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A CGE analysis of the impact of foreign direct investment and tariff reform on female and male wages

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Abstract

This study analyzes the impact on male and female wages of tariff reform and the reduction of regulatory barriers faced by domestic and foreign firms operating in business services. We apply the model to Tanzania and develop a dataset that distinguishes labor and wages by gender for 52 sectors and four skill categories. Our model is the first incorporating modern trade theory to assess the gender implications of trade reform. In particular, we address foreign direct investment in services, with Dixit-Stiglitz endogenous productivity effects from additional varieties in imperfectly competitive sectors. Policies that lower regulatory barriers in services bring about the entry of new (domestic or multinational) services firms. Given that our Dixit-Stiglitz framework results in productivity gains from additional varieties of services, we find that real wages increase across all worker categories. However, the increase of wages is higher for males than for females. This is because business services use males more intensively than females in their production. The most skilled (female and male) workers, who are also most intensively used in the business services sectors, are those who benefit more from the real increases in wages. This model illustrates that as this development process continues and developing countries become more business service oriented, these sectors demand more educated workers and their wages will increase relative to those of unskilled workers. The policy conclusion from this model is that it is crucial to invest in the education of females so their human capital increases and their skills are more marketable in business services and other more technologically modern occupations. Otherwise the wage gap between males and females would likely widen further.

Keywords: gender, FDI in services, trade, ad valorem equivalents.

JEL codes: C68, F21, F23, F17, F16, J16

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1. Introduction

As is well known, the promotion of gender equality is one of the "Millennium development goals". Female workers seem to be more exposed to vulnerability at work than males (e.g., United Nations, 2009; ILO, 2009). Despite recent improvements, women exhibit a higher involvement in unpaid (but productive and time consuming) domestic and care activities in developed and developing countries (Blau and Kahn, 2000). The main body of evidence suggests the persistence of a gender wage gap (i.e., ratio of female to male wages) after having adjusted for worker characteristics (e.g., Aguallo-Tellez, 2011). However, the causes behind these statistics are complex and multifaceted and a variety of factors other than discrimination may bear to some extent on the different situations of female and male workers (Ganguli et al., 2011; Fernandez, 2007). Discrimination seems to exist but a precise estimation of its magnitude is difficult (Blau and Kahn, 2006). Although the first studies go back to Becker (1957) and Arrow (1971), its analysis still remains a challenging topic both from a theoretical and empirical perspective.

In this paper we extend previous analysis based on a computable general equilibrium (CGE) model for Tanzania (Jensen et al., 2010), in order to focus on its gender implications. Given the arguments in favor of a uniform tariff (Tarr, 2002), we analyze the effects of tariff reform, as well as the reduction of regulatory barriers to the provision of specialized services by domestic or foreign firms through foreign direct investment (FDI). How do foreign trade and the entry of new domestic or foreign firms affect female and male workers? To what extent would men and women be reallocated across sectors? What would be the effects on their wages? We aim to shed light on these questions. To this end, we first work on the data that are publicly available from the National Bureau of Statistics of Tanzania (NBS, 2002a). We produce an ambitious three-dimensional (sex-sector-skill) dataset for 52 sectors with factors of production distinguished by four skill levels and by sex.

Our CGE methodology seems particularly well suited for in-depth analyses involving feedback effects across sectors of the economy. Another advantage is its general equilibrium perspective, which allows us to take into account the income and demand side of the economy, as well as the interplay of goods and factor markets. We extend the model of Jensen et al. (2010), which in turn builds on the more stylized theoretical model of Markusen et al. (2005), to include actual gender and factors of production data on the Tanzanian economy. The model therefore exhibits innovative features, compared to other CGEs, such as the presence of FDI and multinational enterprises (MNEs) in advanced services sectors. This, together with the incorporation of a Dixit-Stiglitz-Ethier mechanism in imperfectly competitive sectors, makes possible to capture potential increases in wages and workers' reallocation throughout the

economy. As in Markusen et al. (2005), we find evidence contrasting with the predictions of the Stolper-Samuelson Theorem. This aspect is critical to explaining the evolution of wages. Furthermore, the model explicitly takes into account the different cost structures of foreign and domestic firms in business services. Since foreign firms are generally less labor intensive than national firms, a higher presence of foreign firms could reduce labor demand in business services. We will see how there are both partial and general equilibrium effects of this phenomenon that need to be taken into account simultaneously in order to analyze it. Note that the few gender-aware CGE models that have analyzed trade liberalization processes have included neither imperfect competition nor FDI.

The rest of the paper is organized as follows. The next section presents the previous literature on gender-aware CGE models and other studies related to them. Section 3 offers an overview of data on gender and on the economic structure of the Tanzanian economy. Section 4 explains the model, while section 5 describes the results obtained, including the evolution of output, wages and factors' reallocations. The final section offers the main conclusions.

2. Previous literature

Empirical studies of the impact of trade liberalization and deregulation on the wage gap have found mixed results. Black and Brainerd (2004) find evidence that trade contributed to the reduction in the wage gap in the U.S. during the 1976-93 period. Oostendorp (2009) analyzes a large sample of developed and developing economies, looking at the effects of growth, trade and FDI on gender gaps within particular occupational categories. While he finds a decline in the gender gap for developed economies during the 1980s and 1990s, the effect is less clear or insignificant for developing countries. Aguallo-Tellez (2011), after reviewing the available empirical evidence on the impact of trade liberalization policies and FDI on wage inequality, claims that they have increased wage inequality in both developed and developing countries. Another review by Rama (2003), however, suggests that although the impact of globalization is not evenly distributed across workers, there is no evidence of an increase in the dispersion of wages by occupation. Black and Straham (2001) argue that deregulation in the banking industry in the U.S. (and the subsequent increase in competition) results in reductions of both female and male wages. However, given that the decrease in male wages was greater, the gender wage gap was reduced.

From the theoretical point of view, among economists there are three main strands in the literature on discrimination, leading to different policy prescriptions. They are: 1) The "Taste for discrimination model"; 2) The "Theory of statistical discrimination"; and 3) The "Crowding model of occupational segregation". Chronologically, the first theory goes back to Becker's (1957) "Taste for discrimination model", on which Arrow's (1971) analysis is based. Employers' preferences for discrimination against women are based on the idea that females impose subjective or psychic costs on the employer, and that he (or his employees) wants to maintain a certain physical or social distance from females. The strength of the "psychic cost"

would be reflected in a "discrimination effect" which could be measured in monetary terms. The discriminatory employer would be indifferent between hiring a male or a female if female wages were lower than those of males by an amount superior to the discrimination coefficient. If there is indeed gender discrimination, so that female wages are lower than males', a discriminating employer will hire women only when those wage gaps are higher than his discrimination coefficient. By contrast, non-discriminatory employers would hire every woman independently of whether the wage gap has attained a particular level. Non- or less discriminatory firms would have lower average total costs and product prices than discriminatory producers. The more discriminatory firms would be driven out of business by market forces. A problem for the Becker-Arrow theory is that, since market forces should eliminate discrimination in the long run, it cannot explain the persistence of discrimination over the long term.

A second strand of the literature is the "Theory of statistical discrimination" (Phelps, 1972; Aigner and Cain, 1977; Fang and Moro, 2010). This holds that because it is costly to obtain information about each job applicant, employers often use characteristics such as gender, race or age as a proxy for productivity or other worker attributes that are not easily discernible. In so doing they may well wrongly judge individuals on the basis of the average characteristics of the group to which they belong, rather than on their own personal characteristics. As a result, for example, married women who do not plan to have children (or do not plan to quit their job if they do) would be discriminated against. In contrast to the taste for discrimination theory, in this theory the employer minimizes hiring costs by practicing discrimination; so discrimination may persist because it benefits those practicing it. Although this theory can explain discrimination against an individual, since workers in a group are paid the average marginal productivity of the group, it cannot explain a wage gap between groups.

Finally, the crowding model of occupational segregation (Bergmann, 2005; Sorensen; 1990; Blau and Kahn, 2000, 2006) suggests that there are "women's jobs" and "men's jobs", in the sense that women are systematically excluded from men's jobs that are high-paying and crowded into low-paying occupations. Let us assume that women are as productive as men and have homogeneous labor force characteristics. However, since women are crowded into a rather small group of occupations, their supply exceeds demand and their wage rate is low. For men, who are not confined to particular occupations, their supply does not exceed demand and their productivity (and wage) is higher than those of women. In this model, the productivity of women and men is a sort of "group" or "team" productivity. It depends on how supply compares to demand across occupation. This theory predicts that if women are allowed to enter "male" occupations, due to changes in social attitudes or in legislation, they will be less crowded into the small group of low-paying occupations. Assuming that occupation shifts are costless, women will experience an increase in wages, while men will experience a fall. However, the increase in women's productivity and wages should prevail, since there is a greater increase in their productivity and wages, given that they were disproportionately crowded into certain occupations. Thus this theory predicts both equity and efficiency increases when women are not excluded from certain occupations. This is a version of the Becker-Arrow

theory. If women are as productive as men but paid less, then firms could increase their productivity by hiring women. The more productive firms should drive out the less productive in the long run. Again, it is a challenge for this theory to explain the persistence of a wage gap in the long term.

