Appendix A
Gravity Model Assessment of the Impact of WTO Accession on Russian Trade

To assess the quantitative impact of WTO accession on Russian trade, we draw on estimates for merchandise trade between industrial countries derived from the Peterson Institute gravity model, many of whose explanatory variables have their origin in an augmented version of Andrew Rose's (2004) gravity model. The basic Peterson Institute model (following Rose) evaluates two-way bilateral trade flows, measured in a common currency (and adjusted for inflation), against the gravitational "mass" of explanatory variables describing the characteristics of bilateral trading partners.[1] Two fundamental variables are distance and joint real GDP. In general, gravity models find that two-way trade between countries is significantly greater the larger the combined GDP and the shorter the distance between them. Additional explanatory variables show how much two-way bilateral trade expands or contracts from the quantity predicted by the basic core variables on account of institutional or policy features of the partners. For instance, trading partners that share a common language, a common currency, or belong to the same regional trading arrangement typically enjoy greater mutual trade.

Following Rose (2004), the model additionally includes GATT/WTO membership by one or both trading partners as an institutional factor, with the expectation that membership will enhance bilateral trade. The rationale is straightforward: Accession to the GATT/WTO provides reciprocal most favored nation (MFN) status to both members and hence better trade oppor-

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1. Among other recent applications of the Peterson Institute gravity model, see DeRosa (2009).

tunities.[2] Contrary to his expectation, Rose (2004) found little appreciable impact on trade from the inclusion of two simple GATT/WTO indicator variables. One indicator variable takes a unitary value if both trading partners are members of the GATT/WTO, and zero otherwise. The other indicator variable takes a unitary value if only one trading partner is a member of the GATT/WTO, and zero otherwise.

Rose's findings stimulated considerable controversy in trade policy circles, as summarized by Rose himself (2006). Recent investigators have, for instance, emphasized the importance of so-called country fixed effects and the differential experiences of industrial countries versus less developed countries. The latest studies also stress the creation of bilateral trade by new GATT/WTO members where no trade previously existed. The variant of the Rose model employed here focuses on aggregate merchandise trade between countries at the 1-digit Standard International Trade Classification (SITC) level over the period 1976–2005 and takes into account the influence of inward foreign direct investment (FDI) stocks on the magnitude of bilateral trade flows.

Table A.1 presents estimation results both for all nonfuel merchandise trade (SITC 0 through 8, less SITC 3) and for manufactures trade (SITC 5 through 8) of industrial countries with all their trading partners.[3] Manufactures are widely held to be the most appropriate trade category for estimation by gravity models because intraindustry commerce flourishes when trade barriers are low. Moreover, tariffs on manufactures have historically been the prime object of multilateral trade liberalization under GATT/WTO auspices.

The estimation results in table A.1 indicate that the gravity model explains a substantial proportion of trade for both trade aggregates. Indeed the R-squared value for both sets of estimation results is 0.96.[4] Moreover, the coefficient estimates in table A.1 for traditional gravity model explanatory variables, such as joint GDP and distance between trading partners, bear the anticipated signs and are highly significant—particular hallmarks of gravity models.

Our main interest, however, is to estimate the increase in Russian trade with the world that would result from membership in the WTO and an expansion of inward FDI. To make these calculations, we focus on the coefficient estimates for the GATT/WTO and FDI variables, the explanatory vari-

2. Beyond direct enhancement of trading opportunities, reciprocal MFN policies imply a degree of own-country trade liberalization and therefore indirect enhancement of export competitiveness and performance through more efficient allocation of domestic resources.

3. Following Rose (2004), we use the International Monetary Fund's list of industrial countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, Turkey, United States, and United Kingdom.

4. Some caution should be exercised in interpreting the very high R-squared value for both estimation results. The statistic may be inflated by the Plumper and Troeger (2007) multistage estimation, which measures the statistic only in the last stage of the procedure.

Table A.1 Estimates for nonfuel and manufactures trade by industrial countries with all partners, with WTO membership and foreign direct investment (FDI) explanatory variables, 1976–2005

Explanatory variable	Nonfuel commodities and manufactures (SITC 0 to 8, less SITC 3)	Manufactures (SITC 5 to 8)
Both in GATT/WTO	0.16***	0.16***
One in GATT/WTO	0.15***	0.14***
Joint FDI (inward stock)	0.08***	0.08***
Distance	–0.83***	–1.03***
Joint GDP	1.04***	1.14***
Currency union	0.04**	–0.03
GSP	0.29***	0.49***
Regional FTAs	0.17***	0.18***
Common language	0.36***	0.43***
Common border	0.21***	–0.01
Landlocked	–0.14***	0.00
Island	0.30***	0.29***
Joint land area	–0.14***	–0.18***
Colony now	0.31***	0.37***
Ever a colony	0.75***	0.62***
Constant	–34.85***	–38.07***
R-squared	0.96	0.96
Observations (thousands)	34	34
Groups (thousands)	3	3

