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THE WELFARE IMPACTS OF CHANGES IN THE BRAZILIAN DOMESTIC WORK MARKET

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Edson Paulo Domingues *and* Kênia Barreiro de Souza*

1 INTRODUCTION

Domestic work encompasses a series of activities such as cleaning, housekeeping, cooking, washing clothes and caring for children, elderly or disabled people and pets, among others. Although domestic workers may perform different types of activities, two features are common to all of them: the work is paid, and the work is done in a home other than that of the worker him/herself (ILO, 2011th; ILO, 2011ab).

Because of these and other socio-economic characteristics, paid domestic workers are similar in a number of way, namely: i) predominance of female workers; ii) low wages; iii) the employer is an individual; iv) legislation does not follow the Consolidated Labour Laws (*Consolidação das Leis do Trabalho* – CLT)—in fact, such labour rights are mentioned as exceptions in the Federal Constitution (*Constituição Federal* – CF) itself; and v) there is a high degree of labour informality (ILO, 2011c; IBGE, 2012th).

Paid domestic work accounts for a sizeable portion of the work performed by women because, according to Melo (1998), these are culturally considered to be women's jobs. At the same time, the low skill requirements make it a viable alternative to workers with low educational levels and no training, who receive low wages and work mostly informally (Melo, 1998; Theodoro and Scorzafave, 2011).

According to the International Labour Organization (ILO, 2011c), the average wage of domestic workers is, in general, lower than half the overall average wage. In some countries, it may be as low as less than 20 per cent of the average wage. However, and despite the high level of informality, the minimum wage tends to be used as a reference, and as an element of social development and protection (ILO, 2011c; Theodoro and Scorzafave, 2011).

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The low domestic labour wages can be partially explained by the perception that this type of work is unproductive, because it does not generate direct profits for the employer. However, its economic and social value is not sufficiently considered, in the sense that: i) domestic work has direct effects on the safety, organisation and well-being of household members; ii) it increases the likelihood that other family members will enter the labour market; and iii) it stimulates consumption, thus generating income and contributing to economic growth (ILO, 2011c).

Nevertheless, the under-valuation of domestic work is reflected in the legislation, which fails to include domestic work in the list of occupations governed by the CLT. This is also a consequence of the peculiar nature of domestic services, which presents two difficulties by reducing the possibility of overseeing the hiring process and number of working hours, and the effects of union actions (DIEESE, 2006; ILO, 2011c).

In Brazil, only in 1972 (through Law 5,859) was domestic work recognised and regulated as a profession, and the effects of the legislation were partially extended to such workers. Key rights achieved were: 20 working days of vacation time for each full year of services rendered; access, through compulsory insurance, to benefits and services provided by the Organic Social Security Law (where the employer must pay 8 per cent of the minimum wage, and the employee the other 8 per cent); and sanctions for not making such a payment, which varies between 10 per cent and 50 per cent of the amount owed (DIEESE, 2006; Giubertti, 2010; Theodoro and Scorzafave, 2011).

In turn, the 1988 Constitution, in its Article 7, describes a series of general workers' rights, but grants only some of these rights to domestic workers, namely: minimum wage; salary irreducibility; thirteenth month of salary; weekly paid rest; 30 days of paid leave per year; maternity leave; paternity leave; notice of termination; retirement and contributions to social security (Brazil, 1988).

Even though formal employment is legally mandated, the number of registered workers is low (an average of 35.64 per cent in metropolitan areas in 2005, according to data from the Monthly Employment Survey, *Pesquisa Mensal de Emprego* – PME) (IBGE, 2012a), reflecting the lack of oversight and incentives to formalisation.

In an attempt to overturn this situation, Law No. 11,324 was enacted in 2006, introducing the possibility of deducting social security contributions referring to employees' wages from the employer's income tax (Giubertti, 2010; Theodoro and Scorzafave, 2011). According to DIEESE (2006), two factors need to be revised in this law, as they limit incentives towards labour formalisation: the deduction may not exceed the employer's contribution, based on one minimum wage, restricted to a single worker; and, to qualify for the benefit, the employer must file his/her income taxes using the complete form.

Finally, in 2011, Law No. 10,208 was enacted, making payment of the Guarantee Fund for Time of Service (*Fundo de Garantia por Tempo de Serviço* – FGTS) optional, and ensuring the right to unemployment insurance of one minimum wage for up to three months for domestic workers dismissed without just cause.

Policies of this nature were among the issues discussed at the 2010 and 2011 International Labour Conferences, promoted by the ILO, and which resulted in the Convention on Domestic Workers 2011 (No. 189), accompanied by Recommendation No. 201, which, in its Article 25, reinforces the role of ILO member states in "[encouraging] the continuing development of

the competencies and qualifications of domestic workers, including literacy training as appropriate, in order to enhance their professional development and employment opportunities" (ILO, 2011b).

Before Convention No. 189 can be ratified, deliberations about Proposed Constitutional Amendment No. 478/2010 must conclude. This proposal is about repealing the sole paragraph of Article 7 of the Federal Constitution, thus establishing equal rights for all rural and urban workers, including domestic workers.

Despite the many advances in protecting these workers, informality and low wages are still widespread. One of the recurring issues in the debate about labour formalisation is the increase in the cost of hiring domestic services, which may lead to a reduction in demand, reducing employment opportunities for workers in this sector. As emphasised by Mattos (2009), the imposition of additional charges directly impacts the decision of hiring a domestic worker, thus benefiting those who are employed, and reducing the number of job opportunities available to those who are not.

In Brazil, growth in domestic workers' income has been above the average growth rate of the economy, while, at the same time, the number of hired workers has changed very little, indicating that demand has remained high enough that no jobs were lost in the labour market. In this sense, this study sought to estimate the impact of increased wages paid to domestic workers, through simulations with a computable general equilibrium (CGE) model. As such, one can observe the implications of recent increases in the relative wages of domestic workers in Brazil, considering two concurrent effects: i) the increase in the price of domestic work; and ii) the income gains of domestic workers. Thus, one can assess not only the immediate results on the demand for domestic services but also the effects triggered elsewhere in the economy. Hence, the results indirectly show the likely consequences of formalisation and the inclusion of domestic work under the aegis of labour rights. According to the simulations presented in this study, this would lead to increased income for a portion of the population, and higher costs attached to these services.

2 METHODOLOGY

2.1 OVERVIEW ON COMPUTABLE GENERAL EQUILIBRIUM MODELS

In economics, dealing with an economic problem in partial equilibrium or general equilibrium has important implications. In partial equilibrium, the economy is a system where the problem under study represents an independent and isolated block—or a market. The relations and behaviour of this market have little or no effect on the rest of the system, and vice versa. In general equilibrium, the economy is seen as a system of interrelated markets, in which balance in all relations must be achieved simultaneously. Therefore, the general equilibrium approach is the theoretical/applied framework most suited to the issues addressed in this project, as it allows us to assess not only the direct effects of formalisation of domestic work but also the impacts triggered in other sectors of the economy.

