



UNIVERSIDADE DE SÃO PAULO

DEPARTAMENTO DE ECONOMIA, ADMINISTRAÇÃO E SOCIOLOGIA

ESCOLA SUPERIOR DE AGRICULTURA "LUIZ DE QUEIROZ"

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## BIOFUELS, FOOD SECURITY AND COMPENSATORY SUBSIDIES

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Food and energy have for long been two general types of good and services competing with each other for economic/natural resources in a worldwide extension. The use of energy and the production of food lead to a related problem: environment damage, which in turn demands efforts to produce cleaner energy (biofuel, for example), which then compete with food production and so on. Over the last forty years or so, the prices of oil and food have marched together in parallel lines, though in the sixties and seventies the price of food relative to oil was higher than thereafter. Compared to other goods and services, however, both oil and food became cheaper until the second half of this decade. Very recently a surge on both prices took place characterizing the so called Commodity Crisis, which was suddenly interrupted by the financial crisis that evolved from real-estate bubble begun in the United States and spread over many other countries. See figure 1.

This price behavior is compatible with the pattern of energy and food consumption across country categories. Figure 2 illustrates that emerging and developing countries have both higher intensity of energy use per unity of GDP and higher share of expenditure on food<sup>3</sup>. So the expected trend indicating that emerging and developing countries will grow three times as fast as advanced economies – according to IMF<sup>4</sup> - suggests that the competition between energy and food will remain strong in the next decades.

The third dimension of the problem - related to the environment impacts of the relative scarcity of energy and food – is equally important. High and growing consumption of energy increases the need for cleaner production technologies thereby raising the demand for agro-energy and biofuels.

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<sup>3</sup> Although in general developed countries are less energy-intensive, that is not the case of the USA, where the energy intensity is equivalent to that of emerging countries.

<sup>4</sup> IMF Data Mapper in <http://www.imf.org>.

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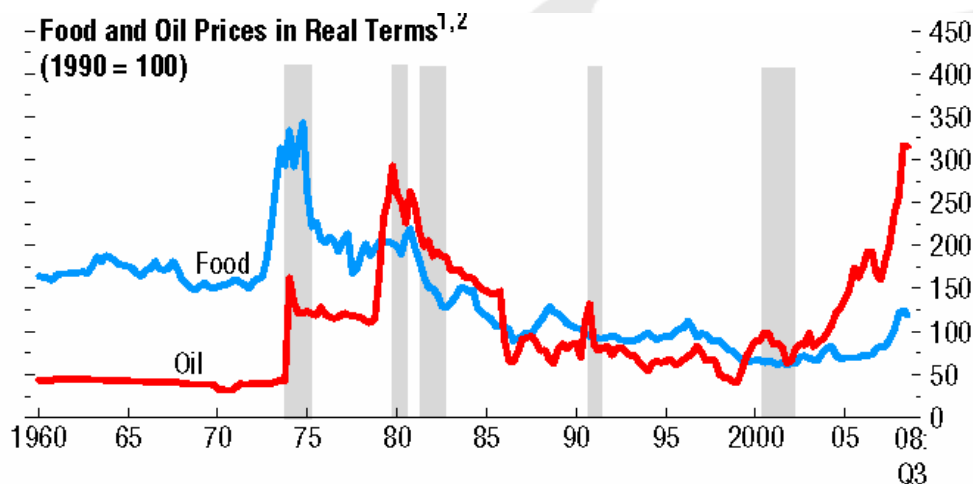