GSP = Generalized System of Preferences; FTAs = free trade agreements; SITC = Standard International Trade Classification

Sources and notes: Fixed-effects estimates obtained by a multistep method developed by Plumper and Troeger (2007). Dependent variables are bilateral trade and bilateral inward FDI stocks, both measured in log real terms. Distance, joint real GDP, joint land area, and joint real inward FDI stocks are measured in log terms. Estimates for year effects are not reported. *,**,*** denote statistical signficance at the 10, 5, and 1 percent levels, respectively. Clusters are the number of ordered country pairs in the panel dataset.

ables specially included to discern the potential impact of WTO accession on Russia's trade. For this purpose, we assume that once Russia joins the WTO, Russian trade will follow the pattern of other industrial countries.

The coefficients of both the GATT/WTO variables and the FDI inward stock variable are positive and significant. Whereas Rose's estimates for the coefficient when both partners are members of the GATT/WTO were frequently negative, the present coefficient estimates for this variable in table A.1 are positive and identical in value, 0.16, for both trade aggregates.[5] This coefficient value implies that WTO accession would raise Russian bilateral trade in nonfuel commodities and manufactures by nearly 20 percent. In dollar terms, total Russian two-way trade in manufactures was $186 billion in 2009, and total bilateral manufactures trade with the United States was $10 billion. Based on the estimated coefficient, these figures could expand to $223 billion and $12 billion, respectively, following Russian accession to the WTO.[6]

It is worth noting that the joint FDI stock variable has an estimated coefficient of 0.08 both for all nonfuel trade and for manufactures trade. This coefficient estimate implies that a 50 percent increase in Russia's inward FDI stock from the current level of about $200 billion to $300 billion—a plausible consequence of WTO membership and greater normalization of the Russian economy—would trigger an increase in total Russian two-way trade in manufactures trade of about 5 percent, or some $9.3 billion. The associated increase in bilateral manufactures trade with the United States would be $0.5 billion, assuming that the United States enjoys only a proportional increase in two-way trade.

The foregoing calculations reflect an orthodox application of gravity model analysis, confined, as mentioned, to Russia's merchandise trade with the world. We believe the results, while orthodox, do not reflect the potential growth in US trade with Russia, especially since US export levels are low compared with the size of Russian GDP and the export experience of other countries that sell into the Russian market.

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5. However, when the same trade data are disaggregated (and pooled) by 1-digit SITC categories, the gravity model frequently finds coefficient estimates for the two GATT/WTO variables that are negative but not statistically significant.

6. The percentage trade expansion is derived from the estimated coefficient for the both-in-GATT/WTO variable. Given the log-linear specification of the gravity model regression equation, the impact of WTO accession on bilateral trade is computed in percentage terms as 100*[*exp(b)* – 1.00]. In this expression, *b* is the estimated coefficient for the both-in-GATT/WTO indicator variable, and *exp(b)* is the value of the natural number *e* raised to the exponent *b*. For example, if the coefficient *b* is 0.33, then the value of *exp(b)* is 1.39, and the percentage expansion in trade is estimated as 100*[1.39 – 1.00], which equals 39 percent. Notably, this calculation assumes that the trading partner of the new WTO member is also a WTO member. According to the estimation results in table A.1, however, the trade impacts of Russian accession to the WTO cited in the main text would be only slightly lower in value if one of its trading partners was not a WTO member, because the coefficient estimates for the one-in-GATT/WTO variable are only somewhat lower in value.

The calculations we offer in the main text and summarize in the next paragraph are more speculative but, in our opinion, better reflect the potential of US-Russian trade within the framework of normal WTO rules. These alternative calculations are based on the supposition that the so-called fixed-effects coefficient that uniquely characterizes US-Russian export relations is zero, rather than the negative value found in gravity model analysis.[7]

Following this approach, it appears the potential total US exports to Russia are 2.8 times the size of actual US exports to Russia.[8] Since actual US exports to Russia in the last "normal" trade year before the Great Recession, namely 2008, were $9.3 billion, it appears that potential US exports could be as much as $26 billion. We think this figure, a near-tripling of total US exports to Russia, better represents the potential growth of trade within the WTO framework than the orthodox gravity model analysis. Conservatively, in the main text, we refer to the prospect of doubling US-Russian trade in the wake of WTO accession and PNTR.

7. See the technical explanation in DeRosa (forthcoming).

8. For US exports of manufactures to Russia, US potential trade is 2.2 times greater than the recorded size of US shipments to Russia.