The rapid evolution of computational and numerical methods has made it possible to solve complex models dealing with national economies and, subsequently, multisectoral and inter-regional models as well. The initial goal, of demonstrating the possibility of achieving a solution in large-scale economic systems, gradually evolved into different applications in

important economic policy issues. In this sense, CGE models have been applied in a wide range of topics and different economic dimensions (at the global, inter-regional or national level).

The Australian CGE modelling school, led by Professor Peter Dixon, has been examining important issues referring to tariff protection in Australia for over 20 years (Dixon and Rimmer, 2002). These models have also been used frequently in literature, as a tool for economic development. They also allow for analyses of trade policies, using global models.

Global (or multi-regional) CGE models, dealing with a set of national economic spaces, share many of the features found in inter-regional models, whose main focus is regional modelling in a national economy. In global models, foreign trade flows are key elements in inter-regional connections, even when the analysis is not geared towards trade policy issues.

2.2 THE BRIDGE MODEL

The CGE model used in this study is called the Brazilian Recursive Dynamic General Equilibrium (BRIDGE) model. The BRIDGE model was developed based on the theoretical framework used in the ORANI (DIXON et al., 1982) and ORANIG (Horridge, 2006) models, incorporating dynamically recursive elements. These elements are essential, especially in simulations related to capital stock (which accumulates over time) or the labour market (which carries a certain momentum in adjusting wages and employment). It is no different in the case of this project.[1]

The BRIDGE model was configured for the year 2005, in accordance with the industry and commodity classifications in the Instituto Brasileiro de Geografia e Estatística (IBGE) input–output matrix: the sectors are divided into 60 industries and 116 commodities, there are five final demand components (household consumption, government consumption, investment, exports and inventory), two primary factors (capital and labour), two marginal sectors (trade and transport), imports by commodity for each of the 60 industries and five final demand components, a set of indirect taxes and a set of taxes on production.

The theoretical specification of the model follows the standard in national CGE models. The productive sectors minimise production costs, while subject to a technology of constant returns to scale, where the combination of intermediate inputs and the primary (aggregate) factor is determined by fixed coefficients (Leontief). As part of the inputs, price-based substitution is carried out between domestic and imported products, through the use of constant elasticity of substitution (CES) functions. As part of the primary factor, there is also price-based substitution between capital and labour, also using CES functions. Even though all sectors have the same theoretical specification, the effects of substitution through prices differ according to the domestic/imported make-up of the inputs used.

Household demand (comprising 10 representative households, classified by income decile) is specified based on Stone-Geary non-homothetic utility functions (Peter et al., 1996), dividing the consumption of goods and services into 'luxury' and 'subsistence' categories in such a way that a fixed amount of spending is reserved for subsistence consumption and the rest is used in 'luxury spending', so that changes in income may cause different changes in the consumption of products—hence its non-homothetic nature.

Sectoral exports respond to demand curves negatively associated with domestic production costs and positively affected by the exogenous expansion of international income, using the hypothesis of a small country in international trade. Government consumption is typically exogenous, and may or may not be associated with household spending or tax collection. Inventory accumulates according to variations in production.

Changes in well-being were measured in monetary terms, based on two income variation measures: compensating and equivalent. When a change in prices occurs, the compensating variation (CV) measures the monetary compensation necessary—given price variations—for the agent (in this case, each of the 10 representative households) to maintain the same initial level of utility. In other words, it is the amount necessary for the consumer to return to his/her original indifference curve.

The second measure, equivalent variation (EV), measures the maximum amount of income that consumers would be willing to pay to avoid the price change and continue consuming their original baskets. That is, it measures the amount of money that would be taken from the consumer, prior to the price changes, to leave him/her at the same level of well-being as after the price change (Mas-Collel et al., 1995).

Annex 1 shows the operations of the BRIDGE model in greater detail.

2.3 ADAPTATION OF THE MODEL

To meet the research objectives, the model was adapted to incorporate specific data about the consumption of domestic services. As such, we were able to more precisely map the kind of household that relies more heavily on domestic work (by income decile). Additionally, we sought to identify the share of domestic workers in each of the income deciles, to gauge the effects of income gains upon formalisation. This expansion was made possible through data from the Household Budget Survey (*Pesquisa de Orçamento Familiar* – POF) conducted by IBGE (IBGE, 2012b).

The distribution of households by income bands was done using data from POF 2002/2003[2] about monthly income per consumption unit (Table 1). We then created the shares of income consumed for each commodity in the matrix for the 10 representative families. These results, in turn, were used for the breakdown of household consumption (Figure 1), according to national accounts (IBGE, 2012c).

The compatibility results, shown in Table 2, demonstrate the distribution of household domestic service consumption per income decile. In households, 1.74 per cent of household consumption relates to domestic services. Most of this volume is consumed by households in the upper income deciles, as expected: about 80 per cent of consumption falls in the ninth and tenth deciles.

The domestic services sector, as described in the national accounts and as part of the CGE model database, includes any expenditure on services provided at home. Thus, to assess the spending specifically on domestic workers, POF Table 19 was used, as it contains the proportion of 'domestic services' expenditures per unit of consumption.

TABLE 1

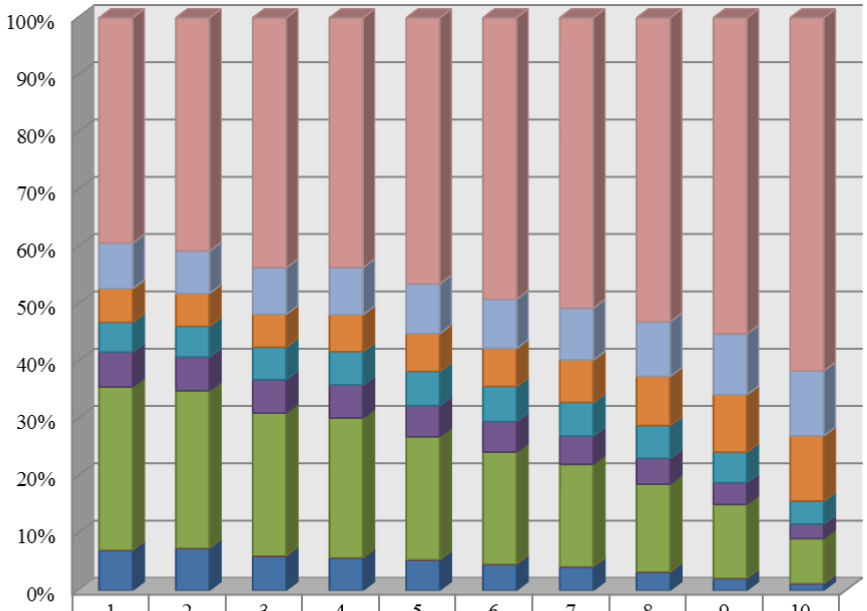
Characteristics of Income Deciles in Brazil, from POF 2002/2003

Decile	Number of observations	Corresponding population	Average income (R$)	Standard deviation (R$)	Minimum (R$)	Maximum (R$)
1	6730	4,877,783	210.71	68.96	4.00	305.00
2	6158	4,836,322	379.11	43.59	306.00	453.00
3	5606	4,869,806	523.81	40.63	454.00	596.00
4	5190	4,846,089	674.80	47.17	597.00	758.00
5	4921	4,843,652	859.31	60.67	759.00	970.00
6	4390	4,861,636	1103.00	80.07	971.00	1246.00
7	4225	4,847,143	1431.09	115.03	1247.00	1652.00
8	3972	4,845,858	1954.89	195.15	1653.00	2341.00
9	3687	4,853,007	3000.83	441.40	2342.00	3878.00
10	3689	4,853,342	8000.76	6617.35	3881.00	385,250.00

Source: Created in house, based on data from POF 2002/2003 (IBGE, 2012b).

