ij} &= -0.65\ \Delta(1\text{-}FTA_{ij}) + 0.02\ \Delta \ln MR_{ij} \\ &= -0.65\ \Delta(1\text{-}FTA_{ij}) + 0.02\ \{\theta_i\ \Delta(1\text{-}FTA_{ij}) + \theta_j\ \Delta(1\text{-}FTA_{ij}) - \theta_i\ \theta_j\ \Delta(1\text{-}FTA_{ij})\} \end{aligned}$$

Consider now the gross trade creation, gross trade diversion, and net trade creation effects for EU-GCC trade from an FTA using Unrestricted Model 3b's coefficients. The gross trade creation effect of this FTA is 0.65, or 65 percent. The gross trade diversion effect is -0.00424, or -0.424 percent. In 2000, GCC imports from the EU were \$26.5 billion and GCC exports to the EU were \$17.3 billion. Consequently, using these formulas, the *net trade creation effect for EU-GCC trade is \$28.3 billion.* This is a significant amount of *net* trade creation; it is a 64.5 percent increase. However, this is partly explained by the low estimated trade diversion effect under specification (3b).

However, with an FTA between the EU and GCC, trade diversion is not limited to that between these two countries; trade is reduced between GCC members with the USA and with the rest-of-the-world (ROW) and between EU members with the USA and with the ROW. We can estimate this trade diversion using the changes in a country's MR terms.

The GCC's gross trade diversion with the USA is:

$$\begin{aligned} \Delta \ln GTD_{GCC,USA} &= -0.02\ \Delta \ln MR_{GCC,USA} \\ &= -0.02\ \{\theta_{EU}\ \Delta(1\text{-}FTA_{EU,GCC}) - \theta_{GCC}\ \theta_{EU}\ \Delta(1\text{-}FTA_{EU,GCC})\} \\ &= -0.02\ \{0.20\ \Delta(1\text{-}FTA_{EU,GCC}) - (0.015)(0.20)\ \Delta(1\text{-}FTA_{EU,GCC})\} \\ &= 0.00394 \end{aligned}$$

For \$27.4 billion of GCC-USA trade, a 0.394 percent trade diversion amounts to a loss of trade of \$0.108 billion.

The GCC's gross trade diversion with the non-USA ROW is:

$$\begin{aligned} \Delta \ln GTD_{GCC,ROW} &= -0.02\ \Delta \ln MR_{GCC,ROW} \\ &= -0.02\ \{\theta_{EU}\ \Delta(1\text{-}FTA_{EU,GCC}) - \theta_{GCC}\ \theta_{EU}\ \Delta(1\text{-}FTA_{EU,GCC})\} \\ &= -0.02\ \{0.20\ \Delta(1\text{-}FTA_{EU,GCC}) - (0.015)(0.20)\ \Delta(1\text{-}FTA_{EU,GCC})\} \\ &= 0.00394 \end{aligned}$$

For \$189.6 billion of trade between the GCC and the non-USA ROW, a 0.394 percent trade diversion amounts to a loss of trade of \$0.747 billion. *On net,* trade creation for the GCC is about \$27 billion, with trade diversion vis-a-vis the ROW of less than \$1 billion. Yet, we will see below that, with estimation using Restricted Model (2a), the NTC is much smaller.

We can also show using Unrestricted Model (3b) that the EU experiences net trade creation from an EU-GCC FTA. The net trade creation between the EU and GCC is $28.3 billion, as estimated earlier. The percentage reduction in trade of the EU with the USA is 0.024 percent; on $579 billion of trade, this is a reduction of EU-USA trade of $0.139 billion. The percentage reduction in trade of the EU with the ROW (including USA) is also 0.024 percent; on $1842 billion of trade, this is a reduction of EU-ROW trade of $0.442 billion. Thus, on net, the EU benefits from an EU-GCC agreement of about $28 billion, which is one to two percent of external trade.

