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Working Paper

Privatization and the unusual case of Belarusian accession to the WTO

BOFIT Discussion Papers, No. 2/2017

Provided in Cooperation with:

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Suggested Citation: Balistreri, Edward J.; Olekseyuk, Zoryana; Tarr, David G. (2017) : Privatization and the unusual case of Belarusian accession to the WTO, BOFIT Discussion Papers, No. 2/2017, ISBN 978-952-323-153-5, Bank of Finland, Institute for Economics in Transition (BOFIT), Helsinki, <https://nbn-resolving.de/urn:nbn:fi:bof-201702271167>

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BOFIT Discussion Papers
2 • 2017

Edward J. Balistreri, Zoryana Olekseyuk and
David G. Tarr

Privatization and the unusual case of Belarusian accession to the WTO



Bank of Finland, BOFIT
Institute for Economies in Transition

BOFIT Discussion Papers
Editor-in-Chief Zuzana Fungáčová

BOFIT Discussion Papers 2/2017
14.2.2017

Edward J. Balistreri, Zoryana Olekseyuk and David G. Tarr: Privatization and the unusual case of Belarusian accession to the WTO

ISBN 978-952-323-153-5, online
ISSN 1456-5889, online

This paper can be downloaded without charge from <http://www.bof.fi/bofit>.

Suomen Pankki
Helsinki 2017

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Edward J. Balistreri, Zoryana Olekseyuk and David G. Tarr

Privatization and the unusual case of Belarusian accession to the WTO

Abstract

The accession negotiations of Belarus to the WTO are unusual since, due to its obligations in the Eurasian Economic Union, WTO accession is not expected to impact its tariffs or formerly substantial trade distorting agricultural subsidies. Nonetheless, we estimate that WTO accession will increase welfare by 8.8 percent per year in Belarus in the medium term. We show that inclusion of (i) foreign direct investment; (ii) reduction on non-discriminatory barriers against services providers; and (iii) our model with imperfect competition and endogenous productivity effects together produce estimated gains eleven times larger than a model of perfect competition with only cross-border trade in services. Our analysis is enabled by our production of a dataset on both discriminatory and non-discriminatory barriers in services and their ad valorem equivalents. Based on a new dataset on labor productivity by sector and type of ownership, in our central model we estimate that privatization will increase welfare by 35.4 percent. We find substantial variance in the estimated gains from privatization depending on model assumptions; but all the estimates of the impacts of privatization indicate substantial welfare gains.

Keywords: privatization, services liberalization, endogenous productivity, foreign direct investment, WTO accession.

JEL Classification: D02, D58, F13, F14, L16, C68.

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Acknowledgements

We express our thanks for helpful conversations, insights and contributions to Sebastian Eckardt, Maryna Sidarenka, Irina Tochitskaya, Zuzana Fungacova and Sebastian Saez. Irina Kolesnikova is responsible for the crucial papers on the estimates of the ad valorem equivalents of the barriers in services and the ownership shares by region in the services sectors. The National Statistical Committee of the Republic of Belarus (Belstat) was extremely helpful in the provision of data, including the labor productivity data. We thank numerous organizations and Ministries in Belarus for providing interviews. Tarr gratefully acknowledges the provision of an excellent research environment for work on this paper at the Bank of Finland Institute for Economics in Transition. The views expressed are those of the authors and do not necessarily reflect those of the World Bank, its Executive Directors, the Bank of Finland or those acknowledged.

1 Introduction

The Working Party on the accession of Belarus to the World Trade Organization (WTO) was established on October 27, 1993, and held its first meeting in June 1997. Despite the fact that the latest meeting of the Working Party was held in May 2005, Belarus has shown increased interest in WTO accession and bilateral market access negotiations have been ongoing in recent years. Belarusian accession to the WTO is complicated by the fact that Belarus is a member of the Eurasian Economic Union (with Russia and Kazakhstan since 2010 and with Armenia and the Kyrgyz Republic since 2015), under which it imposes a common external tariff. Most importantly, Russian accession to the WTO has resulted in Belarusian obligations to adopt many of the commitments of Russia to WTO members, including Russia's tariff commitments and limitations on trade distorting subsidies in agriculture. Consequently, many in Belarus assess their situation as one in which they incur some important obligations as if they were WTO members, without obtaining the rights of a member. Partly motivated by these facts, since 2010, there has been substantial work between the WTO members and the Government of Belarus, especially in bilateral market access negotiations.¹

Despite the tariff and agricultural subsidy obligations of the Government of Belarus under the Eurasian Economic Union (EEU), WTO accession would be expected to have substantial impacts on the economy. Commitments or reform will include areas such as rights of investors in business services (both foreign and domestic), customs regulations, product standards, especially in food and agricultural, possible improved treatment in antidumping investigations of its exporters, trade related intellectual property and trade related investment measures.

We develop an innovative computable general equilibrium model of the economy of Belarus to undertake an assessment of WTO accession of Belarus. Crucially, the model incorporates foreign direct investment (FDI) in business services, since with the incorporation of the GATS in the WTO, the rights of foreign investors in services are a crucial aspect of WTO accession negotiations. Importantly, accession negotiations extract commitments to reduce both discriminatory and non-discriminatory barriers to investors. Also crucially, the model contains endogenous productivity effects through the Dixit-Stiglitz mechanism from additional varieties of services. As such, our model is consistent with both economic theory and the substantial and growing empirical literature² showing

¹For a list of documents available on WTO accession of Belarus by the WTO Secretariat see http://www.wto.org/english/thewto_e/acc_e/a1_belarus_e.htm.

² See Francois and Hoekman (2010) for a survey of the theory and more than a dozen empirical studies that support this finding. Additionally, in recent years, several studies that use firm level data support this finding including Arnold et al. (2011) for the Czech Republic, Fernandes and Paunov (2012) for Chile, Arnold et al. (2015) for India, and Shepotylo and Vakhitov (2015) for Ukraine.

that foreign direct investment and the wide availability of business services results in total factor productivity gains to the manufacturing sector and the economy broadly.

We estimate that WTO accession would be expected to increase the welfare (or real income) of Belarusian nationals by 8.8 percent of private consumption per year. Through our sensitivity and decomposition analysis, we show that these significant estimated gains depend crucially on: (i) our monopolistic competition model with Dixit-Stiglitz endogenous productivity effects; (ii) the inclusion of FDI; and (iii) the reduction of non-discriminatory barriers against services suppliers in Belarus. Compared with an approach which would limit the analysis of services to cross-border trade under perfect competition, we obtain estimated gains more than ten times larger. This analysis was enabled by the production of a dataset on barriers to services in Belarus and their ad valorem equivalents, as well as the market shares of foreign and Belarusian firms in these sectors. We make both datasets publicly available in Kolesnikova (2014a; 2014b).

We obtained access to a dataset courtesy of the National Statistical Committee of Belarus (Belstat) on labor productivity by six aggregate sectors of Belarus and by three types of ownership: (i) 100 percent state owned; (ii) majority state owned; and (iii) majority private, including foreign owned. Based on these data on labor productivity, we assess the impact of a fifty percent reduction in the fully state owned share of each sector, replaced by the private sector³ where we assume that the new private firms would have, on average, the labor productivity of the incumbent private firms. We find that privatization would lead to a dramatic increase in the welfare of Belarus of 35.4 percent of consumption per year under our central modeling assumptions of privatization, i.e., four times larger than assessment of the impact of WTO accession.

By combining and comparing in one paper: (i) privatization, which is a fundamental institutional reform and (ii) accession to the WTO, we contribute to the discussion on the relative importance of trade and institutions. The relative importance of trade and investment liberalization compared to institutional reform is a much debated subject in the literature. Rodrik and Trebbi (2004) argue that institutions are much more important than trade and that once institutions are controlled for in the econometrics; then trade only affects growth through its impact on institutions. On the other hand, Dollar and Kraay (2003) argue that Rodrik and Trebbi did not use proper statistical procedures; their results show an important role for both trade and institutions in the long run and an even stronger role

³ As we explain below, due to data limitations, we rather conservatively exclude the large industry (or manufacturing) sector from the privatization simulation. (See table 1 for all the sectors classified as industry (IND)). Further, we also examine the impact of also excluding the following sectors from the privatization scenario: education; health care and social services; public services; and community, social and personal services. Despite these rather substantial exclusions from the privatization scenario, the gains from privatization remain substantial in all variations of the privatization scenarios.

for trade over institutions under shorter time horizons. Several papers have shown important interaction effects between trade and institutions that complicates the effort to disentangle the impacts. Ades and di Trella (1999) find that trade improves institutions through its reduction in corruption. On the other hand, institutional reform can lead to openness. The strong pressure multinational providers of services exert in WTO accession negotiations suggests that reductions in cost increasing services barriers has the impact of increasing foreign direct investment and opening the economy; this is supported by the results of Alessina et al. (2005).⁴ Finally, Freund and Bolarky (2008) find that trade promotes growth in countries with good institutions; but trade did not increase growth among countries with bad institutions (countries with bad institutions are those that are in the worst quartile of their excessive regulations index).

Given that we have simulation laboratory, we isolate the impact of privatization (as an exogenous labor productivity shock) from the impact of WTO accession (which endogenously improves resource allocation and leads to productivity gains through additional foreign varieties).⁵ As the discussion above suggests, in the real world, the impacts will be interrelated, but they are independent in our simulations.

We conduct extensive sensitivity analysis of both our WTO accession and privatization scenarios, with respect to modeling assumptions and parameter values. Although there is a large variance in the estimated gains from privatization depending on the modeling assumptions, the estimated gains from privatization are always very large.

In section 2, we provide a review of the literature and an overview of the model. In the literature review, we summarize how this class of models produces welfare results substantially larger than perfect competition models without foreign direct investment. The key data are explained in section 3. Results for WTO accession are explained in section 4. Privatization under different modeling assumptions is discussed in section 5. We conduct both modeling and parameter sensitivity analysis in section 6. In section 7 we discuss how this model has been used in the public awareness programs for WTO accession in Russia, Kazakhstan and Ukraine. We offer conclusions in section 7.

⁴Alessina et al. (2005) find that regulatory reform, especially liberalization of barriers against entry, plays a strong role in increasing investment in the sector.

⁵ Our WTO accession scenario results in an increase in the share of multinationals in the services sectors of Belarus, and hence an increase in the private share of the economy. However, in our WTO scenario, we do not incorporate the exogenous labor productivity increase that is the sole shock in our privatization scenario. And in our privatization scenario, we impose the productivity shock on the pre-WTO accession structure of the economy of Belarus. So we believe that our scenarios measure independent reforms.