FIGURE 1

Share of Commodities in Household Consumption, by Income Decile (Aggregated Industries)



	1	2	3	4	5	6	7	8	9	10
Agriculture and Livestock	39,32	40,73	43,62	43,63	46,47	49,13	50,70	53,07	55,19	61,64
Extractive Industry	7,97	7,41	8,14	8,21	8,67	8,60	9,04	9,53	10,59	11,35
Food	5,88	5,73	5,75	6,44	6,59	6,63	7,42	8,60	10,05	11,38
Consumer goods	5,18	5,37	5,69	5,83	5,98	6,09	5,85	5,71	5,32	4,03
Durables Consumption	6,09	5,85	5,79	5,75	5,43	5,36	4,93	4,50	3,80	2,52
Intermediate Goods	28,51	27,51	24,96	24,41	21,50	19,59	17,91	15,37	12,93	7,89
Capital goods	0,04	0,04	0,04	0,04	0,03	0,03	0,03	0,03	0,03	0,02
Services	7,00	7,36	6,01	5,70	5,33	4,55	4,12	3,19	2,09	1,18

Source: Created in house, based on data from POF 2002/2003 (IBGE, 2012b).

TABLE 2

Distribution of the Consumption of Domestic Services and Other Goods and Services, by Income Decile (POF, 2002/2003)

Decile	Domestic services (%)	Other goods and services (%)
1	0.41	2.73
2	1.09	3.47
3	0.93	4.33
4	1.06	5.16
5	1.65	6.09
6	2.95	7.40
7	4.04	9.22
8	8.89	11.80
9	17.78	16.06
10	61.22	33.74
Total	**100.00**	**100.00**

Source: Created in house, based on data from POF 2002/2003 (IBGE, 2012b).

From these expenditures, nine types of workers were selected (Table 3), thus constituting the group of 'domestic workers' under the scope of this research. The other categories were included in 'other services provided at the home', a sector that grows at the same pace as the economy but which remains small in terms of the total amount spent on domestic services across all deciles (Table 4).

If, on the consumption side, the relationship between income deciles and expenditures on domestic work is positive, on the income side it is the opposite, as expected (Table 5). To ascertain the income of domestic workers from the POF data, we considered all individuals who declared themselves to be 'Domestic Workers' and whose income[3] is not zero.

TABLE 3

Services that Make up the Costs of Domestic Workers, from POF

POF Code	Service
101	Employee
201	Cook
301	Janitor
401	Babysitter
801	Chambermaid
1301	Laundress
1401	Kitchen assistant
1501	Ironer (maid)
1701	Laundress and ironer

Source: Created in house, based on POF 2002/2003 (IBGE, 2012b).

TABLE 4

Expenditures on Domestic Services and other Services, by Income Decile, Based on Data from POF 2002/2003

	Share, in relation to all 'Domestic Services' (%)		Share by decile (%)	
Decile	**Other services**	**Domestic work**	**Other services**	**Domestic work**
1	19.88	80.12	0.99	0.36
2	4.48	95.52	0.59	1.13
3	7.37	92.63	0.83	0.94
4	4.38	95.62	0.56	1.10
5	6.58	93.42	1.31	1.68
6	11.14	88.86	3.98	2.86
7	5.36	94.64	2.62	4.16
8	7.93	92.07	8.54	8.92
9	5.11	94.89	11.01	18.39
10	9.38	90.62	69.57	60.47
Total	**8.25**	**91.75**	**100.00**	**100.00**

Source: Created in house, based on data from POF 2002/2003 (IBGE, 2012b).

TABLE 5

Deflated Average Annual Income of Domestic and Non-domestic Workers, by Income Decile (POF 2002/2003)

	Other workers			Domestic workers		
Decile	**Number ***	**Average annual income (R$)**	**Average monthly income (R$)****	**Number ***	**Average annual income (R$)**	**Average monthly income (R$)****
1	4,785,709	967.46	80.62	605,055	831.33	69.28
2	5,135,870	1705.65	142.14	676,012	1326.90	110.57
3	5,755,980	2189.03	182.42	802,231	1508.29	125.69
4	6,506,801	2843.18	236.93	836,030	1722.43	143.54
5	7,445,331	3371.24	280.94	932,962	1940.06	161.67
6	7,773,976	4360.70	363.39	805,133	2012.09	167.67
7	8,484,628	5362.64	446.89	855,038	2584.68	215.39
8	9,182,805	7263.58	605.30	536,295	2405.39	200.45
9	9,306,724	11,067.27	922.27	365,612	3118.06	259.84
10	9,047,207	28,185.49	2348.79	132,502	3698.06	308.17
Total	**73,425,031**	**-**	**-**	**6,546,870**	**-**	**-**

* Domestic workers who earn income from other types of work are included in both groups when counting the number of workers, but the income was separated into income from domestic work and other sources.

** Average annual income, divided by 12.

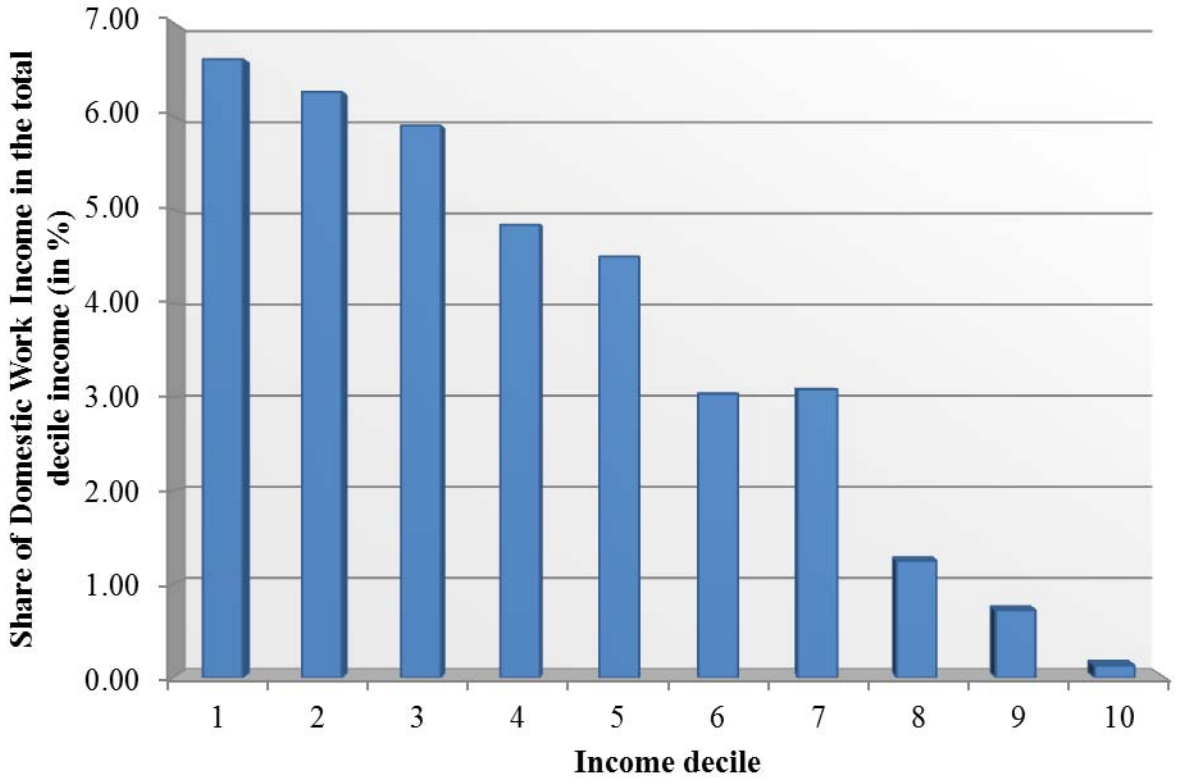
Source: Created in house, based on data from POF 2002/2003 (IBGE, 2012b).