Figure 1. World Real Prices of Food and Oil, 1960/2008

Source: IMF, The Economist<sup>5</sup>

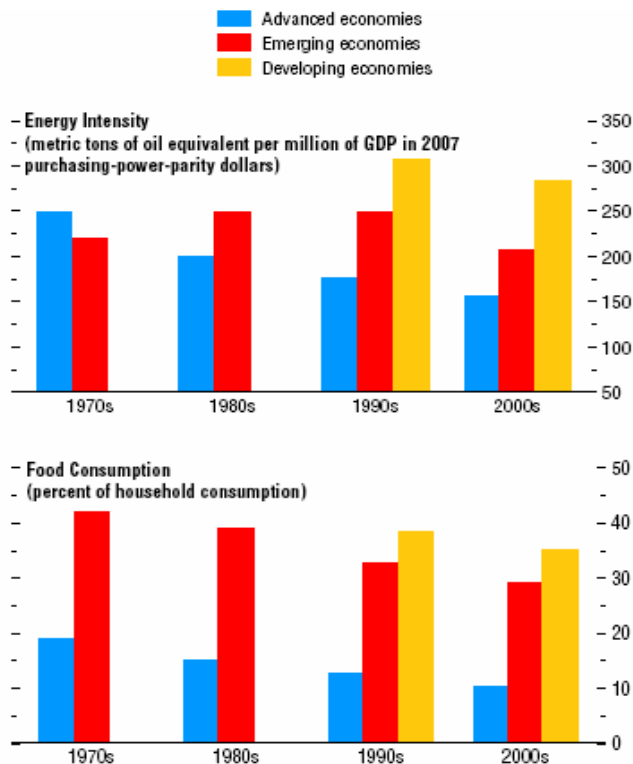


Figure 2. Energy and Food Consumption Intensities 1970s/2000s

Source: USDA/IMF in [http://www.imf.org/external/pubs/ft/weo/2008/02/c3/fig3\\_9.pdf](http://www.imf.org/external/pubs/ft/weo/2008/02/c3/fig3_9.pdf)

<sup>5</sup> THE ECONOMIST. **Special Reports**. In: [www.economist.com](http://www.economist.com). Access: October, 2008.



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Figure 3 indicates that by large the major contributors to the world emission of CO<sub>2</sub> are the developed countries. The USA is the leading CO<sub>2</sub> emitting country. *Per capita* USA's CO<sub>2</sub> emission is four to five times higher than the Brazilian index. Indeed six developed countries appear among those with more than 10 tonnes per capita. Very important oil producing countries (ex. Saudi Arabia, Norway, Russia) are in that group too. The map in figure 3 shows the countries sizes scaled according to CO<sub>2</sub> emission.

Brazil energy matrix reserves a special role – 46% - for renewable sources (Figure 4), of which 35% is provided by sugarcane ethanol<sup>6</sup>. Brazil's renewable energy supply increases at an annual rate of 7.6%, twice the rate of nonrenewable energy<sup>7</sup>. Current ethanol production reached 22.5 billion liters (64% hydrated) compared to 700 million liters in 1975. Still as part of its biofuel program, since 2005 the Brazil is promoting the Biodiesel Program to substitute for the diesel in trucks, buses, tractors, etc. Several alternative feedstocks have been experimented with, but soybeans have been the preferred source so far. Current production capacity is 2.7 billion liters so in July/2008 the government raised the mandatory rate of vegetal oil to 3% in the diesel.

Worldwide biofuel subsidized production and mandated consumption have been associated with food security, in addition to other environmental and social problems. Although in several instances Brazil has not currently been involved in the tradeoff between biofuel and food security, it was during the 1970's and 1980's PROALCOOL implementation<sup>8</sup>. It was argued that sugarcane production would advantageously compete with food crop production, so its expansion would lead to higher food prices. Thirty years later, total farm productivity had increased by some 70%<sup>9</sup> – and particularly for ethanol productive efficiency evolved from 4200 liters of ethanol/ha to 6550 liters/ha, most of quarrel over that tradeoff has been dissipated. Hoffmann, for example, argues that in Brazil poverty is the reason for food insecurity, because food supply largely exceeds the population needs<sup>10</sup>.

Despite of that, in the international arena, the recent surge in food prices has been associated with biofuels by IFPRI<sup>11</sup> and FAO<sup>12</sup>. The first one attributes 30% of the international price rise from 2000 to 2007 to biofuel demand growth. The second one argues that “high economic growth in the emerging economies has the potential to contribute to keeping food prices high not so much because

<sup>6</sup> According to MME, sugar-cane contributes with 45% of the fuel consumption and 3% of the electricity production in Brazil.

<sup>7</sup> Ministério de Minas e Energia. 2007. Resenha Energética Brasileira. In: <http://www.mme.gov.br>

<sup>8</sup> See, for instance, Mello, F.H. 1983. Agricultura, Energia e Recessão Econômica. Revista de Economia Política, 3(2):51-66.