2 Literature review and overview of the model

2.1 Literature review

2.1.1 Representative agent models

With the formation of the World Trade Organization, commitments to foreign investors in services became a key pillar of international trade negotiations. Services commitments are now a key aspect of WTO accession negotiations in particular and are important chapters of modern free trade agreements. As a result, interest in assessing the impacts of services liberalization has emerged. The initial computable general equilibrium (CGE) efforts to model services liberalization (for example, Brown *et al.* (1996); Robinson *et al.* (2002); Konan and Maskus (2006)) did not allow for imperfect competition or a foreign commercial presence; rather they focused on cross-border trade in services under perfect competition.⁶ There have been several papers in recent years, however, that examine FDI in services. Markusen, Rutherford and Tarr (2005) introduced a stylized CGE model with FDI in services and Dixit-Stiglitz endogenous productivity effects. These key features were developed into a full small open economy CGE model with a single representative agent. This model was used to analyze WTO accession of Russia by Jensen, Rutherford and Tarr (2006; 2007), WTO accession in Kazakhstan by Jensen and Tarr (2008) and WTO accession in Ukraine by Copenhagen Economics *et al.*, (2006).⁷

2.1.2 Multiple households and poverty impacts

In order to assess the impact of Russian WTO on poverty, Rutherford and Tarr (2008) extended the model to incorporate all the 50,000 plus households of the Russian household survey as agents. The results confirmed the view of the microsimulation literature that there is substantial diversity in results that is masked by representative agent models. It also showed, however, the crucial importance of incorporating foreign direct investment in services with endogenous productivity effects in WTO

⁶ Konan and Maskus employed a constant returns to scale model with markups above marginal costs. They argue that liberalization of barriers against FDI in services will eliminate the markups; but multinational production in the host country is not modeled and there is no change in FDI flows in their model. A more complete survey of the literature may be found in Tarr (2013) or Francois and Hoekman (2010).

⁷ Other efforts to include FDI in services in CGE models of trade with imperfect competition were Dee *et al.* (2003) and Brown and Stern (2001). Brown and Stern (2001) and Dee *et al.* (2003) employ multi-country numerical models, where FDI is treated as a capital flow, with barriers creating a tax equivalent on the capital flow. A reduction in the barriers against FDI leads to a reallocation of global capital, but multinationals are not treated as producers in the host countries. Their models contain three sectors, agriculture, manufacturing and services, and are thus rather stylized. Results in the Brown and Stern paper depend crucially on capital flows between nations. For example, they estimate that Japan will lose from multilateral liberalization of barriers to FDI service providers because Japan is a capital exporting nation. In Dee *et al.*, (2003) welfare results depend largely on rent capture. The productivity effect from the impact of service sector liberalization on product variety is not mentioned in the results of Brown and Stern and are interpreted as of little relevance in Dee *et al.*

accession models, since the comparable perfect competition model with no foreign direct investment produced an almost non-overlapping distribution of household welfare gain estimates.

2.1.3 Multiple regions

In Rutherford and Tarr (2010), the model of the single representative consumer model was extended into a ten region model of Russia (with a single representative consumer in each region). Russia in aggregate was modeled as a small open economy, but within Russia, the model was a multi-region trade model with foreign direct investment in each of the ten regions. The principal explanation for the differences across regions is the ability of the different regions to benefit from a reduction in barriers against foreign direct investment. The three regions with the largest welfare gains are clearly the regions with the estimated largest shares of multinational investment. Moreover, regions may gain more from WTO accession if they can succeed in creating a good investment climate.

2.1.4 Preferential trade arrangements

Given the importance of preferential commitments to foreign investors in services, the model was extended to incorporate preferential commitments to foreign investors in services. This allowed an assessment of preferential liberalization of services barriers. The model was applied to Kenya in Balistreri, Jensen and Tarr (2015) and to Tanzania in Jensen and Tarr (2010). The authors decomposed the rest of the world into the European Union, an Africa partner region and a residual rest of the world. They showed that there is an imperfect competition extension of the idea of trade diversion. That is, preferential liberalization of barriers against partner country services providers will result in fewer varieties of services from excluded countries. Immiserizing preferential liberalization of services is more likely the more technologically advanced are the excluded regions relative to the partner region and the greater the share of rents from the services barriers captured by the home country initially.

In Jensen and Tarr (2011), the authors applied this model of preferential commitments in goods and services to Armenia to assess the potential “Deep and Comprehensive Free Trade Agreement” under negotiation between Armenia and the European Union. They showed that it was only the deep aspects of the agreement that would benefit Armenia, especially the trade facilitation and services liberalization aspects of the agreement.

2.1.5 Impact of liberalization of non-discriminatory services barriers

In Balistreri, Rutherford and Tarr (2009) and Jensen, Rutherford and Tarr (2010), the methodology was extended to assess the impact of non-discriminatory barriers against foreign suppliers of services and applied in Kenya and Tanzania, respectively. The background empirical work of the barriers in

services revealed that the most important barriers in both countries were barriers that increased costs of both local and multinational providers of services. The estimates showed very substantial potential gains (over ten percent of consumption in the case of Kenya) from a fifty percent reduction of all barriers against potential providers of services (both local and multinational). Due to the fact that non-discriminatory barriers impact all firms, we have found that this reform tends to be one of the most important for the welfare results, a theme that reappears in this paper on Belarus.

2.1.6 Key results across countries – crucial impact of FDI and imperfect competition

A common theme of the above literature is the crucial importance to the welfare results of including foreign direct investment and increasing returns to scale (IRTS) and imperfect competition with Dixit-Stiglitz endogenous productivity effects from additional services providers. In Rutherford and Tarr (2008), the estimated welfare gains of Russian WTO accession from a constant returns to scale (CRTS) perfect competition model were 1.2 percent of consumption; at 7.2 percent on consumption, the estimated gains were six times larger with the IRTS model. The estimated welfare gains for Kazakhstan were 0.5% of consumption with CRTS and 6.7% with IRTS. Balistreri, Rutherford and Tarr (2009) estimated the impact of services liberalization in Kenya at 3.4 percent with CRTS, but 11.1 percent with IRTS. Jensen, Rutherford and Tarr (2010) estimated the gains from services liberalization in Tanzania would be 1.9% of consumption under a CRTS model, but 5.3 percent of consumption with IRTS.

2.1.7 Extensions in the paper

This paper builds on the algebraic structure of Balistreri, Jensen and Tarr (2015) and Jensen and Tarr (2012). But we extend the model in several directions to analyze new issues: (i) productivity increases from privatization; (ii) reductions in non-discriminatory services barriers in the context of WTO accession; and (iii) the impact of the reduction of tariffs in a customs union on a member, including the impact of preference erosion.⁸

2.2 Overview of the model

Here we provide a general description of the structure. A mathematical description of the model is available as appendix G of Balistreri, Olekseyuk and Tarr (2016). There are 35 sectors in the model shown in table 1. Figure 1 depicts the structure of production in a representative sector. Primary

⁸Below, we summarize the results of our analysis of the reduction of tariffs in Belarus as a result of its membership in the Eurasian Economic Union. See World Bank (2015) for details.

factors include skilled and unskilled labor; mobile capital; sector-specific capital in imperfectly competitive sectors; and primary inputs imported by multinational service providers, reflecting specialized management expertise or technology of the firm. The existence of sector specific capital in several sectors implies that there are decreasing returns to scale in the use of the mobile factors and supply curves in these sectors slope up.

There are three categories of firms in the model: (1) perfectly competitive goods and services sectors; (2) imperfectly competitive goods sectors; and (3) imperfectly competitive services sectors with foreign direct investment. Regardless of sector, all firms minimize the cost of production. The model is a small open economy model in which we disaggregate the rest of the world region into four regions: (1) the European Union; (2) Russia-Kazakhstan; (3) the rest of the Commonwealth of Independent States plus Georgia; and (3) the Rest of the World. In the imperfectly competitive sectors, this requires introducing different firm types with distinct cost structures for each region. We retain the small open economy model framework, so only Belarus is modeled fully.

2.2.1 Perfectly competitive goods and services sectors

In the fourteen competitive goods and services sectors, goods or services are produced under constant returns to scale and where price equals marginal costs with zero profits. This includes agriculture, mining and several services sectors such as public services, health and education. In these sectors, we employ the Armington (1969) assumption, which means that products are differentiated by country of origin. All goods producing firms (including imperfectly competitive firms) can sell on the domestic market or export. Firms optimize their output decision between exports and domestic sales based on relative prices and their constant elasticity of transformation production function. Having chosen how much to allocate between exports and domestic sales, firms also optimize their output decision between exports to the four possible export regions, based on relative prices the four regions and their constant elasticity of transformation production function for shifting output between the regions.

2.2.2 Goods produced subject to increasing returns to scale (IRTS)

Goods in these thirteen sectors (and all IRTS services) are differentiated at the firm level. Each firm produces a unique variety that is differentiated in the demand functions of users of the goods. Users of the differentiated goods have an elasticity of substitution (Dixit-Stiglitz) for the different varieties. The number of varieties affects the productivity of the use of imperfectly competitive goods based on the standard Dixit-Stiglitz formulation, i.e., the effective cost function for users declines in the total number of goods-firms in the industry. Manufactured goods may be produced domestically or imported from firms in any region in the model. Firms in these industries set prices such that marginal cost equals marginal revenue; and there is free entry, which drives profits to zero. For domestic firms,

costs are defined by observed domestic primary factors and intermediate inputs to that sector in the base year data. Foreigners produce the goods abroad at constant marginal cost with respect to output (if factor prices are held constant), but incur a fixed cost of operating in Belarus. The transportation cost inclusive import price of foreign goods is simply defined by the import price, and, by the zero profits assumption, in equilibrium the import price must cover fixed and marginal costs of foreign firms. Firms set prices using the Chamberlinian large group monopolistic competition assumption within a Dixit-Stiglitz framework, which results in constant markups over marginal cost for both foreign firms and domestic firms. Following Krugman (1980), we assume that the composition of fixed and marginal cost is identical in all firms producing under increasing returns to scale (in both goods and services). This assumption in our Dixit-Stiglitz based Chamberlinian large-group model assures that output per firm for all firm types remains constant, i.e., the model does not produce rationalization gains or losses.

In the models of Russian WTO accession of Jensen, Rutherford and Tarr (2007) and Rutherford and Tarr (2008), domestic firms faced a perfectly elastic demand curve on export markets and they exported at marginal costs. In this model, consistent with firm level product differentiation, we assume that the elasticity of demand in each of the export markets is the Dixit-Stiglitz elasticity of demand. Firms then set marginal revenue equal to marginal costs in each of the three export markets; then the export markets contribute to the quasi-rents of the firm and affect the entry and exit decisions of firms. Introducing downward sloping demand curves into the model means that there are possible terms of trade affects to consider in this model that were not present in the Jensen, Rutherford and Tarr model.⁹

2.2.3 Service sectors under increasing returns to scale and imperfect competition

In these services sectors, we observe that some services are provided by foreign service providers on a cross-border basis analogous to goods providers from abroad. But a large share of business services are provided by service providers with a domestic presence, both multinational and Belarusian.¹⁰ Our model allows for both types of foreign service provision. There are cross-border services allowed in these sectors and they are provided from abroad at constant costs—this is analogous to competitive

⁹ Balistreri and Markusen (2009) show that since Chamberlinian firms choose an optimal markup based on the elasticity of substitution between firm varieties, which equals the export demand elasticity, the role for optimal tariffs is significantly reduced.