Although the income per worker is higher in the higher deciles, the importance of the income from domestic work decreases with the deciles, reaching 9.8 per cent of the total income of the first decile, and only 0.19 per cent in the tenth decile, as can be seen in Figure 2, showing the redistributive character of increasing the wages of these workers.

The make-up of the deciles by gender (Table 6) makes it clear that women are predominant in this profession at all income levels. While for other types of workers the share of women workers grows with the deciles, in the case of domestic workers the share remains similar, with the exception of the tenth decile, in which the share of men increases to 17 per cent. Out of the entire population, 92.6 per cent of domestic workers are women; in other sectors, women account for only 34.34 per cent.

FIGURE 2

Share of Income from Domestic Work in the Decile's Total Income (in %)



Source: Created in house, based on data from POF 2002/2003 (IBGE, 2012b).

Despite the gender distribution being balanced, the distribution by skin colour illustrates the income inequality between the white and black populations in Brazil (Table 7). In the first decile, 69.41 per cent of the population is black,[4] in the last decile, only 23.38 per cent declared themselves as black. In the case of domestic work, the percentage of white workers is 43.16 per cent, against 56.84 per cent for other kinds of workers, but the distribution is similar in each decile.

TABLE 6

Employee Distribution by Gender (in %), in each Income Decile

	Domestic employees		Other workers		Total	
Decile	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
1	93.37	6.63	23.78	76.22	32.45	67.55
2	91.63	8.37	26.68	73.32	35.08	64.92
3	92.19	7.81	27.98	72.02	36.71	63.29
4	93.19	6.81	28.84	71.16	36.91	63.09
5	94.09	5.91	31.79	68.21	39.43	60.57
6	91.84	8.16	33.29	66.71	39.23	60.77
7	93.31	6.69	35.11	64.89	40.87	59.13
8	93.58	6.42	38.79	61.21	41.94	58.06
9	91.03	8.97	40.25	59.75	42.23	57.77
10	82.93	17.07	42.21	57.79	42.81	57.19
Total	**92.60**	**7.40**	**34.34**	**65.66**	**39.45**	**60.55**

Source: Created in house, based on data from POF 2002/2003 (IBGE, 2012b).

TABLE 7

Employee Distribution by Colour (in %), in each Income decile

	Domestic employees		Other workers		Total	
Decile	**White**	**Black**	**White**	**Black**	**White**	**Black**
1	29.07	70.93	30.81	69.19	30.59	69.41
2	35.59	64.41	34.53	65.47	34.67	65.33
3	38.66	61.34	36.65	63.35	36.93	63.07
4	37.68	62.32	43.35	56.65	42.63	57.37
5	43.46	56.54	46.63	53.37	46.24	53.76
6	47.78	52.22	51.85	48.15	51.44	48.56
7	51.91	48.09	59.66	40.34	58.89	41.11
8	53.51	46.49	60.21	39.79	59.82	40.18
9	48.57	51.43	66.07	33.93	65.39	34.61
10	64.20	35.80	76.81	23.19	76.62	23.38
Total	**43.16**	**56.84**	**54.10**	**45.90**	**53.14**	**46.86**

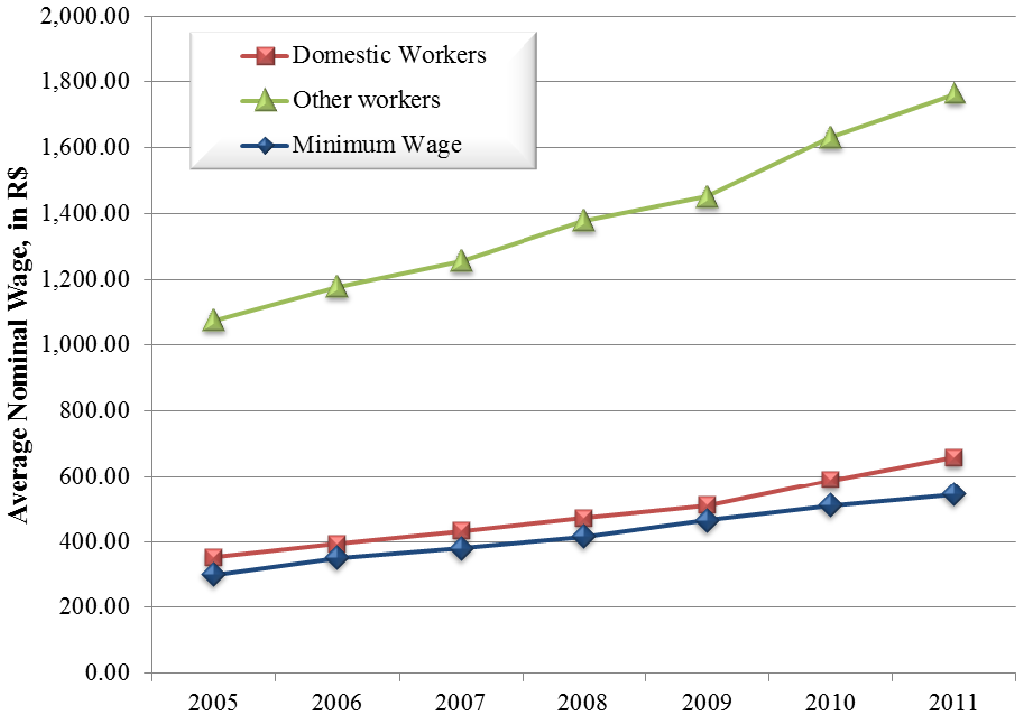
Source: Created in house, based on data from POF 2002/2003 (IBGE, 2012b).