Only a handful of CGE models have dealt with discrimination and the majority have analyzed scenarios of trade liberalization without FDI (e.g., Fontana and Wood, 2000; Fontana, 2003; Siddiqui 2004, 2007; Arndt et al., 2006; Terra et al., 2007). However, their analysis of trade firms' production structure remains anchored in a constant returns to scale setting. It is well known that in modeling trade liberalization in CGEs, there are small welfare gains when increasing returns to scale are absent (e.g., Francois and Reinert, 1997). Further, the previous gender-aware CGE models, like many economic models, evaluate trade liberalization without incorporating FDI. Among the few CGE models that include FDI some have found that FDI liberalization has a stronger impact than trade liberalization (e.g., Jensen et al. 2007, 2010; Brown and Stern, 2001; Bchir et al., 2002). Others have concluded that the result that trade facilitation has more vigorous effects than FDI, (e.g., Jensen and Tarr, 2012) or that the results vary according to a particular geographical area among those analyzed with the same model (e.g., Petri, 1997). See Latorre (2009, 2010) for a review of these models and related literature.

In particular, the models of Jensen et al. (2007, 2010), Jensen and Tarr (2012) and Brown and Stern (2001) incorporate a Dixit-Stiglitz-Ethier framework of monopolistic competition. In this framework an increase in the number of firms (and product varieties) leads to potential increases in both consumers' welfare and producers' productivity. The latter is due to the possibility of obtaining a quality adjusted unit of services at a reduced price when there are more varieties (i.e., more firms producing those services). These models apply to real world data the stylized theoretical model of Markusen et al. (2005), which contradicts the predictions of the Stolper-Samuelson Theorem due to the presence of the Dixit-Stiglitz-Ethier variety and endogenous productivity gains effects. The present application to Tanzania also incorporates these effects and therefore potentially captures factor remuneration adjustments absent in the previous literature. It is of interest, therefore, to look precisely at how important this Dixit-Stiglitz-Ethier framework is for the impact on female and male wages.

The few gender-aware CGE models available have focused on how to deal with "non-market activities", in which women account for a larger share than men. The issue is of relevance, especially in developing countries, where the amount of work involved in household duties is greater than in developed countries (clothes are washed by hand, food must be prepared on a daily basis due to lack of refrigeration, water and firewood have to be carried over long distances, etc.). These "non-market" activities were first analyzed in the papers by Fontana and Wood (2000) and Arndt and Tarp (2000). The main contribution of Fontana and Wood (2000) is to treat "domestic work" and "leisure" activities as two extra sectors in an otherwise standard CGE. The rationale would be, again, that women are much more involved than men in these two extra sectors. In order to add the sectors, information on time use is needed, to be able to account for the amount of time allocated by women and men to leisure, household chores, work, etc. The originality in Arndt and Tarp (2000) is that they develop a different treatment

for home consumption versus market consumption. Both types of consumption are possible for all the commodities in the model.

Neither Fontana and Wood (2000) nor Arndt and Tarp (2000) disaggregate men and women into different types of skill. Siddiqui (2007) does so, while including other improvements. Apart from considering four different levels of skill (as in the present model), Siddiqui introduces an extra interesting feature, namely, one household category for "all female-headed households in rural areas". This is a way of incorporating intra-household reallocation of resources, capturing not only the "production" impact for women through wages but also through the "consumption" side of the economy. There is considerable evidence, however, suggesting that wages are the primary means through which women earn a living (United Nations, 2009; Arndt et al., 2006).

In our model, we capture the impact of non-market consumption through the existence of a factor called the subsistence factor, which is available in "Agricultural sectors" and in "Fishing" and "Hunting and forestry". We offer a revised ambitious four-skill-type disaggregation of women and men. Our main contribution is, we believe, the innovative modeling of potential sources affecting females' and males' remunerations and their sectoral allocations through the presence of the Dixit-Stiglitz-Ethier framework and the entry of multinational firms.

3. Data on gender and the Tanzanian economic structure

We use data (not typically available in most countries) from the Integrated Labour Force Surveys (ILFS) of 2001 (NBS, 2002a) for Tanzania. In each sector, factors of production are distinguished by four skill levels and by sex. At the top of Table 1, we show factor remuneration in billions of current Tanzanian Shillings across all factor categories modeled for four aggregates of sectors from the 52 sectors of our model[1]. The sum of all factor remunerations yields the "Total value added" column, whose value matches that in the Tanzanian National Accounts[2].

Relying on the publicly available data of the ILFS (NBS, 2002a), we have undertaken a thorough revision of labor shares in the SAM of Thurlow and Wobst using: 1) Better proxies for workers' skill levels; 2) A wider coverage of wage data; and 3) More accurate information

[1] The four broad sectors are: 1) "Business services sectors" - those in which FDI is allowed to enter and regulatory barriers are going to be reduced; 2) "Dixit-Stiglitz sectors", which produce under imperfect competition and with increasing returns to scale; 3) "Agricultural sectors" and 4) "Other CRTS"- the remaining sectors that produce with constant returns to scale.

[2] This coincides with the total value added used in the Social Accounting Matrix (SAM) constructed by Thurlow and Wobst (2003), which, except for its original factor shares, will be the base for our simulations. By keeping total value added and using a model with one representative household, we ensure consistency with the rest of the SAM.

on child labor. In our new dataset nine different occupational categories are converted into four different skill levels, following the OECD suggestions (Elias, 1997, p. 7). The new skills of workers are: "Unskilled", "Laborers", "Technicians" and "Professionals". See the note in Table 1 for the exact conversions. Therefore, we do not proxy skill levels with educational categories, as Thurlow and Wobst (2003) do, because apart from "Traditional Agriculture", there is no information on the skill of workers regarding their wages in other sectors. By contrast, we know occupations and wages for nine broad sectors, which are extrapolated into 52 sectors based on their value added weight. Furthermore, we assign different wages to the self-employed, which is one of the main difficulties in estimating labor shares (Arpaia, et al., 2009; Guerriero, 2012; ILO, 2010; Gollin, 2002). We also use children between 10 and 17 years old for whom there is data on their distribution across sectors with their corresponding wages and occupations, instead of the children between 10 and 14 years old of Thurlow and Wobst (2003), on whom that information is not available. In addition to labor, total value added is also composed of subsistence[3], land and capital. Subsistence and land in our model are the same as in the SAM of Thurlow and Wobst (2003), while capital differs only slightly and is calculated (in our new dataset) as a residual, subtracting from total value added the values of subsistence, land and all labor categories.

There are considerable differences in factor intensity in the four broad sectors we analyze in Table 1. As we move from the top to the bottom of that table, two measures of factor intensity appear. There has been a considerable debate on the best way to proxy factor intensity in the literature, particularly in the context of more than two factors of production (e.g., Bowen et al., 1987). We present first a rather standard measure of "Factor intensity", in which the remuneration of each factor corresponds to its weight in total value added, the latter being normalized to 100 (see column "Total value added"). The factor intensity of a sector, e.g., "Business services", is calculated by comparing each factor share in the services with the overall use of that factor in the whole economy (row "All sectors"). Thus, male Professionals are used very intensively in Business services (4.37%) in comparison with their overall use throughout the economy (0.71%). Agriculture makes very intensive use of female Laborers, by contrast[4]. The most capital intensive sectors are the "Dixit-Stiglitz goods" (83.12%>35.75%), although Business services are also very capital intensive (67.07%>35.75%). Finally, "Other CRTS" sectors also use female and male Professionals intensively, but make even more intensive use of male and female Technicians.

We identify a considerable gender wage gap in Tanzania. Under "Labor intensity (%)"in Table 1, the columns of "Child (age 10 to 17)" and "Adult (females+males)" add up to 100, since they represent all the labor available for production in our model. A comparison of labor intensity measured in value added terms with that available in Table 2, which presents the actual number of workers (at the top) and their percentages over the total number of workers

[3] The "subsistence factor" is a composite factor made up of labor, land and capital which produces the "home production". Its overall value is available in the Tanzanian National Accounts.

[4] Indeed, the category of "Laborers" is by far the most numerous in Tanzania because it includes "Skilled agricultural and fishery workers", which is the main occupation in the country.

(below), provides an indication of the existing wage gaps between females and males. Comparing the row "All sectors" for labor intensities in value added and in physical units, we find that even though the percentage of "all females" and "all males" in total physical workers in Tanzania is very similar, 36.85% versus 36.10%, respectively, the former accounts for only 28.57%, while the latter accounts for 67.81% of all workers' remunerations. This indicates the presence of a considerable gender gap.

However, the existence of this gender gap should be regarded with caution as evidence of discrimination. Non-discriminatory factors may explain part or, less likely perhaps, all of the wage differentials between men and women. Discrimination implies that some workers that have the same abilities, education, training, motivation, experience, etc. as others are accorded inferior treatment. Our broadly defined occupations, which are still more accurate than the usual skilled versus unskilled distinction, lack the detail for careful assessment of the exact portion of the pay gap due to labor market discrimination. For example, according to the ILFS (NBS, 2002a) women exhibit lower levels of education than men in Tanzania. This would support the idea of lower productivity (and therefore wages) of women with respect to that of men. Another factor that could (at least partly) explain the wage gap is the higher involvement of women in the low-paying sector of Agriculture. We do not know why women are more involved in Agriculture, perhaps they have freely chosen to do so. In addition, we do not have detailed information on other factors: whether women are married, pregnant or have child care duties, whether they have different work preferences than men or less opportunity to migrate to urban areas, etc.