<sup>9</sup> Bharati, P., L. Fulginiti, 2007. Institutions and Agricultural Productivity in Mercosur. MPRA Paper 9669, in <http://mpa.ub.uni-muenchen.de>

<sup>10</sup> Hoffman R. 2008. Segurança Alimentar e Produção de Etanol no Brasil. <http://www.unicamp.br/nepa>

<sup>11</sup> Von Braun, J. 2008. Biofuels, International Food Prices, and the Poor. Testimony to the United States Senate. In [www.ifpri.org](http://www.ifpri.org)

<sup>12</sup> Alexandratos, N. 2008. Food Price Surges: Possible Causes, Past Experiences and Longer Term Relevance. In: <http://www.fao.org/es/esd/FoodPriceSurges-Alexandratos.pdf>



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of acceleration in the growth of their food demand (as many have proposed, although short lived spurts may occur occasionally), but rather via the energy channel". Accelerated world growth exacerbates energy demand and environment damages thus leading to a surge on generation of cleaner biofuel production from feedstock that would otherwise be used for human consumption. For the World Bank, however, "Biofuels production from sugarcane in Brazil is lower-cost than biofuels production in the U.S. or EU and has not raised sugar prices significantly because sugarcane production has grown fast enough to meet both the demand for sugar and ethanol"<sup>13</sup>.

By the same token, currently biodiesel production would drive vegetal oil out of human consumption to energy production. On the production side, concern concentrates in the European Unity where around 90% of the world biodiesel production occurs<sup>14</sup>. Anyway, looking at the demand side, biodiesel competes directly with human consumption for vegetal oil. Indeed, the economic viability of biodiesel production in Brazil depends upon exports prices of vegetal oil as much as the profitability of sugarcane ethanol depends upon gasoline price. The major difficulty for the Brazilian ethanol production relates to the United States barriers and subsidies to that commodity: a study of the Cornell University estimated that Brazil's ethanol price would rise by 28% if the ethanol import tariff were removed. It turns out that that tariff plays a fundamental role inhibiting the ethanol production in Brazil<sup>15</sup>.

CEPEA/ESALQ/USP has recently evaluated the economic and financial viability of both ethanol and biodiesel production in Brazil using both Value Chain Analyses and Linear Programming Optimizations for a set of six supply chains: beef cattle, soybeans, corn, cotton, peanuts and sunflower. A supply chain includes purchase of farm inputs, farming activities, storing, crushing/processing and sale at wholesale level. The Southeast Brazil was chosen to carry the analyses because that is the current battleground region among food, ethanol and biodiesel. We determined the opportunity cost of producing each of these alternative goods, the possible necessary subsidies if consumption is mandatory, as well the rates of return for the agribusiness (set of interrelated food, fiber and energy supply chains) sector under the scenario elaborated by FAPRI<sup>16</sup>, according to which relative price variations between 2008 and 2018 would be as indicated in figure 5.

It is important to notice that biofuels compete in production with alternative farm and industrial activities and in consumption with other energy sources. In particular, at the production level ethanol competes more fiercely with beef cattle and biodiesel with vegetal oil. In consumption, ethanol competes with gasoline and biodiesel with petrol diesel.

<sup>13</sup> Mitchell, D. 2008. A Note on Rising Food Prices. Policy Research Working Paper 4682 in <http://www-wds.worldbank.org/servlet/>

<sup>14</sup> See Rosegrant, M.W. S. Msangi, T. Sulser, R Valmonte-Santos. 2006. Bioenergy and Agriculture: Promises and Challenges. IFPRI 2020 Vision. In [http://www.ifpri.org/2020/focus/focus14/focus14\\_03.pdf](http://www.ifpri.org/2020/focus/focus14/focus14_03.pdf)

<sup>15</sup> See Gorter, Harry and Just, David R. 2007. The economics of U.S. ethanol import tariffs with a consumption mandate and tax credit. Munich Personal RePEc Archive. In: <http://mpa.ub.uni-muenchen.de>.

<sup>16</sup> FAPRI 2008 World Agricultural Outlook. Iowa State University, in <http://www.fapri.iastate.edu>.