¹⁰ Data for the US show that sales of services for foreign affiliates of multinationals are more than twice that of their cross-border sales of services, Markusen (2013). Brown and Stern (2001, table 1) estimate the world-wide cross-border share of trade in services at 41% and the share of trade in services provided by multinational affiliates at 38%. Travel expenditures (20%) and compensation to employees working abroad (1%) make up the difference.

provision of goods from abroad. Following the estimates of Broda and Weinstein (2006) for an aggregate of services, the elasticity of substitution for services from firms with a domestic presence (either foreign or domestic) is three in our central scenario. Cross border services, however, are not as good substitutes; the elasticity of substitution between cross border services and services provided by firms with a domestic presence is 1.5.

Crucial to the results, we allow multinational service firm providers to establish a presence in Belarus in order to compete with Belarusian firms directly. As in the goods sectors, services that are produced subject to increasing returns to scale are differentiated at the firm level. Firms in these industries set prices such that marginal cost equals marginal revenue; and there is free entry subject to the ad valorem equivalents of the barriers, which drives profits to zero.¹¹ We assume firm level product differentiation and employ the Chamberlinian large group monopolistic competition assumption within a Dixit-Stiglitz framework. Given our assumption on the composition of fixed and variable costs, we have constant markups over marginal cost for both foreign firms and domestic firms, i.e., no rationalization impacts.

For domestic firms, costs are defined by observed primary factors and intermediate inputs to that sector in the base year data. When multinationals service providers decide to establish a domestic presence in Belarus, they will import some of their technology or management expertise. That is, foreign direct investment generally entails importing specialized foreign inputs. Thus, the cost structure of multinationals differs from national only service providers. Multinationals incur costs related to both imported primary inputs and Belarusian primary factors, in addition to intermediate factor inputs. Foreign provision of services differs from foreign provision of goods, since the service providers use Belarusian primary inputs. Domestic service providers do not import the specialized primary factors available to the multinationals. Hence, domestic service firms incur primary factor costs related to Belarusian labor and capital only. These services are characterized by firm-level product differentiation. For multinational firms, the barriers to foreign direct investment affect their profitability and entry. Reduction in the constraints on foreign direct investment creates profit opportunities that will induce foreign entry until a zero profit equilibrium is restored. Entry and more service varieties will lead to productivity gains from the Dixit-Stiglitz variety externality.

2.2.4 Productivity increase from privatization

We have data (discussed below) on labor productivity by sector and by type of ownership. For each sector, firms are classified into three ownership structures: (i) 100 percent state owned enterprises;

¹¹ In some sectors, entry to multinationals, and even to private Belarusian firms, is prohibited. This is equivalent to an infinite ad valorem equivalent.

(ii) majority state owned enterprises; and (iii) majority privately owned firms, including foreign owned firms. In the privatization scenario, we consider a reduction in the share of the fully state owned enterprises by fifty percent and an equal increase in the share of the majority private firms. In our counterfactual privatization scenario, we implement a labor productivity increase that varies by sector based on the productivity differences between the fully state owned enterprises and majority private enterprises by sector, where we assume that the entering private firms have an average labor productivity equal to the incumbent private firms. The productivity changes differ across sectors and are reported in table 2. A formal characterization and explanation of how this implemented in the model is provided by equation 10 in appendix G) of Balistreri, Olekseyuk and Tarr (2016).

3 Key data

3.1 Ad valorem equivalents of barriers to foreign direct investment in services sectors

Estimates of the ad valorem equivalents (AVEs) of the barriers to FDI in services are important to the results. Consequently, to obtain a good picture of the regulatory regimes, Irina Kolesnikova conducted extensive interviews of government regulatory agencies and industry associations¹² in the relevant sectors, utilized official government reports, academic studies and the World Bank 160 page survey of the regulatory regimes in the key business services sectors in Belarus (documented in Borchert *et al.*, 2014). We focus on insurance, banking, fixed line and mobile telecommunications services, air transportation, road transportation, and rail, water and other transportation services, professional services (we base the estimates on legal, accounting and auditing services) and retail services.

As a first step in the process, the methodology involved converting the answers and data of the questionnaires and interviews into two Services Trade Restrictiveness Indices (STRIs) indices in each industry: a non-discriminatory index and a discriminatory index. Some restrictions only apply to foreign firms, such as maximum foreign equity shares in firms in a sector or licensing restrictions that apply to foreigners only. These kinds of restrictions are the basis of the discriminatory STRIs. Other restrictions apply to domestic as well as foreign firms regardless of their national origin. Examples include: blocking entry of all firms to a sector (e.g., reserving the sector for state firms);

¹² The interviews included the following Ministries of Belarus: the National Bank, several departments of the Ministry of Transport and Communications, Ministry of Trade, Ministry of the Economy, Ministry of Finance, Ministry of Communications and “Informatization.” Firms and associations interviewed in Belarus included: Beltelecom, Association of Belarusian Banks, Belarusian Association of Insurers, Belarusian Association of Accountants and Auditors, Belarusian Association of Accountants, Belarusian Association of International Road Carriers, VELCOM, Belarusian Union of Lawyers, law firm of Stepanovski, Papakul and Partners, Economic Journal (Ekonomicheskaya Gazeta).

prohibitions on banks from selling insurance; limitations on the size of retail businesses, their market share in a region or their hours of operation. These kinds of restrictions are the basis of our non-discriminatory STRIs. Since WTO accession involves commitments regarding both discriminatory barriers against FDI in services and non-discriminatory barriers against all firms operating in Belarus, we estimate the ad valorem equivalents of both types of barriers and simulate reductions in both types of barriers as part of WTO accession.¹³ In addition, WTO accession involves commitments to reduce the barriers against cross-border provision of services. We take our estimates of the ad valorem equivalents of barriers against FDI in services as our proxy for the estimates of the barriers against cross-border provision of services.

Our methodology builds on a series of studies supported by the Australian Productivity Commission, including McGuire, Schuele and Smith (2000), McGuire and Schuele (2000), Kalirajan (2000) and Nguyen-Hong (2000). We first score the regulatory barriers indices consistent with the STRI methodology employed by the Australian authors.

We then convert the STRIs into ad valorem equivalents. We rely on econometric estimates by Warren (2000) in telecommunications (for both fixed line and mobile), Kalirajan et al., (2000) in financial services (for both banking and insurance), Kang (2000) in transportation services (for all four transportation sectors), Nguyen-Hong (2000) in professional services (for both accounting and auditing, and legal services) and Kalirajan (2000) for retail distribution services. Except for Warren, in all studies the authors regressed a measure of the price or costs of services against their STRIs and other control variables in a cross-country regression at a point in time to determine the impact of the regulatory barriers on the price of services.¹⁴ Through the estimated coefficient for the STRI in their regressions, the authors estimated the ad valorem equivalents of the regulatory barriers in the countries of their sample. We calculate the AVEs by assuming that the impact of the STRIs in the regressions on these studies applies to Belarus. Results for our services sectors in Belarus are in table 2. What is unusual about the AVEs in Belarus is how high the non-discriminatory barriers are in comparison to other countries where we have performed these exercises and how high they are in relation to the discriminatory barriers, especially in rail, insurance and air services. This is explained by the favoritism provided to state owned enterprises, sometimes de jure and sometimes de facto. This prevents private Belarusian firms from competing in the sector. For example, airport terminal services

¹³ The WTO Guidelines Scheduling Services Commitments notes that non-discriminatory measures that limit market access of WTO members fall under the purview of the GATS scheduling negotiations. In particular, World Trade Organization (2001, p.4) states “all measures falling under any of the categories listed in Article XVI:2 must be scheduled, whether or not such measures are discriminatory.”

¹⁴ Warren estimated quantity impacts and then, using elasticity estimates and a measure of the quantity of telephone subscribers in each country, was able to obtain price impacts and ad valorem equivalents.

are de facto generally reserved for state owned firms, while rail transport services are de jure reserved for the state and all private insurance companies are prohibited from providing many insurance services. Discriminatory barriers are especially high in rail and insurance services. Foreign insurance companies may not provide a very wide range of insurance services. A summary of the key restrictions may be found in Kolesnikova (2014c). Full documentation of the scoring for both discriminatory and non-discriminatory STRIs in Belarus and their AVEs for our eight services sectors may be found in Kolesnikova (2014a).

In our model, and in table 2, we convert the AVEs with the unrestricted price in the denominator (as estimated by Kolesnikova, 2014a) to an AVE with the domestic price with restrictions in the denominator.¹⁵ The conversion implies that our AVEs have a maximum of 100 percent.

3.2 Estimated labor productivity by type of ownership and productivity increases

Belstat provided data to the World Bank on value-added and employment by six aggregate sectors and by three classes of ownership: (i) 100 percent state owned enterprises; (ii) mixed ownership with majority state ownership; and (iii) majority private companies including foreign owned companies. Data are available from 2004 to 2010 inclusive (World Bank, 2012). We map each of the 35 sectors in our model to one of the six aggregate sectors (the mapping is shown in table 1). We use these data to calculate labor productivity by sector and class of ownership by dividing value-added in the sector and class of ownership by corresponding employment. We then calculate the weighted average labor productivity in each of the six sectors in the year 2010,¹⁶ using the ownership shares of value-added in the sector as the weights of the three labor productivities.

In our counterfactual scenarios, we assume that in each of our six aggregate sectors, the share of 100 percent state owned enterprises is decreased by 50 percent and the share of majority private owned firms increases by an identical amount. Then we calculate the predicted weighted average labor productivity in the counterfactual, assuming unchanged labor productivities of the separate classes of ownership. Taking the ratio of the new productivity index to the productivity index using the 2010 data, we calculate the percentage increase in productivity by sector from the increase in the private sector share of the economy. In the counterfactual scenario, we assume that labor productivity

¹⁵ In particular, let $AVE = (D-W)/W$ = ad valorem equivalent with the unrestricted world price as the base, or denominator; let D = domestic price before reform, and W = unrestricted world price. We have: (1) $AVE = (D/W) - 1$, where we take the AVE (as a ratio) from Kolesnikova (2014a). Rearranging, we have: (2) $W/D = 1/[AVE+1]$. Multiplying (1) by W/D and using (2), we have (3) $(D-W)/D = AVE*W/D = AVE/[AVE+1]$.

¹⁶ We use 2010 as the most recent year for which data were available. For a discussion of the full dataset and related issues, see Chapter 3, "Transforming the State Owned Enterprise Sector," in World Bank (2012).

of our sectors increases by the percentages we have calculated. The productivity increases that we assume for each sector in our privatization scenario are listed in table 2. Details of the methodology, including the data and calculations, are provided in appendix C of Balistreri, Olekseyuk and Tarr (2016)).¹⁷

3.3 Social accounting matrix (SAM)

3.3.1 Going from the input-output table to our social accounting matrix (SAM)

The primary data sources were data from the Belarusian National Accounts¹⁸ and the Input-Output (IO) tables for 2011 at basic and consumer prices. The former are publicly available from the National Statistical Committee of the Republic of Belarus (2013), while the latter were supplied by Belstat to the World Bank at our request. Given the applications of our model, it was necessary to supplement the data sources in several areas. Detailed documentation of the construction of the SAM is available as appendix D in Balistreri, Olekseyuk and Tarr (2016). In this and the next subsection, we highlight the three most important adjustments.