We have updated the estimates on the barriers to the entry of multinationals and domestic firms, while keeping the rest of model parameters and values in the SAM. Extensive documentation on the existing inefficiencies in Tanzanian specialized services has been developed elsewhere (Jensen and Tarr, 2010). The restrictiveness to the entry of multinationals and other regulatory barriers faced by domestic firms and multinationals into these services sectors have been translated into ad valorem equivalents by Jafari (2013), who updates the previous estimates of Mircheva (2008). Jafari's (2013) estimates suggest a lower level of ad valorem barriers in business services sectors. Their exact levels are presented in Table 2, together with the actual market shares controlled by multinationals in Tanzania. The table also displays the tariff levels considered in the model, which stem from a particularly detailed dataset provided by the Tanzanian Revenue Authority. Due to the outstanding quality of the latter data, Jensen and Tarr (2010) and Jensen et al. (2010) replaced the tariffs initially present in the SAM developed by Thurlow and Wobst (2003). We also use the tariffs in the Jensen et al. (2010) study in the present model. More information on the weight of sectors in private consumption, aggregate exports and imports, as well as the weight of intermediates from business services in their total costs, is also displayed in that table for future reference.

4. The model

Tanzania is modeled as a small open economy. In its present version the model is the successor of a family of CGE models specialized in the analysis of trade, FDI and regulatory barriers. The model was first applied to the accession of Russia to the World Trade Organization (Jensen et al., 2007; Rutherford and Tarr, 2008). The findings suggest that FDI liberalization in services (i.e., the reduction of barriers to the entry of multinationals) has a much stronger impact than liberalization of tariffs in traditional competitive models of trade in goods. As noted above, not many CGE models have considered the presence of multinationals. Further, the modeling technique is very innovative due to the above mentioned Dixit-Stiglitz-Ethier mechanism incorporating variety effects. Besides, it is also innovative because the model incorporates different technologies of production of multinationals compared to domestic firms operating in the same sector. Multinational service providers import some specialized inputs. Only a few CGE models have incorporated ways of differentiating the technology used by national firms from that of multinationals (e.g., Lakatos and Fukui, 2013; Latorre, 2013; Gómez-Plana and Latorre, 2014; Hosoe, 2014; Latorre and Hosoe, 2013).

The model of Russia has been used in previous analyses of Tanzania (Jensen et al., 2010). As in those analyses, we retain the 52-sector disaggregation, which, in turn, expanded the 43 sectors available in the original SAM for Tanzania (Thurlow and Wobst, 2003). There are 35 perfectly competitive sectors, 18 of which are in Agriculture. These goods and services, produced under constant returns to scale, are differentiated in the demand functions of Tanzanian consumers and firms through the Armington assumption. These sectors appear under the headings of "Agriculture" and "Other CRTS". The model also incorporates 17 sectors producing under increasing returns and imperfect competition. They are further split into the advanced Business services sectors, which are central to the simulations, and the Dixit-Stiglitz sectors, which include most manufacturing sectors. The demand from both firms and consumers of products or services from the latter sectors is characterized as a Dixit-Stiglitz-Ethier composite of domestic and imported varieties with firm-level product differentiation. The Dixit-Stiglitz elasticities are obtained from Broda and Weinstein (2004) and Broda, Greenfeld and Weinstein (2006). In the imperfectly competitive sectors marginal costs are constant and there is a fixed cost. Firms set prices such that marginal costs equal marginal revenue and there is free entry, which drives profits to zero. There is Chamberlinian large-group monopolistic competition, which, together with the assumption that the ratio of fixed to marginal costs is constant, results in constant markups over marginal costs.

The 12-household version used for Tanzania has, however, been transformed into a one representative agent version for this current application. As noted above, this was necessary in order to use the new factor shares we have derived with the rest of Thurlow and Wobst's SAM (2003).

Jensen and Tarr (2010) have expanded the rest of the world region from the model of Jensen et al. (2010) to account for different areas sourcing imports and FDI in Tanzania. Of particular

interest for our analysis is the fact that the multilateral liberalization scenario has the most important impact for Tanzania (i.e., Tanzania gains more when it lowers regulatory barriers to all regions, instead of lowering them to particular regions). Therefore, our two-region analysis focusing on gender aspects seems a "suitable simplification" of the greatest impact that could be attained with the multiregional model.

Another aspect that merits comment is what could be the best approach to model gender differences in our model. We have seen that previous CGE gender-aware models have mostly concentrated on how to deal with "non-market activities" at the same time as they introduce shocks of trade liberalization. It seems clear that despite recent changes women are still primarily responsible for child care and housework duties. Although in developed countries these tasks now tend to interrupt fewer women in work careers, due to the increasing availability of child care facilities or better female pay (e.g., Light and Ureta, 1992; Frederiksen, 2008), the story is different in developing countries. This is certainly an important avenue for research. The task of trying to quantify its main determinants and effects, some of them ranging beyond the boundaries of economics, remains for the future.

How do we model wage formation in the presence of a wage gap? As noted above, we find evidence of the existence of a substantial wage gap. We do not know, however, to what extent that gap is related to discrimination or to other characteristics of women that could make them less productive than men, thus explaining their lower wages. One important question related to the wage setting mechanism in our model is the following: Would the policies we implement (increases in the number of foreign or domestic firms and changes in tariffs) directly impact on the degree of discrimination or change those characteristics that make women less productive than men? This does not seem to be the case. More openness could arguably reduce discrimination itself through changes in customs, new ideas, etc., but not immediately. It would probably be rather a long-term process, not captured in our short- to medium-term time span. Besides, if women are less productive due to, for example, fewer years of schooling than men, this does not seem to be related either to our policy shocks. As Boeters and Savard (2012, p. 5) put it, the crucial necessary condition for different types of labor to be modeled differently arises when the wages of the different groups of workers do not move in parallel (i.e., when they do not move in proportion, maintaining the initial wage difference). Boeters and Savard (2012, pp. 2, 5, 39, 50-51 and 81) repeatedly touch upon this point throughout their chapter on labor markets in CGE models[5].
A related example dealing with differences in wages by sector may be of help in explaining the model treatment of wages. There is abundant evidence of wage differentials across sectors,

[5] There is also empirical evidence which confirms that the introduction of an exogenous wage gap does not lead to any significant change in the results. One of the few CGEs which has compared workers' reallocations and welfare improvements following the elimination of constraints to trade due to import quotas (De Melo and Tarr, 1992) or Voluntary Export Restraints (VERs) (De Melo and Tarr, 1993) has found very similar effects in the case of absence versus presence of exogenous wage gaps. Interestingly, this similarity in results holds for the different market structures, such as monopolistic competition, that are analyzed. The contrasts in results arise, however, when endogenous wage gaps are introduced, which De Melo and Tarr (1992; 1993) model using a framework of labor unions that we believe is not applicable to our developing country setting.

which should a priori not be compatible with treating all labor as homogeneous. However, most CGE models treat labor supply as uniform with market clearing wages which balance labor supply and demand. Why? Because, if we regard the wage gap as remaining constant in the simulations, we are in a case analogous to the well-known wage differences across sectors. After all, as is the case with discrimination, it is also difficult to disentangle what share of the wage differential across sectors is attributable to a different composition of the workforce and what share is a pure sectoral wage differential (Boeters and Savard, 2012; Genre et al., 2011).

Our model fully develops mechanisms not present in previous CGE gender-aware models that affect female (and male) wages and employment. No CGE has modeled a wage-setting mechanism explicitly targeting gender differences (Boeters and Savard, 2012, p. 51). This naturally follows from the fact that, as already discussed in the review of the literature, there is no generally accepted theory of discrimination which can suggest how to model wages endogenously. In this regard, it is important to note that when the policy shock run with the model is not directly labor market oriented, the impact on the labor market occurs through shifts in labor demand (Boeters and Savard, 2012, p.5). Our model has three important mechanisms affecting labor demand. The first mechanism is through the endogenous productivity effects arising from product variety. The second stems from the differences in cost structures of national firms and MNEs. The third is the traditional factor intensity aspects present in CRTS models.

The Dixit-Stiglitz-Ethier mechanism implies that producers' productivity goes up with increases in the number of firms that supply intermediates for them, in line with the findings in other empirical studies. We noted above that when more firms, for example, more foreign multinationals, enter the market, producers can obtain more varieties of intermediates at a quality-adjusted reduced price which raises their productivity. As developed in length in Tarr (2012), the introduction of these endogenous productivity effects leads to estimations of welfare gains that are consistent with the econometric literature on the productivity impacts of the liberalization of services. Further, the welfare gains turn out to be several times larger than those obtained in CGE models with no FDI and no endogenous productivity effects.