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Our results indicated that

- The current ethanol production is resulting in an average 30% loss to producers and that loss would remain for as long the US tariff is applied;
- Biodiesel production would also be unprofitable by a margin of about 20%.
- In general the lower the exchange rate the higher (around R\$1,50/dollar) the subsidy to produce biofuels: for ethanol it aggravates the depressing effect on prices of the USA tariffs; for biodiesel it would simply make soybean production unviable in the long run .
- If Brazil decides to compensate producers for their losses, consumers would be willing to pay for the necessary subsidy for ethanol prices would still remain below gasoline prices; in the case of biodiesel a subsidy would make prices too high for consumers, who would then rather use petrol diesel.
- Agribusiness investment needs for the ethanol and biodiesel programs in Southeast Brazil will add up to R\$60 billion during the next ten years; internal rate of return – as shown in figure 6 - would run from 5.3% to 10.8% if exchange rate varies from R\$1.55 to R\$2.10 per dollar and if the government decides to support production; if, on the other hand, the production losses are left up to producers, the rate of return would range from -6.3% to 3.4%.

The conclusion to be drawn from these evidences are that the world has a pressing demand from clean energy that originates from high pollution in developed country, the USA ahead of all. Brazil, despite of being the most efficient producer of ethanol, may very well be forced do subsidize its ethanol production if the USA persists in imposing importing tariffs on that Brazilian commodity. On food security matters, the production of ethanol has to compete with beef production, whose prices present a rising trend because of strong demand in emerging countries. For the same reason biodiesel becomes less viable the stronger the demand for vegetal oil. Three recommendations spring out of these conclusions:

- a) developed countries must move to less polluting forms of production and consumption;
- b) developed countries must reduce trade barriers on ethanol ( and other commodities);
- c) the world in general must – after the current crises dissipates – accept a slower rate of economic growth to reduce the demand growth for the use of natural resources to a rate compatible to the development of new more efficient technologies.

If these recommendations are not considered, when this current recessionary crisis is overcome, a new one will sooner or later come about, this time characterized by high inflation and famine. As for pollution, it would follow its current dreadful trend.

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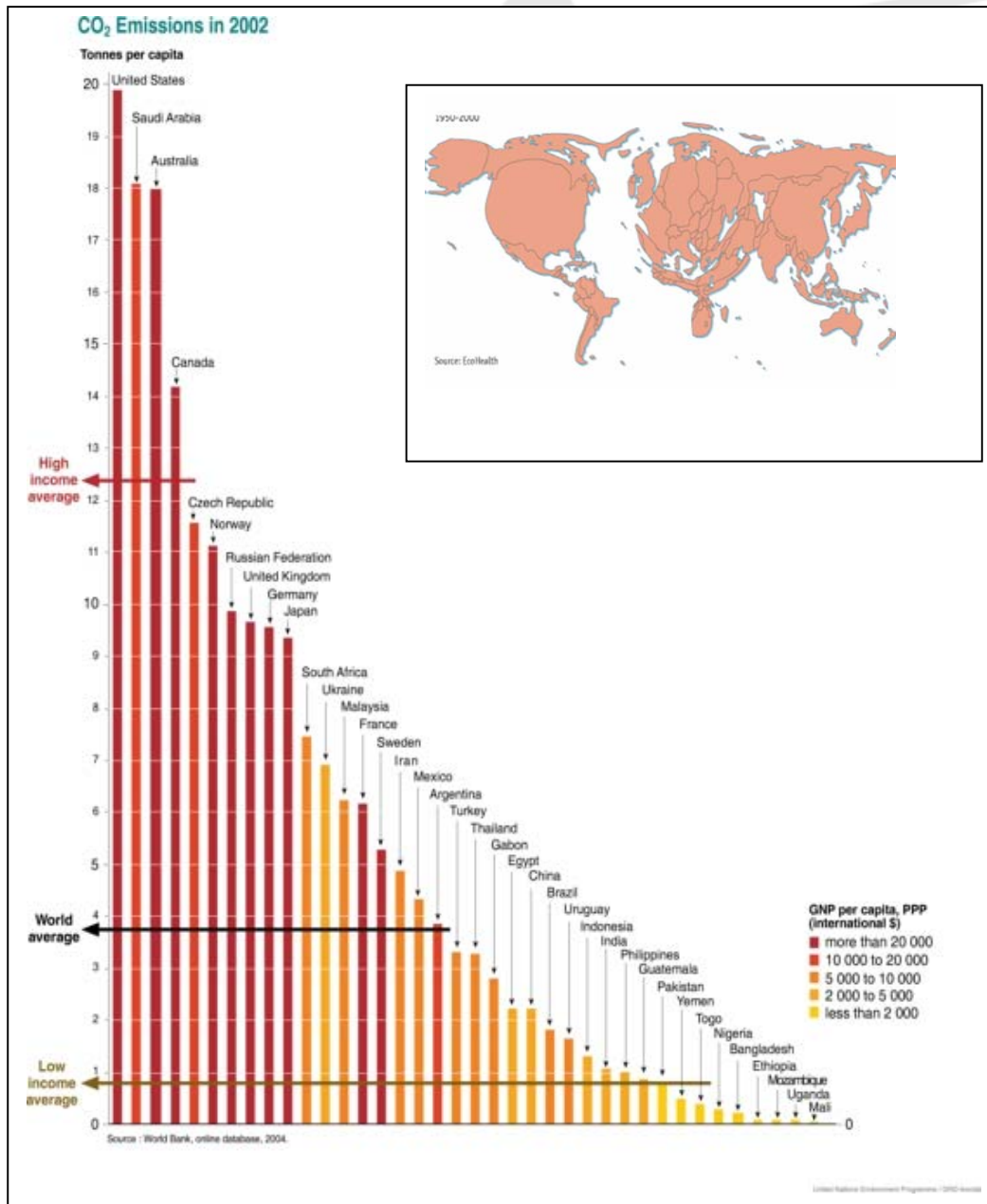