Therefore, any increase in income from domestic labour can have progressive redistributive effects, as it transfers income from the higher to the lower deciles. To capture this effect, we used data from the PME (IBGE, 2012a), through which wage changes can be observed over time.[5]

Figure 3 shows the evolution of the nominal wages of domestic workers[6] and other workers, between 2005 and 2011, and that of the minimum wage during the same period.

FIGURE 3

Average Nominal Income of Domestic Workers and Others, and the Minimum Wage between 2005 and 2011 (December of each Year)



Source: Created in house, based on data from the PME (IBGE, 2012a).

As can be seen, the reality of domestic workers in Brazil fits the characteristics highlighted by the ILO (2011c)—i.e. the average income lies below that of other workers and follows changes in the minimum wage. Nevertheless, between 2005 and 2011, the average income of domestic workers experienced a nominal increase of 86.56 per cent,[7] compared to 64 per cent for other workers, equivalent to average annual increases of 10.95 per cent and 8.89 per cent, respectively.

Despite the higher wages paid to domestic workers, the number of workers has changed little during that period, going from 1,613,510 in 2005 to 1,548,372 in 2011—a 4 per cent decrease in six years. Indeed, this reduction, combined with the rise in the total number of employed workers, has reduced the share of domestic work from 8.47 per cent to 6.98 per cent of total employment.

These changes are not only a consequence of the rise in the cost of domestic work but also of the increased formalisation and expanded job opportunities in other areas, which reduce the number of people willing to work as domestic workers and increase the bargaining power of workers who remain in the sector (Martins, 2010).

2.4 DESIGNING THE ANALYTICAL STRATEGY

Based on the specific information described in the previous section, two direct effects of the increased income of domestic workers will be assessed for the 2006–2011 period: i) higher prices for employers; and ii) income gains for domestic workers.

The recursive dynamics mechanisms allow us to make explicitly temporal use of the CGE model, wherein the endogenous variables are adjusted throughout the analysis period, after an initial shock or series of shocks. Therefore, the operation of CGE models requires certain assumptions in the simulation, or the set of exogenous and endogenous variables that define the so-called 'closure' of the model.

As such, simulations and analyses can be performed from two closures: baseline and policy. The baseline closure establishes the set of endogenous variables and shocks, to reproduce a reference scenario (in this case, the scenario observed in the 2006–2011 period). The policy closure establishes the endogenous and exogenous variables in such a way as to allow for specific exogenous shocks, for certain variables and periods, triggering changes in endogenous variables, through changes in relative prices and real quantities.

For this study, two sets of simulations will be conducted (Table 8) the first set refers to the growth observed between 2005 and 2011, and the second incorporates a set of simulations, i.e. the number of workers is kept constant relative to the baseline scenario; it establishes a 10.95 per cent annual increase in the price of domestic work[8] and a uniform and permanent increase in the income of domestic workers,[9] whose value is based on the weighted share of labour income in the total household income within each decile (Table 9).

TABLE 8

Summary of the Simulations of Changes in the Income of Domestic Workers and the Price of Domestic Services

Simulation	Description	Period
Baseline scenario	**Macroeconomic** scenario observed	2006 to 2011
Policy Closure	1. Increase in the cost of domestic services by 10.95% annually 2. Increase in domestic labour income by 10.95% annually, distributed by income decile	2006 to 2011

Source: Created in house.

TABLE 9

Implicit Increase in Domestic Labour Income from 2006 to 2011 due to Changes in the Domestic Workers´ Labour Market, Distributed by Income Decile

Decile	Share of domestic work income, by decile (in %)	10.95% annual increase, distributed by decile (in %)
1	9.79	1.07
2	9.28	1.01
3	8.76	0.95
4	7.22	0.79
5	6.72	0.73
6	4.56	0.49
7	4.63	0.50
8	1.89	0.20
9	1.09	0.11
10	0.19	0.02

Source: Created in house, based on data from POF 2002/2003 and PME (IBGE, 2012ab).

Thus, the simulation results show a deviation from the baseline (or reference) scenario observed during the period. Methodologically, the growth rate in the baseline scenario does not change the results of the deviation due to the simulation, so the policy simulation represents the portion of the observed result that stems solely from changes in the domestic services market. All simulations were performed using RunDynam software.[10]

3 RESULTS

Generally, the changes in domestic services would have caused fluctuations in the levels of production, employment, wages and consumption in Brazil's economy. Of the cumulative GDP growth occurring between 2006 and 2011 (baseline scenario), 0.58 per cent—or about R$18.9 billion at 2011 prices[11]—can be attributed to the rising incomes of domestic workers, despite the rise in the costs of these services.[12] The result on aggregate employment would be 0.77 per cent—or about 630,000 jobs.[13]

The increase in the income of domestic workers and the increase in real income are reflected by the 1.9 per cent increase in household consumption. As expected, this increase mainly benefits lower income deciles, where most of the gains from domestic work are concentrated. Of the growth in real consumption within the first decile between 2006 and 2011, 6.61 per cent can be attributed to the increase in income from domestic work (Table 10). This figure goes down as we move through the deciles, reaching 0.13 per cent in the wealthiest decile.

Changes in well-being are positive in all deciles (Figure 4), both when measured in terms of compensational income variations (which measures the monetary compensation necessary—given price variations—for each of the 10 representative families to keep the same level of initial satisfaction), and by means of compensating variation (which measures the maximum amount of income that the consumer would be willing to pay to avoid the price change and continue consuming the same combination of goods as before the shock).

TABLE 10

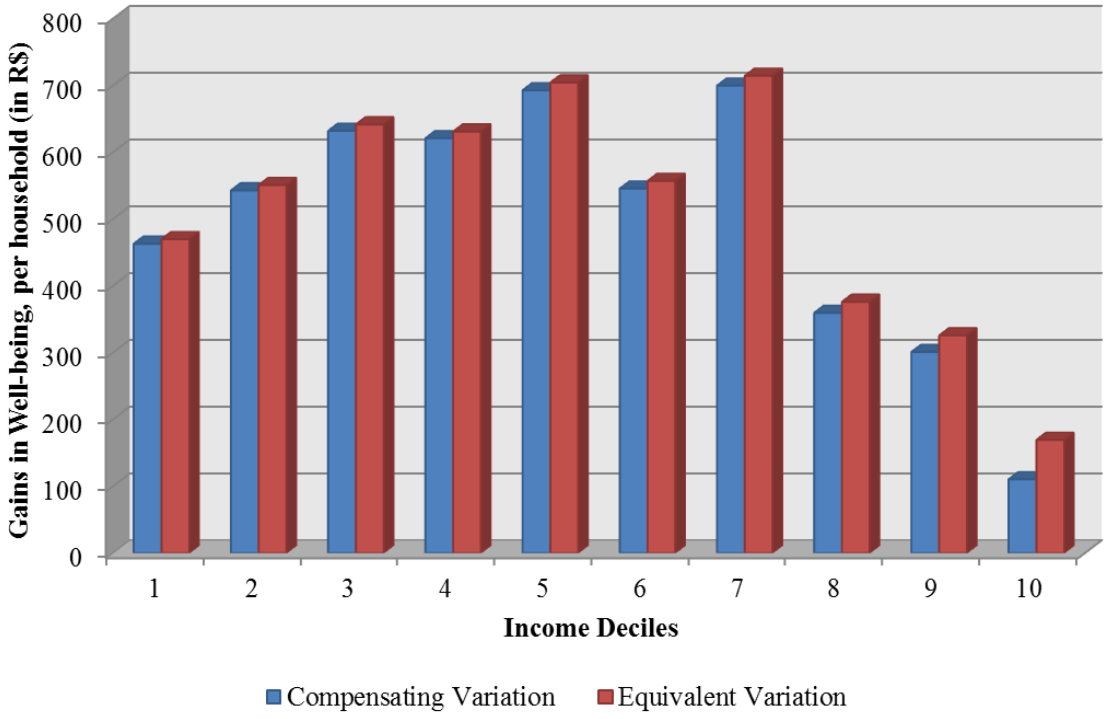
Change in Real Household Consumption, by Income decile, Arising from the Changes in the Price of Domestic Services and in the Income of Domestic Workers – Simulated Results