The model also captures whether the less labor-intensive technologies of foreign firms (compared to domestic) could lead to decreases in labor demand. Interestingly, the predictions of Markusen et al. (2005) and of previous full general equilibrium models calibrated to real economies, recently summarized in Tarr (2012), suggest that generally fears for domestic labor demand are not justified. Foreign multinationals use primary imported intermediates, such as expatriates or specialized technical expertise (not available to national firms), making them economize on labor. After the shock, there can be a partial equilibrium effect which may decrease domestic labor demand in the sectors in which the entry of foreign firms crowds out the more labor-intensive domestic firms. However, another force is at play at the same time. As more foreign firms enter the market, the price of the services they sell goes down, thereby inducing industries and consumers to expand their demand for services. If this latter general

equilibrium effect dominates the labor substitution effect, demand for labor in business services will increase.

5. Results

Sectoral production

The evolution of production, which is critical for labor demand, varies considerably across the different scenarios we simulate. Table 4 presents the percentage changes in output with respect to the benchmark of the 52 sectors in which the Tanzanian economy has been split. At the top of the table appear the different scenarios considered. The scenario "Full reform" combines three different shocks: 1) A 50% reduction of regulatory barriers to services faced by domestic and foreign firms. These are inefficient barriers which raise the costs of domestic and foreign service providers; 2) A 50% reduction of the barriers directed only at foreign firms (i.e., discriminatory barriers against FDI)[6] ; and 3) A change from the heterogeneous import tariffs (available in Table 2), which are charged across the different sectors, to a uniform tariff. The common import tariff modeled obtains exactly the same revenues as the previous different import tariffs. These three shocks are combined in the "Full reform" scenario and are also analyzed individually, i.e., one by one, in order to derive their relative impact. The label "CRTS" refers to the outcome of the same "Full reform" shock in a framework in which all sectors produce under constant returns to scale. Finally, in the "Steady state" again the same three shocks are run simultaneously under an increasing returns to scale framework, while the capital stock is allowed to adjust to its long-run equilibrium.

After the "Full reform" shock, there is a large increase in the number of domestic and foreign service providers. Taking into account the output of the latter operating in Tanzania, production goes up markedly in all Business sectors (with an average rise of 25.7%). The expansion is much larger in Banking, Insurance and Professional Services, than in the Transport and Telecommunication sectors. This is due to the greater non-discriminatory and discriminatory barriers that the former sectors exhibit compared to the latter (as can be seen in Table 2). Further, because the additional FDI barriers are considerably greater in Banking, Insurance and Professional Services than the non-discriminatory barriers, facilitating FDI (i.e., running the "Only barriers against FDI" scenario) expands output more than a shock concentrated only in non-discriminatory barriers (i.e., the "Only non-discriminatory service barriers" scenario).

After the shock "Only uniform tariffs", output falls for the sectors that were previously quite protected and have lost the shelter of their remarkably high tariffs. These are Textile and leather products, which has the highest tariff in Tanzania (29.7%), and Beverages and tobacco (28.4%). These two sectors together, which are relatively substantial among manufacturing

[6] Note that foreign firms operating in Tanzania face an accumulation of regulatory barriers ("non-discriminatory services barriers" which are also present for domestic firms) and additional discriminatory barriers (only "barriers against FDI services" which are set for foreign multinationals).

sectors in terms of value added, explain the reduction in production in the Dixit-Stiglitz sectors. Paddy (20.5%) and Meat and dairy products (27.2%) also contract production. The fall in barriers to FDI and, to a lesser extent, in non-discriminatory barriers dampens the downward pressure on production stemming from the uniform tariffs, in the cases of Beverages and tobacco, Textile and leather products, Paddy, and Meat and dairy products.

There is another group of sectors whose production goes down, even though they do not have high tariffs. This is the group of agricultural sectors composed of Cotton, Coffee, Tea, Cashew nuts, Sisal fiber and Sugar across several scenarios. This seems related to the very low weight in private consumption of these sectors in Tanzania (Table 2), since most of them are very export oriented. National income rises in all scenarios, resulting in an increase in private consumption. The sectors whose weight in private consumption is higher tend to benefit from this upward tendency. This is the case with Maize, Beans, Oil seeds, Other roots and tubes, Fruits and vegetables, Poultry and livestock, Hunting and forestry and, also, though to a lesser extent, Cassava.

The results in the "CRTS" and "Steady state" scenarios exhibit large contrasts. The "CRTS" scenario runs the same simultaneous three shocks performed in the "Full reform" package (i.e., lowering non-discriminatory and discriminatory barriers, as well as the change to a uniform tariff) in a model without increasing returns to scale. The magnitude of the shock is considerably reduced. The opposite applies to the "Steady state" simulation, which magnifies the impacts. The increase in the varieties of services available makes capital more productive, inducing a process of capital accumulation in the long run. With a higher capital stock the economy will both produce and consume more. Our estimations for this scenario represent, however, an upper limit of the possible outcomes since it does not take into account the necessary forgone consumption to achieve a higher capital stock. With the "Steady state" we offer an insight into the long-run results. This contrasts with the rest of the results, which are medium-term predictions stemming from comparative static simulations.

The sectors that expand more do so owing to their downstream (using) connections with Business services. These are Petroleum and refineries (Table 2 shows that 5.1% of total costs are intermediates from Business sectors), Manufacture of basic and industrial chemicals (4.7%), Rubber plastic and other manufacturing (3.8%), Other services (11.8%), Tobacco (9.2%), Hotels and restaurants (4.1%), as well as Postal communication (15.3%). What is more, downstream relationships are especially intense among Business services themselves, which further enhances their expanding tendency.

Labor market outcomes

Variations in factor earnings

Table 5 presents percentage changes in factors' remunerations and in welfare with respect to the benchmark. Recall that we assume full labor mobility and there are eight wage rates in the model: one wage for each skill and female/male category. Wage rates do not differ across

sectors for the same skill and gender combination. The same scenarios from Table 4 are analyzed.

In our increasing returns to scale comparative static model, all real factors' remunerations increase after the different shocks are considered. This is mostly due to Dixit-Stiglitz externality dominating any Stolper-Samuelson effects. A clear upward trend in all factor earnings emerges. Some factors of production stand out due to the high remunerations they receive. "Professional" males experience the largest increase in wages across all factors of production, followed by "Professional" females. These are the factor most intensively used in the Business services sectors (Tables 1 and 2). Males in the categories "Technicians" and "Laborers" come next in importance.

Note, however, that the overall increases in male wages (see row "Adult male wages") are higher than those of females (row "Adult female wages") across almost all scenarios. That is, males benefit more, even though women do also benefit. The key to understanding the gender wage results is to recognize that the Business services sectors expand the most (see Table 4). In the "Full reform" scenario or the "All services barriers" scenario, Business services expand by about 25%, while the other sector groups only change by between plus or minus 2%. Males gain relatively more due to the fact that they are employed more intensively in the expanding sectors. However, as shown in the factor intensity section of Table 1, all four types of male labor are more intensively employed in Business services compared with the same class of female labor. In the case of "Laborers", "Technicians" and "Professionals", the ratio of male to female factor intensity is more than 10 to 1, a ratio higher than in the other sectors. As Business services expand, it must attract skilled male workers from sectors that do not use male workers as intensively, which induces a rise in the relative wage of skilled male workers.

The above described patterns in factors' remunerations hold across the different scenarios, with the exception of the "Only uniform tariffs". The contrasting factor earnings are mostly driven by the reduction in barriers to FDI, which has a greater impact on the expansion of Business services. Even in the "CRTS" simulation the factors used intensively in Business services experience higher wage increases, although the increase is less than half of that experienced with increasing returns to scale. The "Steady state", by contrast, leads to wage increases that are more than double those arising from the "Full reform" package. Since the capital stock expands in the "Steady state", and the marginal productivity of labor increases with increases in the capital stock, the wage increases are higher.

In the "Only uniform tariffs" scenario, factors' remunerations experience less intense increases than in the "Full reform" scenario. The uniform tariff scenario does not allow for services liberalization. So there are little or no Dixit-Stiglitz endogenous productivity effects. Then marginal productivity of labor increases only marginally and, as will be seen shortly, the welfare gains are very small. Females in all categories experience rather small increases in their wages, even though for all adult women the increase is slightly higher (0.74%) than the overall increase experienced by adult men (0.69%). The latter wage increases are surpassed in the rest of the scenarios, except for "Only non-discriminatory barriers".

Agricultural land and capital are the only two factors experiencing a mild reduction in their real remuneration, but only in two scenarios. The price of land goes down in the scenario of "Only non-discriminatory barriers" and in the hypothetical "CRTS" simulation. Note that in these two scenarios a relatively strong fall in production in Agriculture is experienced simultaneously with a rather small increase in the "Other CRTS" sectors, compared to the rest of scenarios. These two sectors always adjust in those directions but they do so less vigorously than in the two exceptional simulations, bringing about a small reduction in land remuneration. The reduction in capital remuneration in the "Steady state" simulation is natural after an intense process of capital accumulation, which indeed raises the overall capital stock in Tanzania by 6.7%.

Even though foreign firms use less labor-intensive technologies than domestic firms, labor still benefits in Tanzania from the entry of foreign firms. We find an overall improvement in real wages. According to these results, in line with previous findings (reviewed in Tarr, 2012), the outcomes of the model support the idea that the partial equilibrium effect of lower demand by foreign firms is dominated by the general equilibrium effect, by which an overall increase in the demand for cheaper Business services will increase overall labor demand in these sectors. That is why those factors most intensively used in the expanding Business sectors benefit most, in relative terms, from the higher wages. By contrast, those used most intensively in Agriculture, which reduces output, still benefit but less than the other worker categories. On the other hand, in the "CRTS" scenario the absence of Dixit-Stiglitz-Ethier variety and of endogenous productivity effects more than halved the positive outcomes on wages.