Figure 3. Countries Carbon Emission per Capita–2002  
Source: Ecohealth<sup>17</sup>

<sup>17</sup> Hildebrand, A. 2008. Climate Change and Health Impacts in South East Asia. World Health Organization in <http://www.wpro.who.int>

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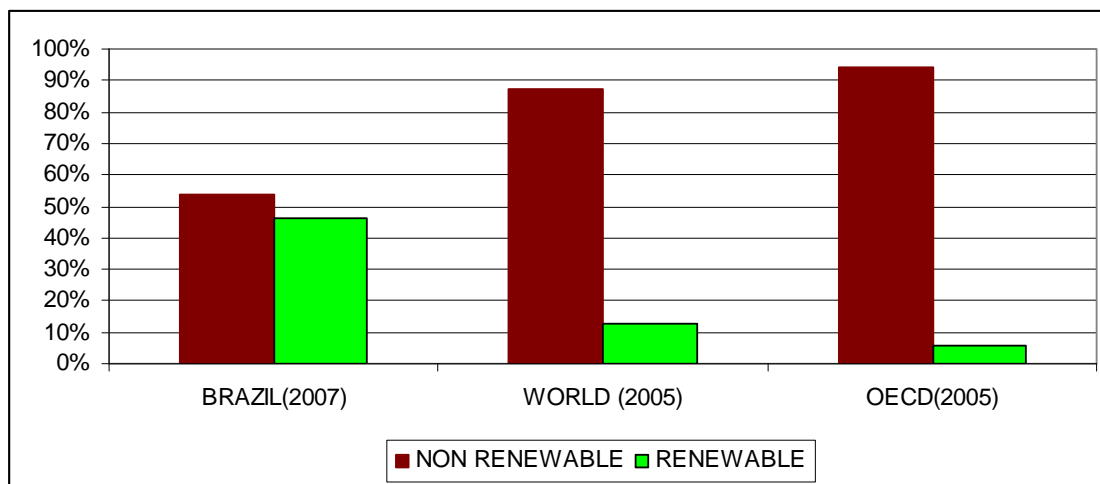


Figure 4. Energy Supply Shares of Renewable Energy.  
Source: Ministry of Mining and Energy<sup>18</sup>