Most importantly, as shown in table 1, our SAM includes 35 sectors. However, the initial IO table includes only 30 sectors, with highly aggregated services. In order to be able to examine the effects of services trade liberalization as a part of WTO accession, we decomposed three of the services sectors in the original IO table into sub-sectors based on data provided by Belstat to the World Bank. In particular, (i) transport and communications is: communication, 20%; air transport, 1%; road transport, 27%; and rail, water and other transport, 52%; (ii) financial activities is: insurance, 3%; other financial services 97%; and (iii) real estate, renting and business services to consumers is: real estate, renting and business services to consumers, 61%; other professional services, 39%. In the disaggregation, we assume that that input-output shares of the subsectors are identical to the aggregate sector.

A second significant departure from the original IO table is that we decomposed the labor input into skilled and unskilled labor. This was based on publicly available data in Belstat (2012a, 2012b).

¹⁷ We map 16 of our sectors to the aggregate “Industry” sector, where we calculate a zero productivity increase. However, the state industry sector, especially the refinery sector, receives oil at less than market prices. This is an implicit subsidy, but it is not accounted for by Belstat. In general, value-added should be adjusted for taxes or subsidies. Had we adjusted for this implicit subsidy, the state companies in the Industry sector would have lower value-added and labor productivity, and we would have estimated a productivity increase from privatization. Our estimates of the productivity increase of privatization should be considered conservative (or biased down) to the extent that we failed to account for the subsidy from state firms receiving energy products at below market prices.

¹⁸ National Statistical Committee of the Republic of Belarus (2013).

3.3.2 Export and import data by sector with decomposition of rest of the world

Using the IO tables for 2011 as a base for the SAM, we only have data on imports and exports with the rest of the world (ROW). However, as different trade regimes apply to different trade partners of Belarus, and we simulate preferential trade policy changes in other applications of our model, we decompose the rest of the world into four regions with three of them being the most important trading partners of Belarus: Russia and Kazakhstan, which were the other members of the Eurasian Customs Union (CU) at the time of the study; other members of the Commonwealth of Independent States (CIS) and Georgia; the European Union (EU); and the ROW (see table 1). We classify commodity trade within the CU as well as with the CIS countries (including Georgia) as free trade according to the plurilateral and bilateral regional trade agreements. Most Favored Nation (MFN) status is applied to the EU and ROW.¹⁹

Regarding trade flows of goods and cross-border flows of services by region of our model, we hold the total trade flows from the IO table constant and calculate import and export shares by region and sector of our model using trade data supplied to us by Belstat. The resulting trade flows by trading partner are presented in World Bank (2015, table 5).

3.4 Share of the output of the sector produced by multinational service providers

The impact of liberalization of barriers to foreign direct investment in business services sectors will depend on the share of the output of the sector sold by multinationals. We need ownership shares for each of the regions of our model for all eight of the sectors of our model with foreign direct investment. Data were obtained from the National Statistical Committee and several Ministries of Belarus, commercial sources such as Bankscope and Axco and several professional associations in Belarus. Details of the calculations may be found in Kolesnikova (2014b) and the results of the calculations are in table 1.

3.5 Small improvement in market access for belarus from treatment in antidumping actions

Belarus already enjoys MFN treatment or better with all of its significant trading partners, so MFN status accorded WTO members will not improve its market access. In antidumping and countervailing duty actions, however, WTO members are guaranteed an injury determination in which the antidumping duty will not be applied if it is found that the domestic industry was not injured by the imports.

¹⁹ Detailed description of the existing trade regimes can be found at http://www.mfa.gov.by/en/foreign_trade/trade_regime/

Since non-WTO members are not assured of an injury hearing, Belarus may expect some small improved market access as a result of WTO membership to the extent that antidumping has been an issue in certain sectors.

Based on a global database of antidumping and countervailing duty actions, described in Bown (2014), we list the antidumping and countervailing duty actions against Belarus by product, initiating country and date in appendix B of Balistreri, Olekseyuk and Tarr (2016); and we estimate price increases by sector for Belarus as a result of WTO membership--listed in table 2. We expect only modest price increases for Belarus in several sectors of between 0.5 percent and 1.5 percent, in part, due to our assessment that the guarantee of an injury determination will not typically impact the imposition of the antidumping duty.

3.6 Dixit-Stiglitz elasticities

Since we do not have rationalization gains in our model, results will differ from a competitive model only to the extent that there is a Dixit-Stiglitz variety externality. Higher Dixit-Stiglitz values mean the gains from variety are smaller and the results will be closer to perfectly competitive. Thus, we classify goods sectors as perfectly competitive if the estimates of the Dixit-Stiglitz elasticity is high or imperfectly competitive for low values.

Broda *et al.*, (2006) estimated Dixit-Stiglitz product variety elasticities of substitution at the 3-digit level in 73 countries. Belarus was not one of the countries in their dataset. As one of the Republics of the former Soviet Union, and with a somewhat comparable industrial structure, we chose Lithuania as the closest proxy for Belarus. See appendix A of Balistreri, Olekseyuk and Tarr (2016) for details of the mapping from the 130 goods sectors estimated by Broda *et al.* into the sectors of our model and the resulting elasticities.

3.7 Non-tariff measures and their ad valorem equivalents (AVEs)

Traditional command and control non-tariff barriers to trade, such as quotas and bans on imports, have largely been eliminated. Research based on a new multi-agency task force database has shown, however, that regulatory measures, especially sanitary and phyto-sanitary (SPS) measures, have become a very important barrier to trade (see Cadot and Gourdon, 2014).

Our estimates of the AVEs of NTMs are based on the estimates of Kee *et al.*, (2009). Specifically, the measures we use from Kee *et al.* are the Overall Trade Restrictiveness Index (OTRI) and the Tariff-only (OTRI_T) at the aggregated level of agriculture and manufacturing. The OTRI measures the uniform tariff equivalent of the country's tariff and NTMs that would generate the same

level of import value for the country in a given year. The OTRI_T focuses only on tariffs of each country. Kee *et al.* provide estimates based on both applied and MFN tariffs; the measure we use is based on applied tariffs, which take into account bilateral trade preferences.

In the case of agriculture in Belarus, calculating the difference between OTRI (which is 21.77 percent) and OTRI_T (which is 4.04 percent) gives us an AVE for NTBs in agriculture for Belarus of 17.7 percent. This value of 17.7 percent²⁰ is reported in table 2 as the benchmark ad valorem equivalent of the non-tariff barriers in agriculture in Belarus. In the case of manufacturing, the estimate from Kee *et al.*, of the ad valorem equivalent is less than 3 percent. Further, reports are that the transition to international standards in the Transition countries appears to be proceeding much more rapidly in industrial goods than in agriculture.²¹ Consequently, we do not assess that WTO accession will result in a reduction of non-tariff barriers in manufactured goods.

3.8 Tariff changes in Belarus as a result of Russia's WTO commitments

Shepotylo and Tarr (2013) have calculated Russian tariffs at the ten digit level for all years from 2001 to 2020, based on actual tariffs in Russia from 2001 to 2011, and have projected tariff rates forward from 2012 to 2020 based on Russia's WTO commitments to lower tariffs. Our calculations in table 2 are a trade-weighted aggregation of the Shepotylo and Tarr ad valorem (including the ad valorem equivalent of the specific tariffs) tariff rates, aggregated to the sectors of our model; these are documented in appendix F of Balistreri, Olekseyuk and Tarr (2016)). Belarus intends to accede to the WTO on the same tariff terms as Russia. Since Russia's WTO tariff obligations are incorporated in the common external tariff of the EEU, and Belarus is implementing the common external tariff, we do not assume any tariff changes of Belarus as part of its WTO accession. The "Tariff After Customs Union" column in table 2 refers to the tariff rates that will prevail in Belarus in 2020 when all commitments of Russia to the WTO are scheduled to be implemented in the common external tariff of the EEU.

3.9 Agricultural subsidies – no WTO accession impact

Despite the fact that Belarus in the early years of this decade significantly supported its agricultural sector with trade distorting subsidies, we assume no required reduction in agricultural subsidies as part of WTO accession. There are three reasons for this assumption.

²⁰ The unweighted average for the 167 countries in the dataset of this measure is 7.2 percent.

²¹ According to representative of Government of Tajikistan during its WTO accession negotiations, "the CIS... Agreement envisaged the harmonization of the new GOST requirements with international, regional and leading national standards. The level of such harmonization had reached 45 per cent by 2010." See WTO (2012, para. 203).

First, as part of the obligations in the then Belarus-Kazakhstan-Russia Customs Union (now EEU), Belarus must reduce its agricultural subsidies approximately consistent with Russian levels under Russia's WTO commitments. So as with tariffs, Belarus must reduce its subsidies as part of its Customs Union obligations, and this should not be considered a marginal commitment of Belarus under its WTO accession.

Second, WTO only limits trade distorting subsidies, what the WTO calls "amber box" subsidies, and permits, without constraint, a wide range of subsidies that are not considered significantly trade distorting (called "green box" subsidies)²². We have been informed by the Ministry of Agriculture of Belarus that amber box subsidies have already been reduced to nine percent of agricultural value-added. This is below what is known as the *de minimis* level for industrialized countries.²³ Subsidies below the *de minimis* level are permitted by the WTO.

Third, the Ministry of Agriculture of Belarus has informed us they are looking for further ways to switch from amber box to green box subsidies. In part, this reflects their awareness of the evidence of the greater benefits to farmers of green box subsidies. (See, for example, Alston *et al.*, 2000.)

4 Results of WTO accession

4.1 Aggregate impacts

In our general WTO scenario, we assume that: (i) discriminatory barriers against FDI by multinational suppliers of services are reduced by fifty percent of their ad valorem equivalents, as indicated in table 2; (ii) non-discriminatory barriers against FDI and Belarusian services providers are reduced by 25 percent of their ad valorem equivalents as indicated in table 2 under the column "after WTO"²⁴; (iii) barriers against cross-border provision of services are reduced by fifty percent of their ad valorem equivalents; (iv) five sectors subject to antidumping actions in export markets receive an exogenous increase in their export price as shown in table 2; and (v) the ad valorem equivalent of barriers in agriculture are reduced by 25 percent, from 17.7 percent to 13.3 percent. In this section we discuss the comparative static results, where the capital stock is fixed. In the sensitivity analysis, we also

²² Green box subsidies include subsidies for agricultural research and development, pest control, general and specialist training, extension and advisory services, inspection services for health and sanitary reasons, infrastructure services and crop insurance subsidies for natural disasters.

²³ The *de minimis* amount for developing countries is ten percent product specific and ten percent overall or roughly 20 percent. In the WTO accession negotiations, however, many Transition countries have been required to take the more stringent obligations on *de minimis* subsidies of industrialized countries.