The highest increases in wages are experienced by the most skilled workers ("Professional" males and females), who are those used most intensively in the Business services. Developing countries, like industrialized countries, are opening up more to foreign investors in services and becoming more business services oriented. Our model illustrates that with this change, these sectors demand more educated workers, the relative wages of the better trained will increase relative to those of the unskilled. The policy conclusion from this model is that it is important to invest in the education of females so their human capital increases and their skills become more marketable in business services and other more technologically modern occupations. Otherwise the wage gap between males and females would likely widen further. (For a similar conclusion see Arndt et al., 2006.)

Finally, at the bottom of Table 5 we present the positive outcomes on aggregate welfare measured as Hicksian equivalent variations of consumption and GDP. They are parallel to the impact on workers' remuneration that we have just analyzed. Welfare improves across all simulations. A "Full reform" scenario, which brings about the most substantial increase in wages, is the one that results in higher welfare, with increases of 2.23% of consumption and 2.03% of GDP. At the opposite extreme, the "Only uniform tariffs" results in a marginal increase in welfare. Note that in this last case, welfare improves despite output reductions in some sectors that we had reported above. We also see that the welfare impact is three times larger in the scenario of "Only barriers against FDI in services" than in that of "Only non-discriminatory services barriers". In this sense, Tanzania would benefit more from measures

targeted to foreign multinationals than those lowering regulatory barriers faced by all kinds of firm.

Table 6 displays more detailed results on the differential evolution of female wages versus those of men across occupational categories. Focusing merely on the analysis of pure gender difference may be misleading in analyzing whether females and males benefit or not from different policy shocks. The changes in percentage points of difference between female and male wages appear at the top of the table. At the bottom is the wage gap measured as the ratio of female over male wages in percentage terms. For the vast majority of estimations the changes in percentage points of difference are negative, because female wage increases tend to be of smaller magnitude than those of males. The largest differences between the sexes appear in "Professionals" followed by "Technicians" and "Laborers". Nevertheless, as shown in Table 5 both female and male "Professionals" experienced the highest increases in wages after the shock. This implies that even though the change in percentage points of difference is greater (in absolute value), both types of worker are better off. Similarly, the largest differences between the sexes appear in the "Steady state" followed by "All service barriers" and the "Full reform" scenario (see the row "All workers" in the middle of Table 6). However, those are precisely the scenarios in which both females and males experienced the strongest wage increases (Table 5). Paradoxically, the change in percentage points of difference is positive in the "Only uniform tariffs" scenario, in which the wage increases for both females and males are nearly the smallest among all the scenarios.

At the bottom of Table 6 we see that the sizeable wage gaps existing in the benchmark remain virtually unchanged across simulations and different occupational categories. In our benchmark dataset, the wage gap in Tanzania is 39.77% (see row "All workers" at the end of the table). This means that in general women's wages are 60% lower than men's, which is a very wide gap in international terms, even though we do not take into account workers' characteristics for this calculation. Ñopo et al. (2011) in their analysis of 64 countries across the world found that gender earnings gaps ranged from 8% to 48% between individuals with the same characteristics. They also established that wage gaps were higher in Sub-Saharan Africa and South Asia compared with other regions. Note that the Tanzanian overall wage gap closely resembles that of 39.43% of the occupation with most workers ("Laborers"). In the other occupations, the wage gap shrinks, particularly, in the case of "Unskilled", for which female wages are around 30% lower than those of males in the benchmark. If we analyze the evolution of the wage gap across occupational categories, we find a very small variation in this indicator[7]. Only for "Unskilled" workers is the wage gap very slightly reduced in some simulations. Indeed, "Unskilled" females experience higher wage increases than "Unskilled" males in some simulations. The higher intensive use of "Unskilled" females versus "Unskilled" males in the expanding "Other CRTS" sectors explains why this occurs, particularly when the output expansion in the Dixit-Stiglitz sectors is not very strong, since the latter make relatively more intensive use of "Unskilled" males than "Unskilled" females.

[7] These outcomes further confirm that our assumption that the policy simulations do not significantly affect the initial wage gap is correct.

In the "Only uniform tariffs" scenario females across most categories undergo slightly higher wage increases than males, even though females are not better off in this scenario compared to the rest. A very small improvement in the wage gap appears. For all female and male workers it would turn from its benchmark value of 39.47% to 39.79%. However, again it is hard to argue that women would be better off in this scenario since they would experience lower wage increases than in the other scenarios (with the exception of the "Only non-discriminatory service barriers"). With the change to a uniform tariff, Business services expand considerably less than in the rest of scenarios, while the female-intensive Agriculture experiences a relatively smaller fall in output. Thus, the demand for female workers is higher in this scenario, compared to the rest, and women's remunerations are slightly higher than those of men. The "improvement" in the wage gap disguises both lower female and male remunerations.

The results displayed in Table 6 suggest that for the wage gap to improve, substantial female wage increases (much larger than those of men) would be needed and that a broader perspective going beyond differences in wages or wage gaps is necessary to address the situation of women. The policies we have analyzed would always improve, in terms of the evolution of wages, the status of women. However, it would improve even more that of men.

Factors' reallocations across sectors

In order to analyze women's (and men's) wellbeing we should also take into account "factor adjustments", i.e. the number of workers that change occupational sector. Traditionally, this has been interpreted as a "cost" for workers. In principle, the higher the number of workers that are reallocated, the more harmful to that economy the shock is (e.g., De Melo and Tarr, 1992).

Table 7 presents small "factor adjustments". Across simulations female and male "Professionals" experience the highest increases in the percentage of workers reallocated, with the sole exception of the "Only uniform tariffs". Recall that, except in this latter scenario, the greatest increases in production take place in the Business sectors where the number of firms has gone up. This increases more sharply the demand for workers most intensively used in those sectors. Across scenarios, as the "Adult females" and "Adult males" rows at the bottom of Table 7 show, the percentage adjustment is slightly larger for men than for women. The exception is, once more, the outcomes from the "Only uniform tariffs". In this latter case, two forces coincide. First, there is still a small fall in output in female-intensive Agriculture, which releases more females than males in that sector. Second, output increases in male-intensive sectors are smaller than in the other simulations, thus attracting a lower number of males to them.

Due to the small share of Business services in the Tanzanian economy (they provide 5.9% of GDP), the overall adjustment of female and male labor is limited. As presented in the last rows, the percentage of "Adult females" changing occupational sector in the economy would be around 1.11%, while for "Adult males" it would be 1.35%. Potential higher adjustments could, however, occur if, for example, FDI inflows (and the number of foreign firms) increase. This seems a plausible scenario in view of the remarkable growth of FDI inflows to Africa in recent

years (UNCTAD, several years). Our analysis points to the idea that the resulting adjustment from FDI would contrast with a pattern following a shock on tariffs. As long as the shock makes the evolution of output in Agriculture the prevailing force behind the adjustment, such as in the "Only uniform tariffs" scenario, agricultural technology is what prevails. Similarly, the absence of Dixit-Stiglitz effects also reduces considerably the potential for workers' reallocation, due to the smaller output increases in the Business services sectors.

Sensitivity analysis

The results of the sensitivity analysis reveal that our findings of larger increases in wages and factor adjustments for men in Tanzania (compared to women) remain under different elasticity specifications. We also find that in all cases, again both women and men experience wage increases after the shock. Table 8 presents the results of piecemeal sensitivity analysis for the evolution of overall female and male wages, as well as factor adjustments. To simplify, we run only the short-run scenario that has the strongest impact on model results, i.e., only the "Full reform" scenario. Elasticities and parameter specifications are changed one by one while keeping the rest as in our central model. The results for this model, shown in Tables 5 and 7, are displayed again here under the label "central", to facilitate comparison.

The results are generally very close to those obtained with the central elasticity values. However, with higher (lower) levels of elasticities increases in wages and factor adjustments tend to be slightly larger (smaller) than in the central case. This is to be expected since higher elasticities imply more flexibility in the economy, which facilitates the shift to products and sectors that become cheaper after the shock. An exception to this tendency arises with the elasticity of substitution between firm varieties in imperfectly competitive sectors (σ (q_i,q_j)). This elasticity has a strong influence on the model results. When it is low, varieties are seen as very different and as poor substitutes. Therefore, additional varieties have a stronger impact on the economy, resulting in higher wages and factor adjustments than in the central case and vice versa. The elasticity of multinational service firms' supply with respect to the price of output (ε (f_i)) is also more influential for the outcomes than the rest, although to a lesser extent than σ (q_i,q_j). If foreign multinationals expand their production more after the fall in output prices (high value case of this elasticity), there will be a sharper increase in wages and worker reallocations in the economy. This result further confirms that despite their relative low labor-intensive technologies (compared to domestic firms), more activity of foreign multinationals is beneficial for the wages of women and men in Tanzania. Finally, it is also interesting that with a high elasticity of substitution between value added and Business services (σ (va,bs)), adult males' wages and factor adjustments experience much higher percentage changes. When this elasticity is high, it becomes easier to benefit from cheaper Business services. This will increase production in Business services more markedly and, since these sectors are male intensive, this type of labor will benefit more (than females).