We can also show that the USA's trade with the non-EU-GCC ROW increases. In the context of Unrestricted Model (3b), the percentage increase in trade is 0.006 percent. This amounts to a trade creation of $0.101 billion on $1687 billion of USA imports and exports with ROW.

Finally, we can calculate the trade creation and trade diversion effects using theory-constrained Restricted Model (2a). In this case, the smaller *CHGNoFTA* coefficient estimate of 0.33 suggests less bilateral trade creation between two FTA members. Moreover, the *CHGMR* coefficient estimate of 0.36 suggests greater trade-diversion effects. Using our approach, the net trade creation for EU-GCC trade from an agreement is 0.254, or *25.4 percent*. On EU-GCC trade of $43.8 billion, this is net trade creation of $11.1 billion (only 40 percent of the net trade creation under the other specification).

Using Restricted Model (2a), the gross trade diversion for the GCC is 7.1 percent. On trade with the ROW of $216.9 billion, the GTD effect for the GCC is $15.4 billion. Thus, the GCC suffers net trade *diversion* from an EU-GCC agreement of $4.3 billion ($11.1 billion - $15.4 billion).

Using this specification, the gross trade diversion for the EU is 0.432 percent. On $1842 billion trade of the EU with the ROW, this amounts to trade diversion of $8.0 billion. On net, the EU has a net trade creation effect of $2.8 billion.

We summarize the net trade creation and diversion effects using the two specifications. Using the Restricted Specification (2a) from Table 4, the EU gains from net trade creation of $2.8 billion. The GCC suffers net trade diversion from an EU-GCC FTA of $4.3 billion. By contrast, using the Unrestricted Specification (3b) from Table 4, the EU gains on net about $28 billion in trade creation while the GCC benefits from about $27 billion in net trade creation from an EU-GCC FTA. While $28 billion is less than 2 percent of EU international trade, $27 billion in net trade creation for the GCC is more than 10 percent of GCC foreign trade.

By contrasting the results between the Restricted and Unrestricted models, we actually shed some light on the long-standing "customs union" issue of whether economic integration agreements are potentially welfare-enhancing. As discussed earlier, the literature reveals that most CGE and CPE economic models of FTAs tend to suggest small net trade creation effects from such agreements. In our pure theory-restricted specification, we find similarly small net trade creation effects and, in the case of the GCC, small net trade diversion. However, by estimating an Unrestricted version of our model, the empirical evidence suggests that the trade-diverting effects of an FTA may be smaller than theory warrants. In fact, using the EU-GCC as an example, we find significant net trade creation for the GCC. Only further research might help explain why such trade-diverting effects tend empirically to be quite moderate. Nevertheless, evidence from the Unrestricted Model is consistent with the growth of regionalism – in the sense of governments pursuing regional FTAs that should on net be welfare-enhancing.

VII. Concluding Comments

The primary purpose of free trade agreements is to eliminate the "artificial" policy-induced barriers to international trade. Typically, governments first apply this "liberalization" of trade to tariffs on foreign goods. Such barriers are transparent, making mutually beneficial trade liberalization obtainable. However, in the case of an EU-GCC FTA, the potential reductions in tariff rates are fairly small. The GCC adopted a common external tariff rate of 5 percent in January 2003. The EU's average tariff rate on foreign goods is only about 3 percent. Thus, the potential net benefits of an EU-GCC FTA might appear rather small.

However, one should view an FTA as a liberalization of policy-induced *trade costs* in general. Perhaps, for most readers, this interpretation may be construed as the elimination of "non-tariff" barriers. Such barriers to trade include quotas on imported foreign goods and (notably) services, and regulations that tend to discriminate against using foreign relative to domestic goods and services. The latter create trade costs that are difficult to quantify (and especially to express in an *ad valorem* form equivalent to tariff rates). Yet as Anderson and van Wincoop (2004) have recently stressed, such trade costs may be quite large.