²⁴ We assume that the WTO Working Group of the accession of the Republic of Belarus will negotiate more aggressively against discriminatory barriers. Consequently, we assume only a 25 percent reduction in the non-discriminatory barriers against services providers.

consider the comparative steady-state. As explained in sections 3.7 and 3.8, we do not assume any change in tariffs or in agricultural subsidies as part of its WTO accession. This is because WTO accession is not likely to require additional commitments of Belarus in these areas beyond its commitments as a member of the EEU.²⁵

The results for our WTO accession scenario are reported in table 3, column 1. We estimate that the welfare gains to Belarus will equal 8.8 percent of Belarusian consumption (or 4.3 percent of GDP) in our comparative static model. We estimate a small depreciation of the real exchange rate which leads to an estimated increase in aggregate exports by one percent. We report that the percentage of labor that will have to move to another sector to obtain employment is nine-tenths of one percent for both unskilled and skilled labor. In table 3, for all nine scenarios, we also report the percentage change in government revenue, aggregate exports, the real exchange rate (an increase is a depreciation) and the earnings of the factors of production in our model.

We execute five scenarios to decompose the impacts of the five key components of our WTO accession scenario and present those results in table 3, columns 2-6. In these scenarios, we allow only the policy at issue to change in the counterfactual, while holding all other policies unchanged. Summing columns 2 and 3 shows that the reduction of barriers against firms with a presence in Belarus (i.e., both Belarusian and the FDI of multinationals) constitutes 80 percent of the gains and, from column 3, the reduction of non-discriminatory services barriers alone on firms with a local presence constitutes 61 percent of the gains of WTO accession.

4.1.1 Impact of improved market access

As shown in table 3, column 5, we estimate the impact of improved market access for Belarus at a rather modest gain of 0.1 percent of consumption. This result follows from the discussion in section 3.5 that the improvements in market access will be small. Despite the fact that countries negotiating accession to the WTO are sometimes motivated by improved market access, this result is another example of what Martin and Winters (1996) noted in summarizing studies of the impact of the Uruguay Round such as Harrison, Rutherford and Tarr (1997). Martin and Winters (1996, p.2) noted that: the countries that liberalize their own policies are predicted to be the greatest gainers.

²⁵ In World Bank (2015) we evaluate the impact on Belarus of tariff reductions in Belarus and the other members of the Eurasian Economic Union due to Russia's WTO tariff obligations. We estimate that preference erosion in the Eurasian Economic Union will cost Belarus 0.9 percent per year of consumption; but the impact of improved resource allocation in Belarus dominates so that we estimate a net gain of 1.1 percent of consumption.

4.1.2 Impact of reduced barriers in agriculture

The estimated welfare gains, shown in column 6, are 0.4 percent of consumption or 0.2 percent of GDP. Since agriculture is modeled as a perfectly competitive sector without foreign direct investment, the estimated gains do not derive from our innovative modeling features in sectors with imperfect competition or foreign direct investment. Rather, the estimated gains derive primarily from two effects: (i) gains from inducing resources to move according to comparative advantage, as prices faced by Belarusian agents will be closer to world prices; and (ii) the freeing up of labor and capital used to comply with standards that do not contribute to health and safety.

4.1.3 Liberalization of discriminatory barriers against services supplied by FDI

As shown in table 3, column 2, we estimate a gain of 1.6 percent of the value of Belarusian consumption from the reduction in the discriminatory barriers on foreign suppliers of services through FDI and a domestic presence in Belarus. This liberalization increases profitability for foreign provision of services in Belarus, thereby inducing new entry by foreign service providers until zero profits are restored. Although there is a loss of domestic service varieties due to increased foreign competition, we find that there is a net increase in varieties. Belarusian businesses will then have improved access to services in areas like telecommunication, banking, insurance, transportation and other business services. The additional service varieties in the business services sectors should lower the cost of doing business and result in a productivity improvement for users of these goods through the Dixit-Stiglitz effect.

4.1.4 Liberalization of non-discriminatory barriers against suppliers of services with a domestic presence in Belarus

With a 25 percent reduction in their ad valorem equivalents, the liberalization of non-discriminatory barriers is only one-half that of discriminatory barriers. Nonetheless, as shown in table 3, column 3, the largest component of the gains derives from the reduction of non-discriminatory barriers against Belarusian suppliers of services and foreign suppliers of services through FDI--it results in estimated gains of 5.4 percent of consumption or 2.7 percent of GDP.²⁶ One might question why the gains from reform of non-discriminatory barriers are so much larger than the gains from reduction of discriminatory barriers against foreign firms. As shown in table 1, the results are explained by the fact that the Belarusian services sectors are dominated by Belarusian firms. When reforms are executed on a small base, even if the supply elasticity is high, the output response and welfare gains usually will not

²⁶ If we assume a comparable fifty percent reduction in the ad valorem equivalent of the non-discriminatory barriers on domestic and multinational service providers in Belarus, the estimated gains from this alone are 11.6 percent of the value of Belarusian consumption (or 5.7 percent of GDP).

be quantitatively large. For the reduction of non-discriminatory barriers in services, however, the reforms apply to the FDI of multinational firms as well as Belarusian firms; so the reforms are applied on 100 percent of the sector (excluding cross-border supply of services). This liberalization increases profitability of all suppliers of services with a domestic presence and induces entry of both foreign and domestic firms until zero profits are restored. New entry brings new varieties and productivity increases for users of the services.

4.1.5 Liberalization of barriers against cross-border suppliers of services

The reduction in barriers against cross-border provision of services results in estimated gains of 0.8 percent of consumption. Our data show that cross-border provision of services constitutes a maximum of 21 percent of domestic supply in any Belarusian sector. Consequently, even though there is rent capture from the liberalization of the barriers on cross-border supply of services, the estimated welfare gains are considerably smaller than the gains from liberalization of barriers against FDI and non-discriminatory local provision of services.

4.2 Sector results

Detailed results of output and employment effects by sector are available in table 6 below. Further detailed sector estimates are in World Bank (2015).²⁷ The most substantial expansion of output occurs in the business services sectors. We estimate they will all expand output, with output expansion ranging from 4.5 to 9.4 percent. The reason is as follows. As a result of a reduction in the barriers to suppliers of services in these sectors, we estimate that there will be an expansion in the number of services firms (both foreign and domestic). Since foreign owned firms that are resident in Belarus employ Belarusian labor and are part of Belarusian GDP, we include the output of foreign firms located in Belarus as part of the output of the sector.

We estimate that most manufacturing sectors will expand slightly, with a slight contraction of several sectors.²⁸ One explanation for small contractions in manufacturing is that the WTO scenario excludes tariff reductions in manufacturing which would have introduced increased competition in these sectors. Further, WTO accession will bring in additional service varieties in the business services sectors and that should lower the cost of doing business due to a productivity improvement for the manufacturing sector as users of business services. Sectors which use business services most

²⁷ In World Bank (2015), we did not include liberalization of cross-border trade in services.

²⁸ We estimate that three manufacturing sectors will contract by more than one percent of output: wood and wood products (-2.8 percent); forestry and related services activities (-3.5 percent); and mining and quarrying except energy (-4.2 percent).

intensely, especially the business services that fall considerably in price, will see their costs fall the most and this will contribute to output increases.

Despite the fact that we incorporate a reduction by 25 percent in the ad valorem equivalent of the non-tariff barriers in agriculture (which is a 4.4 percentage points reduction), we estimate a small increase in the output of agriculture in the medium term of 1.0 percent. The small reduction in protection is offset by the productivity gains and the positive impact of the real exchange rate depreciation since the sector has significant net exports.

5 Impact of increase in the private sector's share

Based on access to the data discussed in section 3.6, we are able to assess the impact of an increase in the private sector's share of the economy. The increase in the share of the private enterprises could arise due to the creation of an institutional environment that does not favor the state sector and which would likely result in the private sector growing relative to the state sector; or it could involve the privatization of state owned companies.

5.1 Impact of privatization: Very large gains in our central scenario

In our central privatization scenario, we assume that the percentage of fully owned state enterprises in all sectors decreases by 50 percent, and the private sector share increases by the decline in the fully state owned share in each sector. We shock the model by assuming that labor productivity in each sector increases by the percentages listed in table 2. The results of our central privatization scenario are shown in table 3, column 8. We estimate that welfare will increase by a very substantial 35.4 percent of consumption or 17.4 percent of GDP. Wages of skilled labor, unskilled labor and returns to capital increase by 7.5 percent, 7.3 percent and 18.0 percent, respectively. Given the very large estimated gains from privatization, we subject this policy reform to sensitivity in various ways to assess the robustness of the results. We begin with some key modeling assumptions specific to the privatization impact analysis in section 5.2, and continue in section 6.4 with parameter sensitivity common to the WTO and privatization analysis.

5.2 Impact of alternate modeling assumptions on the impact of privatization

5.2.1 Limited privatization

In our first robustness scenario, we exclude four services sectors from the privatization scenario: (i) education; (ii) health care and social services; (iii) public services; and (iv) community, social and personal services. Collectively, these sectors exceed 12 percent of GDP. This scenario is based on the question: how far could privatization extend in sectors that are dominated by the public sector? Although there is clearly a significant private sector potential in education, health care and personal services, to assess robustness, in this scenario we assume that the state sector would not be reduced, and thus there would not be any productivity increase in these four sectors. We estimate (table 3, column 10) that eliminating the productivity increase from these four sectors has a strong impact on the results. The estimated welfare increase falls to 14.2 percent of consumption or 7.0 percent of GDP.

5.2.2 Impact of privatization in a model with perfect competition and constant returns to scale

Although we do not believe perfect competition and constant returns to scale is an accurate characterization of all the sectors of the economy of Belarus, many modelers employ perfect competition models to assess policy changes. To assess the impact of this modeling approach, we also assess the impact of our central privatization productivity increase under the assumption that there is perfect competition and constant returns to scale in all sectors of the Belarusian economy. We find (table 3, column 10) that the welfare gains are reduced to 21.6 percent of consumption or 10.6 percent of GDP.

This shows that in our central model with imperfect competition, the welfare gain from the productivity increase is magnified by the expansion of imperfectly competitive firms. That is, the initial productivity increase makes production more profitable in all sectors, including the imperfectly competitive sectors. Then entry will occur in the imperfectly competitive sectors until zero profits are restored. The expansion of the number of firms in the imperfectly competitive sectors increases the productivity of the sectors that use these goods and services, i.e., there is a substantial gain in welfare due to the productivity increase from additional varieties (from the Dixit-Stiglitz externality).

5.2.3 Industry sector productivity

As mentioned in section 3.2, the state industry sector, especially the refinery sector, receives oil at less than market prices. This is an implicit subsidy, but it is not accounted for by Belstat. If we had the data to adjust for this implicit subsidy, the state companies in the industry sector would have lower value-added and labor productivity, and we would have estimated a productivity increase from privatization of those sectors. Our estimates of the productivity increase and welfare gain of privatization

are biased downward to that extent that we failed to account for the subsidy from state firms receiving energy products at below market prices.