Households by income decile	Cumulative change between 2006 and 2011 (in %)
1	6.61
2	6.26
3	5.90
4	4.84
5	4.50
6	3.03
7	3.08
8	1.25
9	0.72
10	0.13

Source: Created in house, based on data from the PME (IBGE, 2012a).

FIGURE 4

Monetary Welfare Gains, per Income Decile in the Brazilian Economy, Resulting from Changes in the Incomes of Domestic Workers and in the Price of Domestic Services – Simulated Results (in R$ at 2005 prices)



Source: Created based on simulation results.

One can see that all families enjoy high levels of well-being, and the biggest change can be found in intermediate income deciles. This is due to two factors: i) in these deciles, the share of household income coming from domestic work is high, and, at the same time, only a small amount of these services are being consumed, so the intermediate deciles receive the benefits of the positive income shock and are little affected by price increases; and ii) in the first deciles, with the lowest incomes (only 1.17 per cent of the national labour income—or about R$10 billion—in the first decile), the equivalent higher and compensating variations are smaller in monetary terms, despite representing a well-being gain compared with the starting income.

On the production side, the sectors adjust to income and price shocks, changing their production and their use of production factors (labour). The increase in household income tends to displace part of the production factors to the sectors most associated with household consumption, increasing production and the use of labour. On the other hand, export- or investment-oriented sectors saw a marginal reduction in their production and employment levels. Thus, from a sectoral perspective, the positive effect of the simulated changes affects the 'consumer goods' sectors, with an increase of 0.85 per cent in production and 2.29 per cent in employment in the manufacturing sector (Table 11).

TABLE 11

Accumulated Percentage Changes, between 2006 and 2011, in Sectoral Employment in the Brazilian Economy, Arising from the Changes in the Income of Domestic Workers and the Prices of Domestic Services – Simulated Results

Sector	Production	Employment
Agriculture and livestock	0.23	0.28
Extractive industry	-1.04	-4.35
Food	0.53	1.00
Consumer goods	0.85	2.29
Durables consumption	0.33	0.22
Intermediate goods	-0.74	-1.76
Capital goods	-1.11	-1.89
Services	0.66	1.27

Source: Created in house based on simulation results.

Among those that benefited most are the 'food industry', 'services', 'durable consumer goods' and 'agriculture and livestock', while sectors traditionally intended for intermediate consumption, such as the 'extractive industry', the 'intermediate goods' industry and the 'capital goods' industry showed a negative deviation, in terms of production and employment. Such changes are clearly explained by the structure of household consumption (see Figure 1) —in particular, the consumption structure of the lower deciles, where the consumption of subsistence items is high.

Through further sectoral disaggregation, one can observe that the sectors whose sales are intended for household consumption benefit quite a lot, such as appliances[14] and various health-related services (Table 12). Regarding the increase in employment, the logic remains

the same, and the sectors that benefit the most are 'hospital activities' and 'pharmaceuticals', with increases of 5.08 per cent and 4.93 per cent, respectively. As expected, the largest negative deviation occurred in 'industry', with a reduction in employment of 7.19 per cent in 'iron ore' and 5.55 per cent in 'resins and elastomers' (Table 13).

TABLE 12

Major Changes in Sectoral Employment in the Brazilian Economy, Arising from the Changes in the Income of Domestic Workers and the Prices of Domestic Services – Simulated Results (between 2006 and 2011)

Sectors benefiting the most	Cumulative % change	Sectors benefiting the least	Cumulative % change
Hospital activities	4.62	Machinery and equipment	-3.79
Appliances	2.69	Other extractive industries	-2.08
Pharmaceuticals manufacturing	2.27	Resin and elastomers	-1.81
Education and public health	1.90	Non-ferrous metals	-1.61
Public administration and social security	1.88	Textiles	-1.43
Maintenance and repair services	1.58	Rubber and plastics	-1.40
Clothing	1.29	Metal products	-1.34
Medical-hospital assistance	1.20	Steel and its by-products	-1.26
Perfumery and other	1.07	Chemicals	-1.25
Different industries	1.03	Iron ore	-0.96

Source: Created in house based on simulation results.

TABLE 13

Major Changes in Sectoral Employment in the Brazilian Economy, Arising from the Changes in the Income of Domestic Workers and the Prices of Domestic Services – Simulated Results

Sectors benefiting the most	Cumulative % change	Sectors benefiting the least	Cumulative % change
Hospital activities	5.08	Iron ore	-7.29
Manufacturing of pharmaceuticals	4.93	Resin and elastomers	-5.55
Appliances	4.15	Machines and equipment	-5.23
Maintenance and repair services	3.07	Other extractive industries	-4.74
Perfumery and other	2.74	Non-ferrous metals	-4.42
Medical-hospital assistance	2.22	Steel and its by-products	-4.06
Public administration and social security	2.20	Oil and gas	-3.71
Different industries	2.15	Textiles	-3.01
Public health	2.08	Metal products	-2.99
Public education	2.06	Chemicals	-2.73

Source: Created in house based on simulation results.

4 CONCLUDING THOUGHTS

The economic growth seen in the early 21st century, combined with various income transfer policies and social incentives, have resulted in permanent increases in well-being for the lower economic tiers of Brazil's population, who now have access to more employment opportunities. Among the beneficiaries are domestic workers, whose wages have grown above the average increases seen in other occupations, even though they still remain far removed from the overall average wage.

In this context, this study investigated the economic consequences of the changes that took place in the domestic services market between 2005 and 2011. As such, we used a general equilibrium model computed with recursive dynamics (BRIDGE), with details for 116 commodities, 60 industries and 10 representative families distributed by income decile. Thus, it was possible to assess not only the direct impact on the domestic services sector but also the changes in income, consumption and well-being of households with different economic characteristics.

Under the framework of general equilibrium models, and based on the macroeconomic scenario observed during the period, a simulation was conducted as follows: i) the number of domestic workers remained fixed; ii) the price of domestic labour grew by 10.95 per cent a year; and iii) the income of domestic workers increased annually by 10.95 per cent, distributed according to the participation of these workers in each income decile. The values used in the shock were taken from the data observed in the PME (IBGE, 2012a).