Beyond the elimination of explicit policy-induced tariff and non-tariff barriers, the formation of an FTA may pry open more "information" flows between nations' governments, firms, and households that spur (endogenously) more transactions between countries, which likely would lead to greater specialization among countries with its consequent benefits of greater production efficiencies, a wider variety of potential intermediate and final goods, and the associated benefits of higher standards of living.

Our early exploration of GCC trade patterns reveals that GCC member countries' bilateral trade flows tend to *fit well* the pattern of bilateral trade flows of most countries. In the context here, GCC trade with 94 other countries and with EU countries tends to be explained well using the gravity equation, which has been used for decades to explain trade patterns among developed economies, as well as between and among developing economies. This suggests that the gravity-equation framework is a potentially suitable one for exploring the impacts of economic integration agreements.

As the reader will likely have surmised, two imposing problems have always faced economists in quantifying the net benefits or costs of discriminatory trade agreements. The first imposing problem is quantifying the *reduction in trade costs* associated with an FTA (or other economic integration agreement). Most numerical CGE models have estimated the initial trade costs using tariff rates and – in some cases – *ad valorem* equivalents of non-tariff barriers. However, as Anderson and van Wincoop (2004) stress recently, these factors alone may underestimate considerably trade costs, and consequently underestimate the potential benefits of regional integration agreements. One benefit of the approach used in this study has been to "let the data decide" the *average treatment effect* of an FTA. Our study suggests fairly reliably that the ATE (or gross bilateral trade creation effect) of forming an FTA ranges from 33 percent (over five years) to 90 percent (over 15 years). These estimates suggest that the average effect of an FTA is to add *5 percent annually* to the *level* of two countries' bilateral trade (for up to approximately 15 years); consistent with our theoretical model, an FTA does not increase permanently the growth of trade.

The second imposing problem is estimating reliably the trade-diversion effects of an FTA. Quantitative estimates of the trade-diverting effects of FTAs still vary considerably, leaving much doubt for policymakers of the potential *net* economic gains from such agreements. While the approach here has not resolved the issue, we hope we have shed some light on the issue. By providing various sets of econometric estimates categorized by alternative sets of restrictions on parameter estimates, we hope to have made more transparent the underlying assumptions present in our quantitative estimates of trade-diversion effects.

Our hope is that future research will pursue further estimation of the effects of multilateral price resistance terms to help ascertain more precise estimates of trade diversion. For now, the present estimates tend to suggest net trade *creation* for both the EU and GCC from forming an FTA. Should our estimates be correct, the GCC especially should benefit – as typically does a region smaller in relative economic size – from a large percentage increase in trade.

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TABLE 1

Does the Gravity Equation Work in the Persian Gulf?

Standard Estimates for 1995 for 100 countries and GCC trade (excluding zeros)

Variable	100 countries	GCC countries	EU-GCC countries
GDPs	1.05*	1.26*	1.08*
	(106.62)	(29.63)	(19.41)
Distance	1.25*	1.59*	-0.63*
	(-30.98)	(-10.40)	(-2.10)
Adjacency	0.33	0.95	-0.15
	(1.79)	(1.09)	(-0.27)
Language	0.76*	-0.03	—
	(7.49)	(-0.10)	
FTA	-0.19	—	—
	(-1.24)		
GCC	—	0.61	2.36*
		(0.94)	(3.36)
R^2	0.75	0.70	0.81
No. of Observations	4422	417	96

*denotes statistical significance at the 5 percent level is two-tailed t-tests.