Conclusions

Policies lowering regulatory barriers faced by both domestic and MNEs operating in the business services sectors increase the number of firms in those sectors and their share of the economy. Due to Dixit-Stiglitz endogenous productivity impacts from additional business services, there is an increase in the demand for all labor categories, raising wages across all worker categories, and, contrasting with the predictions of the Stolper-Samuelson Theorem, the real remuneration of all factors of production rises simultaneously. Even though foreign MNEs exhibit lower labor intensity in production than national firms, labor demand benefits from the arrival of foreign firms. However, the increase in wages is higher for males than for females. This is because the expanding business services exhibit higher male than female worker intensity.

Developing countries, like industrialized countries, are opening up more to foreign investors in services and becoming more business services oriented. This model illustrates that as this development process continues, these sectors demand more educated workers and the relative wages of the better trained will increase relative to the unskilled. The policy conclusion from this model is that it is crucial to invest in the education of females so their human capital increases and their skills are more marketable in business services and other more technologically modern occupations. Otherwise the wage gap between males and females would likely widen further.

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Table 1. Factor remunerations and factor intensities in the benchmark (in billions of current Tanzanian Shillings and %)

	Child (age 10 to 17)	Female (Unskilled)	Female (Laborers)	Female (Technicians)	Female (Professionals)	Male (Unskilled)	Male (Laborers)	Male (Technicians)	Male (Professionals)	Subsistence	Capital	Land	All females	All males	Adult (females +males)	**Total Value Added**
Factors remuneration (in billions of current Tanzanian Shillings)																
Business Services	47	1,631	12,030	1,126	1,899	5,618	91,143	13,437	19,402		297,996		16,686	129,599	146,285	**444,328**
Dixit-Stiglitz Goods	466	1,110	9,776	567	315	10,849	54,574	5,434	1,039	33,572	579,777		11,768	71,896	83,665	**697,479**
Agriculture	72,280	4,494	363,150	377		35,079	611,045	1,327	523	1,195,472	463,261	251,691	368,021	647,973	1,015,995	**2,998,698**
Other CRTS	21,876	93,790	202,511	47,782	5,747	107,334	603,313	178,600	32,698	719,918	1,369,809	58,549	349,830	921,946	1,271,776	**3,441,928**
ALL SECTORS	94,668	101,025	587,467	49,852	7,962	158,880	1,360,075	198,798	53,662	1,948,962	2,710,842	310,240	746,306	1,771,415	2,517,721	**7,582,433**
Factor intensity (in %)																
Business Services	0.01	0.37	2.71	0.25	0.43	1.26	20.51	3.02	4.37	0.00	67.07	-	3.76	29.17	32.92	100
Dixit-Stiglitz Goods	0.07	0.16	1.40	0.08	0.05	1.56	7.82	0.78	0.15	4.81	83.12	-	1.69	10.31	12.00	100
Agriculture	2.41	0.15	12.11	0.01	0.00	1.17	20.38	0.04	0.02	39.87	15.45	8.39	12.27	21.61	33.88	100
Other CRTS	0.64	2.72	5.88	1.39	0.17	3.12	17.53	5.19	0.95	20.92	39.80	1.70	10.16	26.79	36.95	100
ALL SECTORS	1.25	1.33	7.75	0.66	0.10	2.10	17.94	2.62	0.71	25.70	35.75	4.09	9.84	23.36	33.20	**100**
Labor intensity (in %)																
Business Services	0.03	1.11	8.22	0.77	1.30	3.84	62.28	9.18	13.26	-	-	-	11.40	88.57	99.97	-
Dixit-Stiglitz Goods	0.55	1.32	11.62	0.67	0.37	12.90	64.87	6.46	1.24	-	-	-	13.99	85.46	99.45	-
Agriculture	6.64	0.41	33.37	0.03	0.00	3.22	56.15	0.12	0.05	-	-	-	33.82	59.54	93.36	-
Other CRTS	1.69	7.25	15.65	3.69	0.44	8.30	46.64	13.81	2.53	-	-	-	27.04	71.27	98.31	-
ALL SECTORS	3.62	3.87	22.49	1.91	0.30	6.08	52.06	7.61	2.05	-	-	-	28.57	67.81	96.38	-

Source: Authors' calculations based on NBS (2002a).

Notes: the conversion of occupations to labor categories is as follows: Unskilled ("Elementary occupations"); Laborers (comprised of five occupations: "Clerks", "Services and shop workers", "Skilled agricultural and fishery workers", "Craft and related workers" and "Plant and machine operators and assemblers"); Technicians ("Technicians and associate Professionals") and Professionals ("Professionals"). "Factor intensity" of each factor of production corresponds to the percentage weight of its remuneration in total value added, the latter being normalized to 100 in the column "Total value added". "Labor intensity" is the percentage weight of the remuneration of each category of labor over total labor remuneration. The percentages in columns of "Child (age 10 to 17)" and "Adult (females+males)" add up to 100, since they represent all the labor available for production in the model, excluding the labor allocated to subsistence. In turn, the values in the column "Adult (females+males)" are the sum of the values in columns "All females" and "All males".

Table 2. Number of workers and labor intensity in the benchmark (in physical units and %)

	Child (age 10 to 17)	Female (Unskilled)	Female (Laborers)	Female (Technicians)	Female (Professionals)	Male (Unskilled)	Male (Laborers)	Male (Technicians)	Male (Professionals)	Subsistence	Capital	Land	All females	All males	Adult (females +males)	**Total Number of workers**
Number of workers																
Business Services	1,248	1,582	6,092	564	599	9,634	82,464	7,027	5,013	-	-	-	8,837	104,137	112,975	**114,223**
Dixit-Stiglitz Goods	12,497	3,108	34,609	1,129	566	12,527	68,826	4,235	610	22,965	-	-	39,412	86,198	125,610	**138,107**
Agriculture	2,858,933	30,730	3,825,359	2,537	0	117,406	3,199,983	4,202	1,571	3,939,135	-	-	3,858,627	3,323,162	7,181,788	**10,040,722**
Other CRTS	591,038	303,606	386,820	109,178	11,464	165,564	693,025	220,259	30,389	148,478	-	-	811,067	1,109,237	1,920,305	**2,511,342**
ALL SECTORS	3,463,716	339,026	4,252,880	113,408	12,629	305,131	4,044,297	235,723	37,583	4,110,578	-	-	4,717,943	4,622,734	9,340,678	**12,804,394**
Lactor intensity (in %)																
Business Services	1.09	1.39	5.33	0.49	0.52	8.43	72.20	6.15	4.39	-	-	-	7.74	91.17	98.91	100
Dixit-Stiglitz Goods	9.05	2.25	25.06	0.82	0.41	9.07	49.84	3.07	0.44	-	-	-	28.54	62.41	90.95	100
Agriculture	28.47	0.31	38.10	0.03	0.00	1.17	31.87	0.04	0.02	-	-	-	38.43	33.10	71.53	100
Other CRTS	23.53	12.09	15.40	4.35	0.46	6.59	27.60	8.77	1.21	-	-	-	32.30	44.17	76.47	100
ALL SECTORS	27.05	2.65	33.21	0.89	0.10	2.38	31.59	1.84	0.29	-	-	-	36.85	36.10	72.95	**100**

Note: For the conversions of occupations to labor categories see note in Table 1. “Labor intensity” is the percentage weight of the number of workers of each category in the total number of workers. The percentages in the columns “Child (age 10 to 17)” and “Adult (females+males)” add up to 100 as reflected in the column “Total number of workers”, since they represent all the labor available for production in the model, excluding the labor allocated to subsistence. In turn, the values in the column “Adult (females+males)” are the sum of the values in columns “All females” and “All males”.

Source: Authors’ calculations based on NBS (2002a).