The results show that 0.58 per cent of the economic growth seen during the period, equivalent to R$18,869,634,196, can be attributed to changes in the market for domestic work, which triggered income increases, especially among the lower economic tiers of the Brazilian population. Thus, the valuation of domestic work has led to increased consumption—mainly of essential goods, such as appliances and health services—increasing the general well-being of the population.

The economic impact of the increased income of these workers sets out a way forward for public policies by showing that, by valuing the traditionally marginal work categories in the Brazilian economy, it is possible to improve the living conditions of the low-income population, while at the same time increasing the well-being of the entire population.

Thus, although the increase in domestic workers' income is a result of a combination of multiple factors, one can infer (given the model assumptions) that any increases in income distributed throughout the population, according to the behaviour of supply and the consumption of domestic services, would lead to similar results.

Indirectly, the results suggest what would be the consequences of the process of labour formalisation and the inclusion of domestic work under the aegis of labour rights. Similarly to the simulation presented, this would lead to an increased income for a portion of the population and to increased costs of these services.

That is, in general, one can say that the demand for domestic services is elastic enough to accommodate price increases (resulting from greater formalisation, for example). At the same time, the indirect effects resulting from this process tend to generate an income transfer from the richest deciles to the poorest deciles of the distribution, leading to changes in consumption patterns that can benefit the population as a whole, leading to positive results in employment and in aggregate income.

ANNEX 1. THE BRIDGE MODEL: SOME GENERAL ASPECTS

The operation of a CGE model consists of two parts. The first part deals with specifications, which involves determining the functional forms, based on traditionally consolidated microeconomic theory. The second part is called calibration, and consists of determining an initial solution. Both stages require two types of data: data from the absorption matrix (the core of the model's database), which depict the flows of the economy, and behavioural parameters related to the functional forms used (for example, export elasticities and substitution elasticities).

The structure of the core of the model's database is shown in Figure 5. The lines show the structure of the purchases made by each agent represented in columns. Each of the 116 identified goods can be obtained from the national or international market. The goods are consumed by the 60 sectors, for investment, consumption by the 10 representative households, government consumption, inventory changes and exports. Margins (m) and taxes (t) are levied upon the consumption of goods. Three primary factors are used: land, labour and capital. Taxes (V1PTX) and payroll taxes (VLTAX) are levied upon the sectors' production. The production matrix (MAKE) represents the production of goods (c) by sectors (i), and the tax levied upon imports is represented by the V0TAR vector.

The model requires demand equations for all agents and flows represented in the economy: demand for domestic and imported products, demand for production factors, equations for the prices of goods and factors, market equilibrium equations, and equations for economic aggregates.

The tax coefficients, in turn, deal with the sum of the IPI and ICMS taxes, as well as 'other taxes, minus subsidies' for all users (minus inventory). Although the model allows for treating the effect of taxes on the flow of exports, in Brazil such exports are tax exempt by law. Thus, the calibration of the representative coefficients with the taxes upon basic flows (for example, V1TAX) followed a procedure similar to that of the marginal coefficients. The vectors for IPI, ICMS and Other Taxes (minus subsidies) were also distributed by industry, particularly for V1TAX and V2TAX and, in the remaining coefficients, only by origin (domestic and imported), based on the fees calculated based on the total basic value. The exception to this procedure was the government, in Exports and Changes in Inventory, upon which no taxes are levied.

In addition to data from input–output matrices, CGE models employ parameters and elasticity estimates. These figures come from literature, which is justifiable, given the lack of data that can be used for estimation. The main parameters used refer to the elasticities of substitution among primary factors, Armington-type elasticities of substitution (between domestic and imported varieties of goods) and the expenditure elasticity of household consumption.

Many of these parameters, such as the elasticity of substitution among primary factors and the elasticity of substitution between domestic and imported goods, were obtained from econometric estimates in the TERM-CEDEPLAR Multi-Regional Computable General Equilibrium Model (Domingues et al., 2009). The Armington elasticity is defined by commodity and is identical for both intermediate (SIGMA1) and investment goods (SIGMA2), as well as household demand (SIGMA3). These parameters were extracted from Tourinho et al. (2007). Whenever necessary, the estimates were made compatible with the model's sectors.

FIGURE 5

Core of the CGE Model Database

		Agents					
		Producers	Investors	Households	Exports	Government	Inventory
	Dimensions	i	1	f = 1, ... , 10	1	1	1
Basic flows	c*s	V1BAS	V2BAS	V3BAS	V4BAS	V5BAS	V6BAS
Margins	c*s*m	V1MAR	V2MAR	V3MAR	V4MAR	V5MAR	V6MAR
Taxes	c*s*t	V1TAX	V2TAX	V3TAX	V4TAX	V5TAX	V6TAX
Labour	c	V1LAB					
Labour taxes	c	V1TAX					
Capital	c	V1CAP					
Land	c	V1LND					
Taxes on production	c	V1PTX					
Other costs	c	V1OCT					

c - commodities (1, ..., 116)
i - industries (1, ..., 60)
t - indirect taxes (ICMS, IPI, Other)
f - households
s - origen (domestic, imported)
m - margins (trade, transport)

	Production Matrix	Import Tariffs
Dimension	i	1
c	MAKE	V0TAR

Source: In-house creation.

The structure of household demand also incorporates the Frisch parameter (Frisch, 1959) within its formula, a substitution parameter that measures the sensitivity of the marginal utility of income.[15] It is estimated through a negative value and grows, in a module, together with the level of poverty of the population being analysed. In other words, the higher this parameter is in a module, the lower the level of 'luxury' consumption and the higher the level of 'subsistence' consumption. The BRIDGE-TAX uses the figure 2.48, the first to be used for the Brazilian economy in the aforementioned model (i.e. the Multi-Regional TERM-CEDEPLAR). The results show an estimate of -2.48, which, according to the original definition (Frisch, 1959), places Brazil at the average income level of consumption (Domingues et al., 2009).

To complement the structure of household demand, we use a parameter which measures its EPS (expenditure elasticity). These figures were obtained from Hoffman (2007). Hoffman (2007) calculates the income elasticity of various types of expenditures (for example, food, housing, clothing and transportation, among others) using data from POF 2002/2003, broken down into 10 per capita income categories. From these estimates, the income elasticities were made compatible with the model sectors; thus, we obtained an array of expenditure elasticities for 10 types of families, distributed by **income** deciles.