6 Sensitivity analysis

In section 6.1 we evaluate the impact of our modeling extensions. Our model is the first to incorporate all four of the following features: (i) imperfect competition with endogenous productivity effects from additional varieties of services; (ii) foreign direct investment with production in the host country; (iii) reduction in non-discriminatory barriers against both domestic and foreign supply of services; and (iv) reduction of barriers against cross-border supply of services. The results depend on the choice of parameters in the model as well as certain assumptions or model “closures.” In sections 6.2 and 6.3, we assess the impact of rent capture and a steady-state closure, respectively. Then in section 6.4, we discuss the results of “piecemeal sensitivity” analysis on the parameters of the model.

6.1 Sensitivity to imperfect competition, FDI and non-discriminatory barriers

In table 4, we present the results of scenarios designed to investigate the relative importance of our modeling approach compared with more traditional or earlier approaches that focused on cross-border services under perfect competition. In column 1 we reproduce the results of our central model that we showed in table 3. We see from column 3, that exclusion of the reduction in non-discriminatory barriers against investors with a local presence has the largest impact—it would reduce the estimated gains by about two-thirds to 2.99 percent of consumption. Column 2 shows that exclusion of FDI would reduce the estimated gains by about 28 percent to 6.30 percent of consumption. Column 5 shows that executing the model under perfect competition, but including FDI and reduction of non-discriminatory barriers to local service provision would reduce the estimated gains to 3.5 percent of consumption or 39 percent of the estimates of our central model. Column 8 shows that focusing only on cross-border trade in services (plus limited market access improvement and reduction of SPS barriers), while excluding imperfect competition, FDI and reduction of non-discriminatory barriers against local suppliers, results in estimated gains of only 0.83 percent of consumption. Thus, the approach in our central model yields gains more than ten times larger than a perfectly competitive model with only cross-border services liberalization.

6.2 Rent capture

In our central WTO accession scenario we have assumed that the ad valorem equivalents of the barriers represent real resource costs, and WTO accession frees resources so they become available for productive activities. Here we consider the alternative, where there is no loss of capital and labor in wasteful license seeking activities and the like, because licenses are allocated without real resource costs and the rents are captured by domestic agents. Under this assumption, the estimated gains from WTO accession fall to 4.9 percent of consumption (table 5, final row of results), which reflects a large share of rents (or losses from dissipated rents) in the economy of Belarus. The estimated gains from privatization are unchanged with respect to the rent capture assumption, however, since we do not assume a gain in rents in the central privatization scenario.

6.3 Comparative steady-state results of WTO accession

In this model, we assume that prior to the WTO accession shock, the economy is in a long run steady-state equilibrium and the economy will adjust to a new long run steady-state equilibrium after the WTO accession shock. In the comparative static model, the capital stock is fixed and the real rate of return on capital is variable. We reverse the assumptions in the steady-state model: the real rate of return on capital is fixed but the capital stock is variable. If a shock, such as WTO accession increases the real rate of return on capital in our comparative static model, this will induce an increase in investment and the capital stock until the marginal productivity of capital declines such that the real rate of return on investment is restored to the initial steady-state rate.

With our comparative steady-state model, we estimate (table 3, column 7) that the gains to Belarus from WTO accession are 17.8 percent of consumption (8.7 percent of GDP). The reason the gains are larger than in the comparative static model is that we estimate that WTO accession will induce an increase in the real rental rate on capital in Belarus in the comparative static model by 3.9 percent, which induces an expansion of the capital stock in the new equilibrium by about 7.5 percent. With a higher capital stock, the economy is able to produce more output and there is more consumption. Rutherford and Tarr (2003) demonstrated that there is an important upward bias in this model since the model fails to account for the foregone consumption necessary to achieve the higher capital stock. However, Rutherford and Tarr (2002) have shown that a fully dynamic Romer style endogenous growth model, which takes into account foregone consumption from investment decisions, could produce estimated welfare gains that are significantly larger than these comparative steady-state results.

6.4 Piecemeal sensitivity analysis

Our piecemeal sensitivity analysis in table 5 shows how the results change when we vary the value of key parameters one-by-one, with central values of all parameters except the one under consideration. Two sets of parameters stand out as having a strong impact on the results.

The elasticity of substitution between firm varieties in imperfectly competitive services sectors, $\sigma(q_i, q_j)$ has a very strong impact in both the WTO and privatization scenarios. At the low end of the elasticity range (2.5 in all services sectors), the estimated gains increase to 11.7 per cent of consumption from WTO accession and 45.3 percent from privatization. Unlike most other elasticities, a lower value of $\sigma(q_i, q_j)$ increases the welfare gains because lower values of this elasticity imply that varieties are less close to each other; so additional varieties are worth more. Since the policy shocks in goods are much less, the elasticity variation in goods has a smaller impact, but its impact is nonetheless significant.

The elasticity of substitution between value-added and business services, $\sigma(va, bs)$, also has a strong impact. At its upper value of 1.75 in the WTO accession scenario (1.70 in the privatization scenario), the estimated gains increase to 11.4 percent of consumption in the WTO accession scenario and 42.7 percent of consumption in the privatization scenario. The more easily firms are able to substitute business services for labor and capital, the more the economy will gain from the reforms that reduce the quality adjusted price of business services.

The results are rather robust with respect to the other elasticities in the model. That is, the results are within plus or minus ten percent of the central estimate for these parameter values for the WTO accession and privatization scenarios. The impact of changing elasticities follows the Le Chatelier principle, i.e., larger elasticities typically lead to larger welfare gains, as the economy can adapt more readily. For example, a larger elasticity of firm supply means that more firms will enter when profits are available, which results in more varieties and productivity increases.

7 Conclusions

We develop a computable general equilibrium model of the economy of Belarus that includes FDI and endogenous productivity effects from additional varieties of goods and services that are produced under imperfect competition. We apply this model to assess privatization in Belarus and the unusual case of the accession of Belarus to the WTO. We are able to conduct the privatization analysis based on a dataset provided to us by Belstat. Our analysis of WTO accession is built on a dataset on services barriers (including non-discriminatory barriers) and FDI shares in Belarus that we generated for this study.

We find that WTO accession would be expected to increase the welfare of Belarusian nationals by 8.8 percent of consumption per year primarily due to the reduction of barriers against suppliers of services. We have shown that these significant estimated gain depends crucially on: (i) our monopolistic competition model with Dixit-Stiglitz endogenous productivity effects; (ii) the inclusion of FDI; and (iii) the reduction of non-discriminatory barriers against services suppliers with a domestic presence in Belarus. Compared with an approach which would limit the analysis of services to cross-border trade under perfect competition, we obtain estimated gains ten times larger. Interestingly, it is the reduction of non-discriminatory services barriers that is the largest component of the welfare gain, and we show that deeper reduction of the non-discriminatory barriers would substantially increase welfare.

We find that partial privatization would lead to a large increase in the productivity of Belarus, yielding gains of 35.4 percent of consumption per year under our central modeling assumptions. We conduct extensive sensitivity analysis of both our WTO accession and privatization scenarios, with respect to modeling assumptions and parameter values. Although there is a large variance in the estimated gains from privatization that depend on the modeling assumptions, the gains are always very large.

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Tables and figure

Table 1 List of sectors, regions and factors of production, market shares in FDI sectors by region and by ownership type in aggregate sectors

Aggregate sector		Regions of the model and their market shares in FDI sectors				
		Belarus	Russia and Kazakhstan	Rest of Commonwealth of Independent States plus Georgia	European Union	Rest of the World
Business services with FDI						
TDC	Trade and various mechanical repairs -----	82,0	9,0	1,0	7,0	1,0
TCM	Communication -----	77,0	7,0	0,0	13,0	3,0
OSR	Insurance -----	85,0	9,0	1,0	5,0	0,0
OSR	Other financial services -----	65,0	25,0	1,0	0,0	9,0
OSR	Other professional services (incl R and D) -----	95,0	1,0	0,0	3,0	1,0
TCM	Rail, water and other transport -----	100,0	0,0	0,0	0,0	0,0
TCM	Air transport -----	100,0	0,0	0,0	0,0	0,0
TCM	Road transport -----	98,0	1,0	0,0	0,0	1,0
IRTS (Dixit-Stiglitz) goods						
IND	Manufacture of food products , beverages and tobacco					
IND	Textiles and textile products					
IND	Manufacture of wood and of products of wood					
IND	Pulp and paper production and Publishing					
IND	Manufacture of coke, refined petroleum and nuclear fuel					
IND	Chemicals and chemical products					
IND	Manufacture of rubber and plastic products					
IND	Manufacture of other non-metallic mineral products					
IND	Manufacture of basic metals and fabricated metal products					
IND	Manufacture of machinery and equipment					
IND	Manufacture of electrical and optical equipment					
IND	Manufacture of transport equipment					
IND	Other manufacturing					
CRTS goods and services						
AGF	Agriculture, hunting and related services in these areas					
AGF	Forestry and related service activities					
AGF	Fishing, fish farming and related services in these areas					
IND	Mining and quarrying of energy minerals					
IND	Mining and quarrying except energy					
IND	Manufacture of leather, leather products and footwear					
IND	Production and distribution of electricity, gas and water					
CST	Construction					
OSR	Hotels and restaurants					
OSR	Real estate renting and business services					
OSR	Public services					
OSR	Education					
OSR	Health care and social services					
OSR	Community, social and personal services					

Aggregate sectors key

AGF	= Agriculture, forestry and fishing
CST	= Construction
IND	= Industry
TDC	= Trade and catering
TCM	= Transport and communications
OSR	= Other services

Value added share by type of ownership

	Majority state owned	Majority private
AGF	0,09	0,74
CST	0,31	0,45
IND	0,40	0,37
TDC	0,05	0,83
TCM	0,21	0,21
OSR	0,02	0,36

Primary factors of production

Compensation of unskilled employees
Compensation of skilled employees
Capital – Gross operation surplus, mixed income

Source: Kolesnikova (2014b) for market shares by region. Value-added data provided by Belstat.