Table 3. Benchmark sectoral information (in %)

	Tariff	% in aggregate exports	% in aggregate imports	Market shares		Regulatory barriers		Weight in private consumption	Business services intermediates (% of total costs)
				Domestic firms	Foreign firms	All firms	Additional barriers for foreign firms		
Business Services		**12.5**	**10.9**					**4.7**	
Telecommunication		1.0	1.9	10.0	90.0	3.0	10.7	0.9	15.3
Insurance		0.2	0.1	70.0	30.0	17.9	55.6	0.0	11.8
Banking		4.4	2.2	60.0	40.0	14.7	50.9	0.8	11.8
Professional business services		4.8	2.4	70.0	30.0	6.9	24.0	0.9	11.8
Air transport		0.2	0.4	60.0	40.0	0.0	30.0	0.2	11.6
Road transport		1.3	2.7	80.0	20.0	0.0	0.0	1.3	11.6
Railway transport		0.1	0.1	40.0	60.0	0.0	10.7	0.1	11.6
Water transport		0.5	1.0	20.0	80.0	0.0	42.0	0.5	15.3
Dixit-Stiglitz Goods	**7.4**	**3.9**	**60.7**					**38.0**	
Processed food	11.1	0.5	3.4					10.6	2.0
Beverages & tobacco products	28.4	0.1	0.7					3.9	4.0
Textile & leather products	29.7	1.3	3.3					10.7	2.6
Wood paper printing	11.6	0.4	3.0					0.8	2.6
Manufacture of basic & industrial chemicals	3.6	0.2	5.1					3.6	4.7
Manufacture of fertilizers & pesticides		0.0	0.6					0.0	0.5
Petroleum refineries	3.2	0.0	10.8					4.4	5.1
Rubber plastic & other manufacturing	6.0	0.1	2.9					1.4	3.8
Glass & cement	7.1	0.5	0.3					0.3	2.9
Iron steel & metal products	5.5	0.1	5.8					1.3	2.2
Manufacture of equipment	6.3	0.6	24.9					1.0	1.9
Agriculture	**15.1**	**26.0**	**7.0**					**21.1**	
Maize	0.2	0.1	1.0					3.5	1.0
Paddy	20.5	0.2	1.2					0.7	2.0
Sorghum or millets	4.6	0.0	0.0					0.4	3.6
Wheat	8.7	0.0	1.1					0.1	2.4
Beans	25.1	0.1	0.0					2.5	0.6
Cassava	25.0	0.0	0.0					1.0	0.0
Other cereals	8.8	0.0	0.0					0.1	0.5
Oil seeds	1.1	0.3	0.0					1.4	0.6
Other roots & tubes	0.5		0.0					1.3	0.0
Cotton	1.2	2.9	0.0					0.0	4.9
Coffee	11.8	6.6	0.0					0.0	1.7
Tobacco	11.1	3.4	0.0					0.0	9.2
Tea	18.9	1.8	0.0					0.5	3.1
Cashew nuts	22.2	6.9	0.0					0.0	0.8
Sisal fiber								0.0	2.4
Sugar	22.3	0.9	3.0					0.2	2.8
Fruits & vegetables	6.7	1.9	0.5					6.8	0.4
Other crops	4.3	0.3	0.0					0.6	0.8
Poultry & livestock	4.4	0.5	0.2					2.2	1.2
Other CRTS	**3.9**	**14.9**	**4.3**					**36.1**	
Fish	22.7	4.9	0.0					5.5	0.0
Hunting & forestry		0.4	0.0					2.8	2.7
Mining & quarrying	3.2	1.5	0.9					0.0	2.5
Meat & dairy products	27.2	0.0	0.2					5.9	0.3
Grain milling	8.6	0.5	0.9					13.2	0.3
Utilities								1.3	6.6
Construction			0.1					0.0	3.2
Wholesale & retail trade								0.0	11.5
Hotels & restaurants								5.6	4.1
Postal communication		0.1	0.1					0.1	15.3
Real estate								0.3	2.8
Other services		1.8	0.9					0.3	11.8
Public administration health & education		42.7	17.1					1.1	2.9
Tourism		5.6	1.0						13.1

Source: Authors' calculations based on Jensen and Tarr (2010) and Thurlow and Wobst (2003).

Table 4. Impacts on Sectoral Activity (% change from benchmark).

Scenario definition	Full Reform	All services barriers	Only non-discrimina-tory services barriers	Only barriers against FDI in services	Only uniform tariffs	CRTS	Steady State
Liberalization of regulatory barriers for all services firms	Yes	Yes	Yes	No	No	Yes	Yes
Liberalization of discriminatory barriers on foreign services firms	Yes	Yes	No	Yes	No	Yes	Yes
Uniform import tariffs?	Yes	No	No	No	Yes	Yes	Yes
Steady-state capital stock	No	No	No	No	No	No	Yes
Dixit-Stiglitz variety-induced productivity gains	Yes	Yes	Yes	Yes	Yes	No	Yes
IRTS Goods and Services	**8.3**	**9.5**	**2.5**	**6.1**	**-1.1**	**3.3**	**14.4**
CRTS Goods and Services	**1.5**	**0.1**	**-0.2**	**0.3**	**1.3**	**0.5**	**3.7**
Business Services	**25.7**	**24.8**	**6.7**	**15.7**	**0.9**	**9.4**	**34.5**
Telecommunication	12.4	13.0	3.2	8.8	-0.6	4.0	17.0
Insurance	61.5	63.4	20.5	38.2	-1.3	25.0	78.3
Banking	59.1	61.0	17.9	38.6	-1.3	24.6	75.7
Professional business services	39.9	41.7	12.2	24.0	-1.3	13.1	56.1
Air transport	10.8	6.0	0.4	5.1	4.4	4.1	14.8
Road transport	9.1	4.2	0.4	3.3	4.4	2.8	13.1
Railway transport	9.8	5.0	0.4	4.2	4.3	3.5	13.7
Water transport	14.4	14.9	2.6	11.3	-0.6	5.7	18.9
Dixit-Stiglitz Goods	**-0.5**	**1.8**	**0.4**	**1.2**	**-2.2**	**0.2**	**4.3**
Processed food	2.8	1.1	0.3	0.8	1.7	2.3	5.6
Beverages & tobacco products	-2.4	2.0	0.4	1.5	-4.3	-0.8	0.2
Textile & leather products	-9.3	1.6	0.4	1.1	-10.7	-3.3	-4.4
Wood paper printing	0.1	4.8	1.4	2.9	-4.2	0.3	4.6
Manufacture of basic & industrial chemicals	5.2	3.9	0.9	2.7	1.4	0.9	12.0
Manufacture of fertilizers & pesticides	5.6	-5.7	-1.8	-3.5	11.7	4.4	11.4
Petroleum refineries	11.6	3.0	0.7	2.0	8.8	4.5	20.9
Rubber plastic & other manufacturing	4.0	2.6	0.6	1.8	1.5	1.3	11.3
Glass & cement	0.8	1.0	0.2	0.7	-0.2	0.3	6.1
Iron steel & metal products	3.7	1.2	0.3	0.8	2.7	1.6	10.0
Manufacture of equipment	2.6	1.3	0.3	0.8	1.5	1.2	12.5
Agriculture	**-1.9**	**-1.6**	**-0.6**	**-1.0**	**-0.3**	**-1.1**	**-0.9**
Maize	1.1	0.7	0.2	0.4	0.4	0.7	1.6
Paddy	-2.5	0.7	0.2	0.5	-3.1	-2.7	-1.8
Sorghum or millets	1.2	1.1	0.2	0.8	0.1	0.5	2.4
Wheat	-1.5	0.3	0.2	0.1	-1.5	-0.9	-0.1
Beans	0.8	0.7	0.2	0.5	0.0	0.3	1.0
Cassava	0.3	0.5	0.1	0.3	-0.1	0.1	0.3
Other cereals	0.6	1.0	0.2	0.7	-0.4	0.3	2.5
Oil seeds	0.9	0.6	0.2	0.4	0.4	0.6	2.5
Other roots & tubes	0.6	0.6	0.2	0.4	0.0	0.2	0.9
Cotton	-7.3	0.0	-0.3	0.4	-7.3	-2.4	-2.0
Coffee	-9.0	-19.8	-6.0	-12.9	9.4	-1.2	-10.1
Tobacco	1.0	-0.2	-1.0	1.2	0.8	0.9	5.1
Tea	-3.6	-3.6	-1.2	-1.9	-0.6	-2.4	1.4
Cashew nuts	-8.2	-26.4	-8.6	-17.1	19.0	0.5	-5.2
Sisal fiber	-9.3	1.6	0.4	1.1	-10.7	-3.3	-4.4
Sugar	-13.7	-0.2	0.0	-0.2	-13.1	-12.6	-12.1
Fruits & vegetables	0.5	0.3	0.1	0.2	0.2	0.3	0.4
Other crops	1.0	0.4	0.1	0.3	0.6	0.4	1.6
Poultry & livestock	0.4	0.1	0.0	0.1	0.2	0.1	1.1
Other CRTS	**2.0**	**1.7**	**0.4**	**1.1**	**0.2**	**0.7**	**4.4**
Fish	0.1	-0.9	-0.2	-0.5	0.9	0.2	2.4
Hunting & forestry	0.9	1.2	0.3	0.7	-0.3	0.4	1.6
Mining & quarrying	3.7	0.0	0.0	0.0	3.7	2.8	11.5
Meat & dairy products	-0.4	0.6	0.2	0.4	-1.0	-0.7	0.0
Grain milling	1.2	1.0	0.2	0.7	0.2	0.6	2.9
Utilities	1.2	3.0	0.7	2.0	-1.7	0.3	6.2
Construction	1.1	1.2	0.3	0.8	-0.1	0.4	6.5
Wholesale & retail trade	1.2	1.3	0.3	0.9	-0.1	0.5	4.9
Hotels & restaurants	5.2	1.8	0.1	1.6	3.1	1.8	8.5
Postal communication	6.4	6.9	1.7	4.4	-0.5	2.1	11.2
Real estate	3.9	3.9	1.0	2.5	0.0	1.2	6.5
Other services	10.0	11.0	2.8	6.6	-0.8	3.4	10.7
Tourism	11.9	-12.4	-5.8	-5.1	22.0	4.9	14.8
Public administration health & education	0.8	0.8	0.2	0.5	0.0	0.3	1.0

Source: Authors' estimates.