TABLE 2

Actual and Predicted Bilateral Trade Flows among GCC Member Countries
Sum of Gross Bilateral Trade Flows between the Country Pair, in Thousands of US$)
(Predicted Trade Flows based upon Specification (1) from Table 1)

Country Pair	Actual Trade	Predicted Trade	Actual Trade Greater than Predicted Trade
Saudi Arabia – Bahrain	$452,700	$215,507	Yes
Saudi Arabia – Kuwait	595,600	1,300,992	No
Saudi Arabia – Oman	220,493	216,646	Yes
Bahrain – Kuwait	74,610	27,066	Yes
Bahrain – Oman	22,080	9,900	Yes
Bahrain – Qatar	43,150	38,436	Yes
Bahrain – UAE	176,651	91,382	Yes
Oman – Kuwait	27,028	18,923	Yes
Oman – Qatar	23,885	7,534	Yes
Oman - UAE	1,657,040	256,840	Yes
UAE – Kuwait	252,472	112,812	Yes
Qatar - Kuwait	41,342	13,994	Yes

TABLE 3

Gravity Equation Coefficient Estimates using Fixed-Effects Regressions

Variables	No F.E. (1)	Time Effects (2)	Pair F.E. (3)	Time & Pair F.E. (4)
EXRGDP	0.95	0.97	0.71	1.27
	(217.5)	(230.98)	(34.54)	(47.16)
IMRGDP	0.94	0.97	0.58	1.22
	(224.99)	(235.43)	(26.57)	(41.60)
DIST	-1.03	-1.01		
	(79.09)	(-78.60)		
ADJ	0.41	0.38		
	(8.23)	(7.28)		
LANG	0.63	0.58		
	(19.06)	(17.73)		
FTA	0.13	0.27	0.51	0.68
	(3.73)	(7.19)	(10.74)	(14.27)
Constant	-14.46	-14.31	-13.03	-32.42
	(-99.71)	(98.79)	(-51.85)	(-49.29)
R^2	0.66	0.68	0.63	0.66
			(Between)	(Between)
No. of Observ.	47,081	47,081	47,081	47,081

Specifications:

(1) No Time nor Country-Pair Fixed Effects

(2) Time Fixed Effects only (F.E. coefficient estimates not shown)

(3) Country-Pair Fixed Effects only (F.E. coefficient estimates not shown)

(4) Time and Country-Pair Fixed Effects (F.E. coefficient estimates not shown)

TABLE 4
Gravity Equation Coefficient Estimates using First-Differenced Data

Variables	(1a) No Time Dummies	(1b) With Time Dummies[1]	(2a) With MR Terms	(2b) W/MR Terms & Time Dum.	(3a) With Lags & MR Terms	(3b) With Lags, MRs & Time Dum.	
GEXRGDP	0.85 (16.57)	0.87 (16.16)	0.85 (16.54)	0.87 (16.08)	1.05 (21.78)	1.03 (20.59)	
GIMRGDP	1.08 (18.86)	1.15 (19.09)	1.07 (18.81)	1.15 (19.03)	1.11 (19.46)	1.11 (18.84)	
CHGNoFTA	-0.29 (-8.72)	-0.26 (-7.81)	-0.33 (-8.09)	-0.33 (-8.10)	-0.31 (-4.47)	-0.30 (-4.42)	
CHGNoFTA{-1}					-0.22 (-2.52)	-0.23 (-2.63)	
CHGNoFTA{-2}					-0.15 (-1.50)	-0.13 (-1.29)	Sum of CHGNoFTA Coeff. Est. = -0.6542
CHGMR			0.36 (1.72)	0.65 (2.91)	0.57 (2.43)	0.63 (2.63)	
CHGMR{-1}					-0.37 (-1.28)	-0.18 (-0.61)	
CHGMR{-2}					0.01 (0.03)	-0.43 (-1.36)	Sum of CHGMR Coeff. Est. = 0.0178
Constant	-0.11 (-7.13)	-0.26 (-9.59)	-0.10 (-6.65)	-0.25 (-9.49)	-0.12 (-7.88)	-0.08 (-2.67)	
R^2	0.0259	0.0307	0.0260	0.0309	0.0294	0.0327	
No. of Observ.	36,563	36,563	36,563	36,563	31,172	31,172	

[1] Coefficient estimates for Time dummies and Country-Pair Fixed Effects dummies are not presented. The coefficient estimate sums pertain to specification (3b).