Table 2 Distortions in the benchmark (BenchM) and counterfactual (after) scenarios, (in %)*

									Services regulatory barriers				
Tariff (EU and ROW only)			Nontariff barriers		Export price increase	Export tax	Con- sump- tion tax	Privatization productivity increase %	Non- discriminatory- all firms			Discriminatory- foreign firms only	
After customs									After 50% cut			After	
BenchM	union	BenchM	After	After	BenchM	BenchM	After	BenchM	WTO	cut	BenchM	WTO	
Business services													
- Trade, repair of motor vehicles, household appliances and personal items						2,9	17,9	1,4	6,3	4,7	3,1		
- Communication						0,6	-10,3	1,3	5,3	4,0	2,6	2,3	1,1
- Insurance								51,8	19,7	14,7	9,8	33,3	16,7
- Other financial services								51,8	7,9	5,9	3,9	14,2	7,1
- Other professional services (incl R and D)						1,8	-20,1	51,8	11,1	8,3	5,5	19,8	9,9
- Rail, water and other transport						0,6	-10,3	1,3	47,5	35,6	23,8	42,5	21,2
- Air transport						0,6	-10,3	1,3	12,6	9,5	6,3	25,3	12,6
- Road transport						0,6	-10,3	1,3					
Dixit-Stiglitz goods													
- Manufacture of food products, beverages and tobacco						6,5	11,9	0,0					
- Textiles and textile products					0,5	4,1	15,2	0,0					
- Manufacture of wood and of products of wood						3,9	11,4	0,0					
- Publishing						4,3	18,5	0,0					
- Manufacture of coke, refined petroleum and nuclear fuel						6,2	26,2	0,0					
- Chemicals and chemical products					0,5	3,4	6,3	0,0					
- Manufacture of rubber and plastic products					1,0	3,5	14,1	0,0					
- Manufacture of other non-metallic mineral products					1,0	3,7	18,4	0,0					
- Manufacture of basic metals and fabricated metal products					1,5	3,5	21,7	0,0					
- Manufacture of machinery and equipment						3,6	15,1	0,0					
- Manufacture of electrical and optical equipment						3,5	19,8	0,0					
- Manufacture of transport equipment						4,7	8,6	0,0					
- Manufacturing nec						3,4	14,4	0,0					
CRTS goods and services													
- Agriculture, hunting and related services in these areas					6,2	3,8	17,7	13,3					
- Forestry and related service					5,4	5,2			3,9	2,9	7,0		
- Fishing, fish farming and related services in these areas					10,0	3,1			3,3	18,8	7,0		
- Mining and quarrying of energy minerals									3,9	18,4	7,0		
- Mining and quarrying except energy					0,0	0,0			46,3	3,2	0,0		
- Manufacture of leather, leather products and footwear					4,9	4,8			4,7		0,0		
- Production and distribution of electricity, gas and water					8,0	4,6			3,6	14,8	0,0		
- Construction									3,3	0,9	0,0		
- Hotels and restaurants									0,4	0,4	1,2		
- Real estate renting and business services									0,8	11,1	1,4		
- Public services									1,8	-20,1	51,8		
- Education											51,8		
- Health care and social services									0,2	0,2	51,8		
- Community, social and personal services										0,0	51,8		
									1,9	-2,8	51,8		

*A blank in a cell in the table implies zero distortion.

Source: Kolesnikova (2014a) for the services regulatory barriers (converted to percentage of domestic prices); appendix C of Balistreri, Oleksyuk and Tarr (2016) for labor productivity changes; Shepotylo and Tarr (2014) for tariff changes and Comtrade data for 2011 trade weights. Kee et al (2009) for non-tariff barrier estimates and GTAP data for aggregation; Balistreri, Oleksyuk and Tarr (2016, appendix B) for export price increases. Export and consumption taxes and subsidies from the Input-Output table for 2011.

Table 3 Summary of impacts of WTO accession and privatization,
(results are percentage change from initial equilibrium, unless otherwise indicated)

Scenario definition	Bench- mark	WTO accession-comparative static						WTO accession steady state	Privatization scenarios		
		WTO accession all policies	Only discriminatory FDI services barriers (50% reduction)	Only non- discriminatory services barriers (25% reduction)	Only cross- border services barriers (50% reduction)	Only improved market access	Only reduction in WTO inconsistent SPS barriers		Privatization central scenario	Constant returns to scale	Limited privatization
			1	2	3	4	5	6			
- 50% reduction in discriminatory services barriers for FDI firms	No	Yes	Yes	No	No	No	No	Yes	No	No	No
- 25% reduction of non-discriminatory barriers on all services firms	No	Yes	No	Yes	No	No	No	Yes	No	No	No
- 50% reduction in discriminatory services barriers for cross-border foreign firms	No	Yes	No	No	Yes	No	No	Yes	No	No	No
- Increase in the export price for selected sectors	No	Yes	No	No	No	Yes	No	Yes	No	No	No
- 25% reduction in non-tariff barriers in SPS	No	Yes	No	No	No	No	Yes	Yes	No	No	No
- Steady-state capital stock	No	No	No	No	No	No	No	Yes	No	No	No
- 100% State controlled share decreases by 50% in each sector	No	No	No	No	No	No	No	No	Yes	No	No
- Constant returns to scale all sectors	No	No	No	No	No	No	No	No	No	Yes	No
- Eliminate four typically govt. provided services from privatization	No	No	No	No	No	No	No	No	No	No	Yes
Aggregate welfare											
- Welfare (EV as % of consumption)		8,8	1,6	5,4	0,8	0,1	0,4	17,8	35,4	21,6	14,2
- Welfare (EV as % of GDP)		4,3	0,8	2,7	0,4	0,1	0,2	8,7	17,4	10,6	7,0
Government budget											
- Tariff revenue (% of GDP)	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,4	2,5	2,5	2,5
- Tariff revenue		1,9	1,2	0,4	-0,1	0,1	0,2	2,0	-15,7	-22,4	-3,4
Aggregate trade											
- Real exchange rate		0,6	0,2	0,2	0,2	0,0	0,1	0,9	2,9	0,7	0,5
- Aggregate exports		1,0	1,3	-0,4	-0,1	0,0	0,1	0,4	-19,7	-25,0	-6,4
Factor earnings											
- Skilled labor		4,2	1,0	2,3	0,5	0,0	0,2	7,9	7,5	1,2	10,6
- Unskilled labor		4,0	0,9	2,4	0,5	0,0	0,1	7,8	7,3	1,0	8,1
- Capital		3,9	1,0	2,1	0,5	0,1	0,0	0,7	18,0	11,6	8,6
- Specific factors (domestic)		6,3	0,5	5,0	0,2	0,1	0,6	11,4	1,1	-8,3	-1,6
- Specific factors (multinationals)		7,0	3,9	1,8	0,6	0,1	0,2	11,4	13,3	4,0	3,4
Factor adjustments*											
- Skilled labor		0,9	0,2	0,6	0,1	0,0	0,1	1,3	9,9	9,7	4,3
- Unskilled labor		0,9	0,2	0,7	0,1	0,0	0,1	1,4	7,8	7,7	3,2
- Capital		1,0	0,3	0,8	0,1	0,1	0,2	0,0	6,3	5,6	4,7
Capital stock change (steady state only)								7,5			

*Percentage of the factor that must change sectors.

Source: Authors' estimates.

Table 4 Sensitivity of welfare results to inclusion of imperfect competition, FDI and non-discriminatory barriers in services, (results are percentage change from initial equilibrium)

	Imperfect competition (IRTS)				Perfect competition (CRTS)			
	WTO accession (central model)	No FDI	No change in non- discriminatory services barriers	No FDI + no change in non- discriminatory services barriers	WTO accession	No FDI	No change in non- discriminatory services barriers	No FDI + no change in non- discriminatory services barriers
Scenario definition	1	2	3	4	5	6	7	8
- Perfect competition – constant returns to scale (CRTS)	No	No	No	No	Yes	Yes	Yes	Yes
- FDI in services included--50% reduction of barriers	Yes	No	Yes	No	Yes	No	Yes	No
- 25% Reduction in barriers against all locally supplied services	Yes	Yes	No	No	Yes	Yes	No	No
- 50% reduction of barriers on cross-border provision of services	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- Increase in the export price for selected sectors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- 25% reduction in non-tariff barriers in SPS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aggregate welfare								
Welfare (EV as % of consumption)	8,81	6,30	2,99	1,35	3,47	3,18	1,07	0,83
Welfare (EV as % of GDP)	4,32	3,09	1,47	0,66	1,70	1,56	0,53	0,41

Source: Authors' estimates

Table 5 Piecemeal sensitivity analysis from WTO accession and privatization,
results are percentage change in equivalent variation (EV) from benchmark

	Parameter value			%EV full WTO			%EV privatization		
	Lower	Central	Upper	Lower	Central	Upper	Lower	Central	Upper
$\sigma(va, bs)^{**}$	0,75	1,25	1,75	7,2	8,8	11,4	31,4	35,4	42,7
$\sigma(q_i, q_j)$ – services sectors	2,50	3,00	4,00	11,7	8,8	6,9	45,3	35,4	30,4
$\sigma(q_i, q_j)$ – goods sectors*	x0.75	x1	x1.5	9,6	8,8	8,2	38,2	35,4	32,5
$\sigma(D, M)$	2,00	4,00	6,00	8,4	8,8	9,2	35,4	35,4	35,5
$\sigma(L, K)$	0,50	1,00	1,50	8,8	8,8	8,8	32,3	35,4	36,9
$\sigma(A_1, \dots, A_n)$	0,00	0,00	0,25	8,8	8,8	9,0	35,4	35,4	35,2
$\sigma(D, E)$	3,00	4,00	5,00	8,5	8,8	9,2	37,5	35,4	31,9
$\varepsilon(\text{Belarus})^*$	x0.75	x1	x1.5	8,4	8,8	9,5	34,1	35,4	37,3
$\varepsilon(\text{CIS})^*$	x0.75	x1	x1.5	8,8	8,8	8,8	35,4	35,4	35,5
$\varepsilon(\text{CU})^*$	x0.75	x1	x1.5	8,6	8,8	9,3	34,8	35,4	36,5
$\varepsilon(\text{EU})^*$	x0.75	x1	x1.5	8,6	8,8	9,4	34,6	35,4	37,3
$\varepsilon(\text{ROW})^*$	x0.75	x1	x1.5	8,5	8,8	9,5	34,6	35,4	37,3
θ_r	0,00	0,00	1,00	8,8	8,8	4,9	35,4	35,4	35,4

*We scale the entire set of elasticities by the number indicated in the table subject to a lower bound on $\sigma(q_i, q_j)$ —goods sectors of 2.0 to avoid numerical instability. See World Bank (2015, table 7) for the sets of elasticity values for $\sigma(q_i, q_j)$ and for all elasticity values for the ε parameters

**In the Privatization upper sensitivity scenario, an upper bound of 1.70 was placed on $\sigma(va, bs)$ to avoid numerical instability.

Key:

$\sigma(q_i, q_j)$: Elasticity of substitution between firm varieties in imperfectly competitive sectors; for cross-border services, the elasticity of substitution is one half-this value; see figure 1.