Table 5. Variation in factor earnings and in aggregate welfare (% change from benchmark)

	Full Reform	All services barriers	Only non-discrimina-tory services barriers	Only barriers against FDI in services	Only uniform tariffs	CRTS	Steady State
Variation in factor earnings							
Subsistence Factor	2.52	2.11	0.49	1.50	0.37	0.73	5.75
Child labor (age 10 to 17)	1.33	0.63	0.04	0.52	0.64	0.25	4.07
Female wages (Unskilled)	2.53	1.33	0.29	0.96	1.07	1.03	5.23
Female wages (Laborers)	1.79	1.03	0.16	0.78	0.69	0.49	4.57
Female wages (Technicians)	2.50	1.76	0.48	1.14	0.68	1.00	4.00
Female wages (Professionals)	7.96	7.23	2.10	4.59	0.68	3.14	11.25
Male wages (Unskilled)	2.15	1.35	0.28	0.98	0.71	0.82	4.89
Male wages (Laborers)	2.28	1.49	0.29	1.08	0.71	0.74	5.15
Male wages (Technicians)	3.90	3.21	0.92	2.05	0.63	1.56	6.00
Male wages (Professionals)	13.17	12.66	3.77	7.94	0.48	5.16	18.05
Return on subsistence Factor	2.52	2.11	0.49	1.50	0.37	0.73	5.75
Return on capital	2.63	2.07	0.50	1.40	0.50	1.04	-0.70
Return on land	0.52	0.04	-0.15	0.15	0.43	-0.27	3.13
Adult female wages	2.00	1.18	0.22	0.87	0.74	0.62	4.69
Adult male wages	2.78	2.01	0.47	1.39	0.69	0.97	5.61
Adult (female and male) wages	2.60	1.84	0.43	1.28	0.71	0.90	5.37
Aggregate welfare							
Welfare (EV as % of consumption)	2.23	1.95	0.46	1.32	0.26	0.67	4.52
Welfare (EV as % of GDP)	2.03	1.77	0.42	1.20	0.24	0.61	4.11

Source: Authors' estimates.

Table 6. Difference in wages by sex (change in percentage points of difference) and evolution of the wage gap (in %)

	Benchmark	Full Reform	All services barriers	Only non-discrimina-tory services barriers	Only barriers against FDI in services	Only uniform tariffs	CRTS	Steady State
Change in percentage points of difference between females wages and males wages								
Female-male wages (Unskilled)	-	0.38	-0.02	0.01	-0.02	0.36	0.21	0.34
Female-male wages (Laborers)	-	-0.49	-0.46	-0.13	-0.30	-0.02	-0.25	-0.58
Female-male wages (Technicians)	-	-1.40	-1.45	-0.43	-0.91	0.05	-0.56	-2.00
Female-male wages (Professionals)	-	-5.21	-5.43	-1.67	-3.35	0.20	-2.01	-6.81
Female-male wages (All workers)	-	-0.78	-0.83	-0.25	-0.52	0.05	-0.35	-0.92
Wage gap								
Female/male wages (Unskilled)	67.66	67.91	67.65	67.66	67.65	67.90	67.80	67.88
Female/male wages (Laborers)	39.43	39.24	39.25	39.38	39.31	39.42	39.33	39.21
Female/male wages (Technicians)	52.22	51.52	51.49	52.00	51.75	52.25	51.94	51.24
Female/male wages (Professionals)	41.46	39.55	39.46	40.80	40.18	41.54	40.67	39.07
Female/male wages (All workers)	39.77	39.47	39.45	39.67	39.56	39.79	39.63	39.42

Source: Authors' estimates.
Note: the wage gap is the ratio of female to male wages in percentage terms. Wages can be obtained by dividing total remuneration of each type of worker by the corresponding number of physical workers based on NBS (2002a) for the benchmark and in the simulation results for the remaining scenarios.

Table 7: Factor adjustments (% change from benchmark)

	Full Reform	All services barriers	Only non-discrimina-tory services barriers	Only barriers against FDI in services	Only uniform tariffs	CRTS	Steady State
Child labor (age 10 to 17)	1.12	1.08	0.34	0.69	0.87	0.65	1.18
Female (Unskilled)	1.09	0.61	0.17	0.45	0.55	0.39	1.14
Female (Laborers)	1.11	1.00	0.31	0.65	0.82	0.57	1.19
Female (Technicians)	0.57	0.48	0.12	0.31	0.17	0.20	0.66
Female (Professionals)	4.13	4.38	1.41	2.77	0.47	1.70	5.08
Male (Unskilled)	1.03	0.66	0.20	0.46	0.70	0.42	1.18
Male (Laborers)	1.12	0.91	0.29	0.60	0.80	0.52	1.31
Male (Technicians)	1.74	1.71	0.52	1.07	0.26	0.68	2.13
Male (Professionals)	6.78	7.11	2.40	4.54	0.51	2.88	8.28
Subsistence Factor	0.30	0.15	0.04	0.11	0.27	0.24	0.48
Capital	1.98	1.64	0.51	1.05	1.26	0.87	4.01
Land	1.52	1.47	0.47	0.95	1.27	0.95	1.58
Adult females	1.11	0.95	0.29	0.62	0.73	0.53	1.19
Adult males	1.35	1.17	0.37	0.76	0.72	0.60	1.60
Adult (female and male) wages	1.28	1.10	0.35	0.72	0.73	0.58	1.48

Source: Authors' estimates.

Table 8: Piecemeal sensitivity analysis: Variation in Adult female and male wages and factor adjustments after "Full reform" (% change with respect to benchmark)

Parameter	Parameter value			Variation in Adult female and male wages (% change with respecto to benchmark)						Factor adjustments (% change with respecto to benchmark)					
	Lower	Central	Upper	Lower		Central		Upper		Lower		Central		Upper	
				Adult Females	Adult Males	Adult Females	Adult Males	Adult Females	Adult Males	Adult Females	Adult Males	Adult Females	Adult Males	Adult Females	Adult Males
σ (va, bs)	0.5	1.25	2.00	1.80	2.30	2.00	2.78	2.36	3.64	0.82	0.95	1.11	1.35	1.66	2.15
σ (q_i, q_j)	2.00	3.00	4.00	4.98	6.90	2.00	2.78	1.62	2.20	2.45	2.87	1.11	1.35	0.89	1.14
σ (D, M)	2.00	4.00	6.00	1.93	2.23	2.00	2.78	2.11	3.26	0.70	0.91	1.11	1.35	1.48	1.75
σ (L,K)	0.7	1.00	1.3	1.87	2.85	2.00	2.78	2.09	2.73	1.06	1.30	1.11	1.35	1.14	1.39
σ (A_1,…,A_n)	0.00	0.00	0.25	2.00	2.78	2.00	2.78	2.01	2.79	1.11	1.35	1.11	1.35	1.11	1.35
σ (D,E)	2.00	4.00	6.00	2.03	2.66	2.00	2.78	1.98	2.88	0.95	1.20	1.11	1.35	1.25	1.51
ε (d_i)	2.00	4.00	6.00	1.98	2.73	2.00	2.78	2.02	2.82	1.04	1.27	1.11	1.35	1.15	1.41
ε (f_i)	2.00	4.00	6.00	1.06	1.39	2.00	2.78	2.78	3.86	0.67	0.77	1.11	1.35	1.42	1.78
θ_m (i)	See table below			1.97	2.81	2.00	2.78	2.07	2.71	1.15	1.41	1.11	1.35	1.04	1.26
θ_{fdi} (i)				1.82	2.51	2.00	2.78	2.17	3.02	1.00	1.22	1.11	1.35	1.21	1.47

Parameter	**Definition of the parameter**
σ (va, bs)	Elasticity of substitution between value-added and business services
σ (q_i, q_j)	Elasticity of substitution between firm varieties in imperfectly competitive sectors
σ (D, M)	Armington elasticity of substitution between imports and domestic goods in CRTS sectors
σ (L,K)	Elasticity of substitution between primary factors of production in value added
σ (A_1,…,A_n)	Elasticity of substitution in intermediate production between composite Armington aggregate goods
σ (D,E)	Elasticity of transformation (domestic output versus exports)
ε (d_i)	Elasticity of national service firm supply with respect to price of output
ε (f_i)	Elasticity of multinational service firm supply with respect to price of output
θ_m (i)	Share of value added in multinational firms in sector I due to specialized primary factor imports in the benchmark equilibrium
θ_{fdi} (i)	Share of output of service sector i captured by multinationals firms in the benchmark equilibrium

Parameters values for:	θ_{fdi} (i)			θ_m (i)		
	Lower	Central	Upper	Lower	Central	Upper
Telecommunication	0.85	0.9	0.95	0.025	0.05	0.1
Insurance	0.2	0.3	0.4	0.025	0.05	0.1
Banking	0.3	0.4	0.5	0.025	0.05	0.1
Professional business services	0.2	0.3	0.4	0.025	0.05	0.1
Road transport	0.1	0.2	0.3	0.025	0.05	0.1
Railway transport	0.5	0.6	0.7	0.025	0.05	0.1
Water transport	0.7	0.8	0.9	0.025	0.05	0.1
Air transport	0.3	0.4	0.5	0.025	0.05	0.1