The schematic presentation of Johansen's solutions for CGE models is a literature standard. What follows is a summary of this procedure, to convey a general overview of how the model is implemented. Further details can be found in Dixon et al. (1982) and Dixon and Parmenter (1996). The system of equations in the model can be expressed as:

$$\mathbf{F(V)} = \mathbf{0} \tag{1}$$

Where V is an equilibrium vector of size *n* (number of variables), and *F* is a non-linear vector-function of size *m* (number of equations). It is assumed that *F* is differentiable, and that the number of variables is greater than the number of equations in the *(n> m)* system. Thus, *(n—m)* variables must be determined exogenously. An initial equilibrium solution, V^*, must be determined for calibration purposes, i.e. it is assumed that:

$$\exists \mathbf{V} = \mathbf{V}^* \text{ such that } F(\mathbf{V}^*) = \mathbf{0} \tag{2}$$

Given the initial solution, V*, a new set of solutions can be obtained for a given vector of changes in exogenous variables. As such, to compute the new set of solutions to the model, one must partition vector *V* into two groups of variables, endogenous and exogenous, where Y is the vector containing the *m* endogenous variables and X is the vector containing the *(n—m)* exogenous variables. Equation (2) can be rewritten as:

$$\mathbf{F(Y, X)} = \mathbf{0} \tag{3}$$

The problem here is to compute Y for a given X; it is not normally possible to express Y as an explicit function of X. Several techniques can be used to compute Y. The linearisation solution assumes that there already is a solution for the system (Y^0, X^0), such that:

$$\mathbf{F(Y^0, X^0)} = \mathbf{0} \tag{4}$$

In general, the starting solution is obtained from the base-period data in which the model is calibrated—that is, we assume that the system is valid for some point in the past. For small changes in dX and dY, and under conventional assumptions on the behaviour of function *F*, the full differentiation of (4) yields:[16]

$$\mathbf{F_Y(Y, X)dY} + \mathbf{F_X(Y, X)dX} = \mathbf{0} \tag{5}$$

Where F_Y and F_X are matrices composed of partial derivatives of *F* calculated at (Y^0, X^0). For the solutions to be in the form of change rates, it is convenient to express dY and dX as small percentage variations, x and y. Therefore, a typical element of vectors x and y is defined as:

$$\mathbf{Y = 100dY/Y \text{ and } x = 100dX/X} \tag{6}$$

Likewise, we can define the following functions:

$$\mathbf{G_Y(Y,X) = F_Y(Y,X)\hat{Y}} \quad \text{and} \quad \mathbf{G_X(Y,X) = F_X(Y,X)\hat{X}}, \tag{7}$$

Where $\hat{\mathbf{Y}}$ and $\hat{\mathbf{X}}$ are diagonal matrices. Thus, the linearised system becomes:

$$\mathbf{G_Y(Y,X)y + G_X(Y,X)x = 0} \tag{8}$$

Solutions for systems like (8) can be easily computed with linear algebra techniques. They represent, however, only one accurate solution for small changes in X and Y. Otherwise, linearisation errors may occur. Linear—or first-order—approximation of the solution (8) is given by:

$$\mathbf{y = -G_Y(Y,X)^{-1}G_X(Y,X)x} \tag{9}$$

Equation (9) leads to the Johansen solution, Y^J, an approximation of the true solution, Y^{exact}. This observation leads to the idea of partitioning the changes in X into small steps and, for each sub-change in X, using linear approximation to derive the Y sub-response. Based on the new X and Y values, coefficient matrices G_Y and G_X are recomputed, and the process is repeated for each step. This technique is known as the Euler method, one of the simplest of numerical integration techniques—the process of using differential equations to move from one solution to another. For a three-step approximation, the linearisation error is significantly smaller, approaching the exact solution. The higher the number of steps, the better the approximation.

The CGE models are operated using the GEMPACK programme.[17] In addition to the Euler method, we can obtain solutions through two alternative methods, Gragg and Midpoint. These methods are variations of the Euler method and can, in some cases, produce more accurate results with the same number of steps. In the case of this model, we used a multiple-stage calculation procedure (Johansen/Euler), wherein the exogenous shocks vector is divided into *p* equal parts. Thus, one can define a sequence of calculations in such a way that matrices G_Y and G_X are re-estimated at each stage.

The theoretical issue at hand refers to the way through which the solution of the model converges to the 'real' solution, as *p* grows and, if it converges, to the number of stages (size of *p*) needed to obtain a precise solution to the model. Dixon et al. (1982) demonstrate that, when *p* tends to infinity, the Johansen/Euler multi-stage method will produce an exact solution to the model.

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NOTES

1. CGE models with recursive dynamics are not new in Brazilian literature. See, for example, Domingues et al. (2010), asegawa (2003), Haddad and Domingues (2001) and Fochezato and Souza (2000).

2. Data from POF 2007/2008 are already available. We, however, used data from 2002/2003 for two reasons: i) the CGE model database had been calibrated for 2005, and the core data came from the 2005 Brazilian input–output matrix. In addition to POF 2002/2003, other data were also used; and ii) the structure of consumption, that is, the share of each commodity in household consumption does not change significantly between the two surveys.

3. We used the variable entitled 'value of annualised and deflated gross income'.

4. '*Pretos'* and '*pardos'* ('black' and 'brown') were included in the 'black' category.

5. The PME was chosen because it allows us to analyse a longer period of time (up to 2011). However, one limiting factor is that the study was conducted only in metropolitan areas, where wages are, on average, higher. Nevertheless, for the simulation, we used only the variation in wages and not the actual amounts. As such, we assume that, even with different wage amounts, wage variation in Brazil follows the variations seen in metropolitan areas.

6. In the case of the PME, we used the entire group of domestic workers, because we cannot reach the same level of disaggregation as in the POF. However, since the domestic services described in Table 1 account for more than 90 per cent of all domestic services, the simulation is not hindered.

7. Considering cumulative inflation over that period, of about 41.87 per cent, according to IPCA (IBGE, 2012d), domestic workers had a real gain of about 44.7 per cent, against 22.14 per cent for other workers.

8. Although the shock is nominal, the results are real, because the inflation in that period is accounted for in the baseline scenario—it is the adjustment between the actual and nominal values in the CGE model.

9. The increase in income is assumed to be homogeneous for all workers, regardless of their characteristics (such as the level of income of these workers, and whether they work formally or informally).

10. RunDynam is a custom application customised by Gempack 10.0 (Harrison and Pearson, 2002) for recursive dynamics simulations and inter-temporal models. For more details, see <http://www.monash.edu.au/policy>.

11. Number of employed persons, calculated based on the employed population in 2005, according to IPEA (2012a). In exact numbers, this amounts to 632,946 jobs.

12. Value in R$ calculated based on the 2005 GDP at 2011 prices, with data estimated by IPEA (2012th). In exact terms, this amounts to R$18,869,634,196.

13. Between 2006 and 2011, Brazilian GDP grew by 27.7 per cent, i.e. the effect of the changes in the domestic services market amounts to about 2 per cent of the growth observed in that period.

14. Between 2006 and 2011, appliance and furniture sales grew by 91 per cent. Thus, the model results indicate that, without the changes made to the domestic services market, the growth would have been 2.69 percentage points lower.

15. For more detail, see Dixon et al. (1998).

16. The usual assumptions are in favour of the continuity and differentiability of *F*, as well as a unique solution. Usually, these characteristics are met in Walrasian general equilibrium systems, expressed in the form of linearised equations.

17. The model was done in version 10.0 of the GEMPACK programme. For more information about its use in the implementation of CGE models, see Harrison and Pearson (2002).

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