$\sigma(va, bs)$: Elasticity of substitution between value-added and business services

$\sigma(D, M)$: Elasticity of substitution between domestic and imported varieties

$\sigma(L, K)$: Elasticity of substitution between primary factors of production in value added

$\sigma(A_1, \dots, A_n)$: Elasticity of substitution in intermediate production between composite Armington aggregate goods

$\sigma(D, E)$: Elasticity of transformation (domestic output versus exports)

$\varepsilon(\text{Belarus})$: Elasticity of national service firm supply with respect to price of output

$\varepsilon(\text{CU})$: Elasticity of Russia-Kazakhstan service firm supply with respect to price of output in Belarus

$\varepsilon(\text{EU})$: Elasticity of EU service firm supply with respect to price of output in Belarus

$\varepsilon(\text{CIS})$: Elasticity of CIS service firm supply with respect to price of output in Belarus

$\varepsilon(\text{ROW})$: Elasticity of Rest of World service firm supply with respect to price of output in Belarus

θ_r : Share of rents in services sectors captured by domestic agents

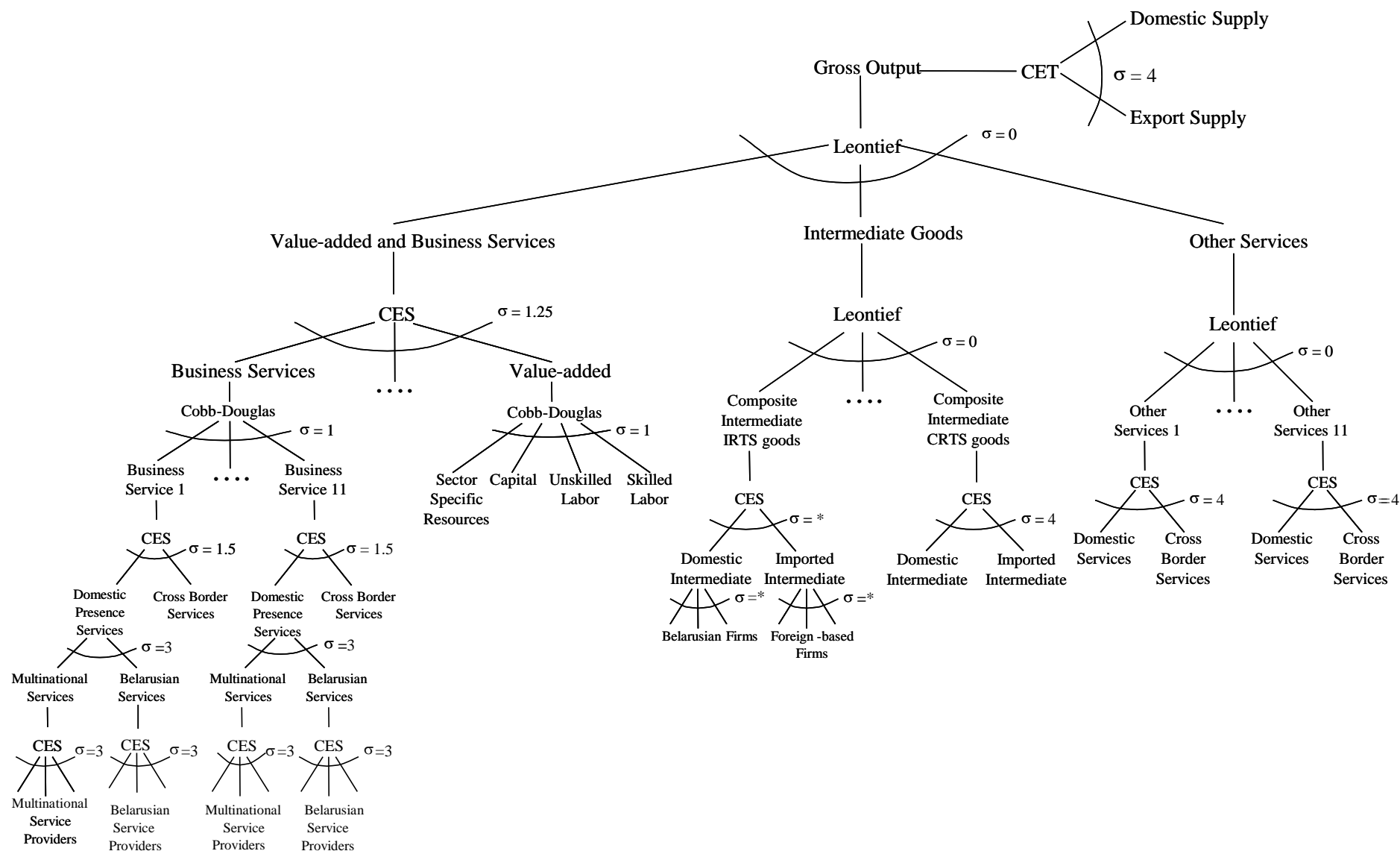
Source: Authors' estimates

Table 6 Output and employment impacts of key policy reforms, percentage change from benchmark

	WTO accession-medium term			WTO accession --Steady State			Russia's WTO tariff commitments			Only non-discriminatory Services Barriers-- 50% Reduction			Privatization Impact		
	employment			employment			employment			employment			employment		
	output	skilled	unskilled	output	skilled	unskilled	output	skilled	unskilled	output	skilled	unskilled	output	skilled	unskilled
Business Services															
Trade, repair of motor vehicles, household appliances and personal items	4.5	-3.5	-3.4	10.4	-3.2	-3.1	0.7	0.2	0.3	5.4	-5.7	-5.8	11.2	2.2	2.4
Communication	9.4	5.2	5.4	12.0	4.5	4.6	1.2	1.0	1.2	9.0	6.1	6.0	21.5	13.3	13.5
Insurance	8.1	6.7	6.9	14.4	8.6	8.7	0.7	0.6	0.8	5.2	4.3	4.2	51.2	15.9	16.0
Other financial services	6.8	5.4	5.6	13.0	7.3	7.4	0.7	0.7	0.8	4.4	3.5	3.4	54.7	18.5	18.7
Other professional services (incl R and D)	6.4	4.4	4.5	9.4	4.8	4.9	0.6	0.6	0.7	4.4	3.1	3.1	94.2	21.6	21.8
Water rail transport and transport nec	8.9	3.8	4.0	11.7	3.1	3.2	1.0	0.8	1.0	11.3	7.7	7.6	14.4	3.6	3.7
Air transport	7.1	2.2	2.4	10.3	1.9	2.0	1.0	0.8	1.0	8.1	4.6	4.5	14.4	3.7	3.8
Road transport	8.9	3.8	4.0	12.9	4.2	4.4	1.3	1.1	1.3	7.7	4.2	4.2	21.8	10.3	10.5
Dixit-Stiglitz Goods															
Manufacture of food products , beverages and tobacco	2.6	0.5	0.6	6.7	1.3	1.4	0.7	0.6	0.8	2.5	1.1	1.0	9.2	7.0	7.2
Textiles and textile products	1.8	0.3	0.5	4.6	0.6	0.8	-0.3	-0.3	-0.2	1.7	0.8	0.7	7.1	6.3	6.4
Manufacture of wood and of products of wood	-2.8	-4.1	-3.9	-3.7	-6.8	-6.7	-3.7	-3.8	-3.6	-4.8	-5.5	-5.6	4.7	3.6	3.8
Pulp and paper production. Publishing	1.9	0.1	0.2	4.9	0.5	0.7	-5.5	-5.5	-5.4	1.2	0.0	0.0	14.6	12.2	12.3
Manufacture of coke, refined petroleum and nuclear fuel	1.4	-0.9	-0.8	3.0	-4.3	-4.1	0.6	0.6	0.7	1.6	0.0	0.0	1.9	1.8	1.9
Chemicals and chemical products	2.3	0.3	0.5	8.4	1.6	1.7	2.7	2.6	2.8	-0.2	-1.6	-1.7	-6.2	-5.3	-5.2
Manufacture of rubber and plastic products	-0.2	-2.1	-1.9	1.6	-3.1	-2.9	-1.9	-1.9	-1.8	-2.3	-3.5	-3.6	0.6	-1.3	-1.2
Manufacture of other non-metallic mineral products	0.6	-1.0	-0.8	1.5	-2.4	-2.3	-1.2	-1.3	-1.1	0.2	-0.9	-0.9	3.5	1.9	2.0
Manufacture of basic metals and fabricated metal products	0.7	-0.8	-0.6	1.9	-2.4	-2.3	-1.0	-1.1	-0.9	-0.5	-1.5	-1.5	0.7	0.1	0.3
Manufacture of machinery and equipment	-0.9	-2.4	-2.3	-0.9	-4.6	-4.4	2.6	2.5	2.7	-1.9	-2.9	-2.9	-0.1	-1.6	-1.4
Manufacture of electrical and optical equipment	-1.0	-2.5	-2.3	-0.8	-4.6	-4.4	-1.1	-1.1	-1.0	-2.1	-3.0	-3.1	1.2	-0.1	0.0
Manufacture of transport equipment	-0.7	-2.3	-2.2	1.5	-3.3	-3.1	-10.9	-11.0	-10.9	-2.3	-3.3	-3.4	-2.2	-2.8	-2.6
Manufacturing nec	1.5	-0.9	-0.7	3.5	-1.7	-1.5	-3.2	-3.3	-3.1	1.0	-0.5	-0.6	9.6	5.9	6.0
CRTS Goods and Services															
Agriculture, hunting and related services in these areas	1.0	-0.2	0.0	7.1	1.6	1.8	-0.4	-0.4	-0.3	3.3	2.5	2.4	13.2	13.3	13.5
Forestry and related service activities	-3.5	-4.1	-3.9	-4.3	-6.0	-5.8	-0.9	-1.0	-0.9	-5.2	-5.5	-5.6	14.5	7.9	8.0
Fishing, fish farming and related services in these areas	0.9	-0.3	-0.1	7.6	1.9	2.0	-8.9	-8.9	-8.8	0.3	-0.5	-0.6	8.2	8.7	8.8
Mining and quarrying of energy minerals	3.0	1.8	2.0	21.6	14.0	14.2	2.6	2.6	2.7	4.5	3.7	3.6	-15.4	-11.4	-11.3
Mining and quarrying except energy	-4.2	-5.3	-5.1	-0.8	-5.2	-5.1	3.8	3.7	3.9	-7.9	-8.6	-8.7	-12.8	-11.0	-10.9
Manufacture of leather , leather products and footwear	3.3	1.8	2.0	15.1	8.7	8.9	-7.8	-7.8	-7.6	3.8	2.8	2.7	7.2	9.0	9.1
Production and distribution of electricity, gas and water	2.4	0.8	0.9	6.1	2.6	2.7	0.1	0.0	0.2	2.3	1.3	1.2	14.4	11.4	11.6
Construction	0.1	-1.3	-1.2	0.3	-3.6	-3.5	0.2	0.1	0.3	0.0	-0.9	-1.0	1.0	-0.2	-0.1
Hotels and restaurants	-3.3	-4.1	-3.9	-1.4	-3.9	-3.8	3.0	2.9	3.1	-4.9	-5.3	-5.4	12.8	11.9	12.0
Real estate renting and business services	2.1	0.5	0.6	6.1	1.1	1.3	0.9	0.8	1.0	1.4	0.4	0.3	192.2	104.7	104.9
Public services	0.0	-0.1	0.1	0.1	-0.2	-0.1	0.0	0.0	0.2	0.1	0.0	0.0	18.1	-41.7	-41.6
Education	0.7	0.5	0.6	1.5	0.7	0.8	0.1	0.1	0.2	1.0	0.9	0.8	26.0	-34.9	-34.8
Health care and social services	0.6	0.4	0.6	1.2	0.9	1.0	0.1	0.0	0.1	0.8	0.8	0.7	14.3	-43.7	-43.6
Community, social and personal services	3.5	2.4	2.6	7.8	4.8	5.0	0.3	0.2	0.3	4.4	3.8	3.7	44.3	-15.9	-15.8

Source: Authors' estimates.

Figure 1 Production and allocation of output



*Note: Elasticities of substitution in imperfectly competitive sectors (Dixit-Stiglitz elasticities) vary by sector; See appendix A.

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