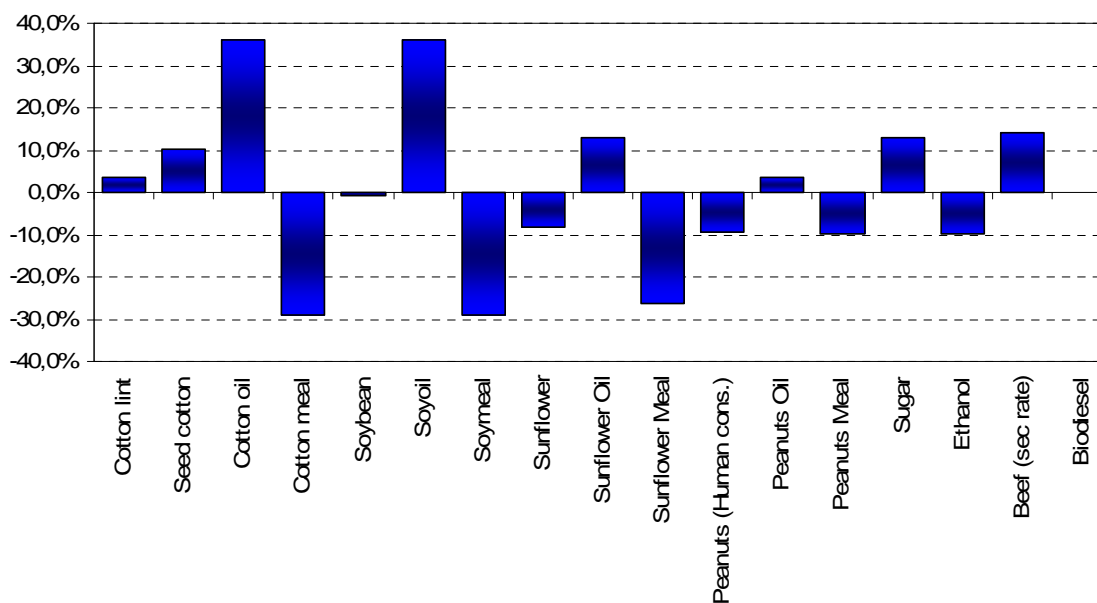


Figure 5. Real Dollar Price Variation between 2008 and 2018.  
Source: FAPRI, 2008.

<sup>18</sup> MME. 2008. Resenha Energética Brasileira.



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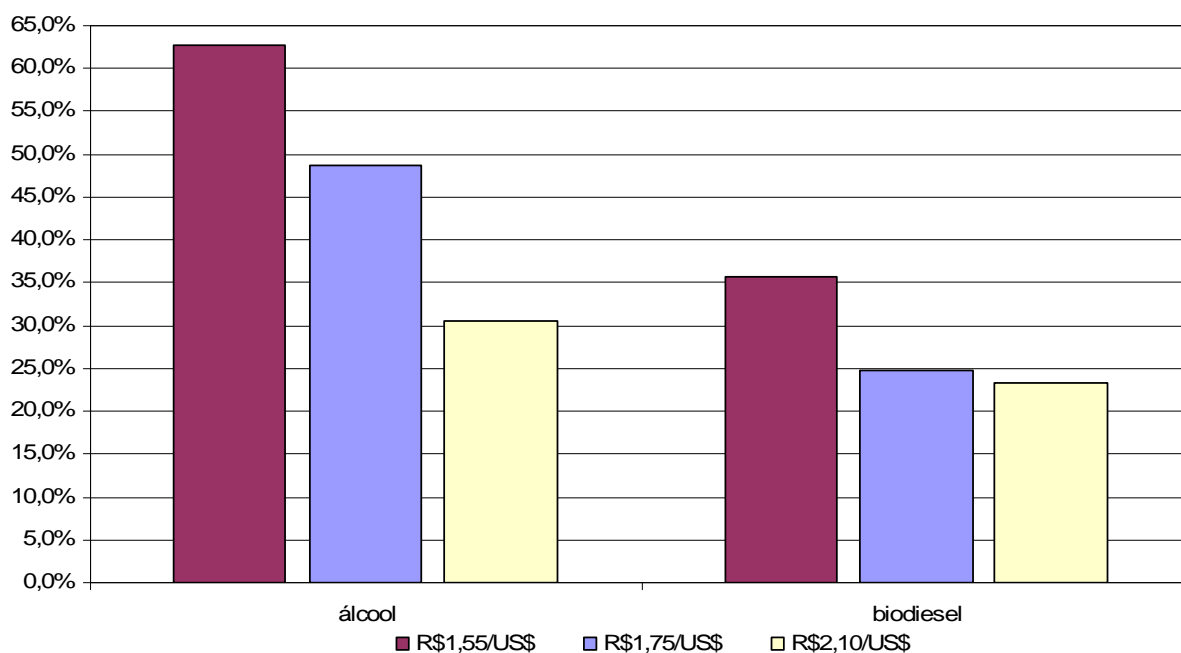


Figure 6. Production Subsidies (% of market price) in 2018 at three alternative Exchange Rates.  
Source: CEPEA

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