

# A new wholesale price index for Brazil during the period 1870-1913\*

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Although there are many price-level indices for the Brazilian economy prior to the First World War, they are of extremely poor quality. Many of them are derivatives of a highly limited basket of products and they lack a system of representative weighting, while others are based on empirically no-proven theoretical suppositions, such as the theory of purchasing power parity (PPP). This article presents a new wholesale price index based on a much broader basket of goods and on a macroeconomically representative weighting system derived from the first national production census in 1919. The new index therefore provides a considerably more exact measure of the historical pattern of Brazilian inflation during the 1870-1913 period. Such a measure is clearly important for a rigorous evaluation of the different hypothesis with regard to the growth and macroeconomic stability of the country since the late nineteenth century.

*1. Introduction; 2. Commodity coverage and data sources; 3. The weight system; 4. A comparison with the previously existing indices.*

## 1. Introduction

It is well-known that Brazil's high inflation is not exclusively a post-World War II phenomenon but one which goes far back in time (Furtado, 1963; Leff, 1982; Goldsmith, 1986). Yet, its proximate magnitude and cyclical pattern during the XIXth century to the eve of World War I is still an unsettled issue. This is due to the serious deficiencies of the

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existing price level indicators for the period.<sup>1</sup> Price series such as those constructed by Lobo et alii (1971), Buescu (1973), Mattoso (1973), Eisenberg (1974), although based on detailed research on newspapers and other contemporary publications, present two major flaws: they have a rather limited commodity coverage and lack an adequate system of weights.<sup>2</sup> Alternatively, indicators based on the purchasing power parity (PPP), though widely used (Contador & Haddad, 1975; Peláez & Suzigan, 1976; Leff, 1982), are clearly unsatisfactory given both the theoretical and empirical objections to the validity of PPP (Dornbusch, 1989, Adler & Lehmann, 1983; Edison, 1987), particularly in the economy such as pre-1914 Brazil's (Catão, 1991).

This paper presents the methodology and final estimate of a new annual price series for Brazil during 1870-1913. The proposed index is superior to the existing ones in two important respects: first, it consists of a much more representative sample of commodities; secondly, it employs a weighting system based on the national censuses of production.

Sections 2 and 3 below discuss the commodity coverage, data sources and the weighting method used in the construction of the new price index. Section 4 concludes the paper by comparing Brazil's price trends according to the new indicator with those suggested by previously existing indices.

## 2. Commodity coverage and data sources

The main data source used in this work was Brazil's most important newspaper at the time — the *Jornal do Commercio* (JC henceforth). From the section entitled *Revista do Mercado* it was possible to obtain price figures for 30 different products, namely: beans, beer, Brazilian brandy (*aguardente*), butter, candle, cement, cod fish, coffee, corn, dried meat, grease, ham, Italian pasta, linseed oil, kerosene, manioc flour, matches,

<sup>1</sup> With reference to the post-1913 period, a relatively reliable aggregate wholesale price indicator was constructed by Haddad (1978).

<sup>2</sup> The weighting systems used by Lobo et alii based on consumers' expenditures in 1856 and 1919 are certainly not representative at a macroeconomic level. This is because hard information on household consumption patterns did not become available until 1949, when across-the-board research on the composition of household expenditures in Rio was first undertaken (*Conjuntura Econômica*, 1949). Although Lobo et alii (1971) also consider a weighting system derived from this 1949 research, it is very doubtful that the expenditure composition of the representative household remained unchanged between 1850 and 1949, the period covered by their indice and during which substantial structural changes were taking place in the Brazilian economy.

olive oil, pinewood, rice, salt, sugar, tallow, tar, tea, tobacco, turpentine, vinegar, wheat flour and wine.<sup>3</sup>

The respective quotations for these goods refer to prices in the Rio de Janeiro market. However, there exists a strong case for taking such figures as representative at a national level. First, Rio de Janeiro was the country's most important economic centre during the XIXth century, only being superseded by São Paulo towards the second decade of this century. Secondly, a rough comparison between the indices of Lobo et alii (1971) for Rio and those of Mattoso (1973) for Salvador and Eisenberg (1974) for Recife, shows that price trends were very similar across these state capitals. Thirdly, a number of the commodities with price quotations in the *JC* were in fact imported into Rio from other states. This was the case, for example, of coffee from São Paulo, dried meat from Rio Grande do Sul, manioc flour from Pará and tobacco from Bahia. For these reasons, it will be assumed here that the *JC* price quotations adequately represent price trends of the respective commodity at a national level.

The *annual* price of the aforementioned commodities was computed as an arithmetic average of the price quotations for the months of March, July, September and December. Unfortunately, some goods did not have their prices quoted during certain years — e.g. grease during 1904 and 1906-13, Italian pasta in 1903/4 and 1906-13, linseed oil in 1900, pinewood in 1893, Brazilian brandy during 1894 and 1895, tobacco in 1892, 1908 and 1912/13, beer during 1906-13 and matches during 1870-87. In these cases, the value of the missing observation was estimated on the basis of other commodities' price. For example, grease had its price highly correlated with that of tallow during 1870-1903 ( $r=0.99$ ). So, the grease price during 1904 and 1906-1913 was obtained by splicing its series with that of the tallow price for those years. Only in the case of beer during 1906-13, could we manage to obtain the price of imported beer inclusive of tariff charges.<sup>4</sup> This was taken as a proxy for the domestic price of beer.<sup>5</sup>

<sup>3</sup> Since the *Jornal do Commercio* only published the maximum and the minimum price quotation of a good within a fortnight, rather than on a daily basis, the price of each of these goods was computed as an arithmetic average of these two extreme values. Also, in most cases, the price of a few brands of each good was provided. The brand then taken as representative was the most heavily traded (according to import quantum data provided in the same source). In any case, the choice of a particular brand instead of another would make little difference, as the price of different brands proved to be highly correlated.

<sup>4</sup> As estimated by M.T. Versiani and kindly furnished.

<sup>5</sup> Although from the early 1900s most of the domestic consumption of beer was met by local production, price trends of domestically produced beer must have been very similar to those of imports for beer was a tradable good.

With reference to other important goods not listed in the *Seção do mercado* — *JC*, such as cotton textiles, capital goods, raw cotton, cocoa, mate tea, rubber, and leather and skins, their prices were obtained from a number of secondary sources. Cotton textile prices were derived from the FOB unit value of cotton textile exports from the UK,<sup>6</sup> available in the UK Board of Trade (1870-1913), converted into *mil-réis*, put into CIF terms according to the implicit FOB/CIF coefficient provided in Gonçalves (1982), and then added of the respective *ad valorem* tariff (as estimated by Versiani, 1979). This no doubt constitutes an adequate proxy on the grounds that textiles were tradable goods, so that domestic producers' price were to be set in line with import prices.

Likewise, domestic capital goods prices were derived from the UK price of capital goods available in Feinstein (1972),<sup>7</sup> then converted into *mil-réis* and set in CIF terms;<sup>8</sup> tariffs did not need to be considered, since capital good imports remained duty-free throughout the whole 1870-1913 period (Nunes & Silva, 1929).

The remaining goods — cotton, cocoa, mate tea, rubber and leather and skins were some of Brazil's most important export commodities. Their prices were taken from IBGE (1941).

Once these individual price series were put together in the form of index numbers with a common base year (1913=100), the next step was to devise a system of weights.

<sup>6</sup> On the basis that UK supplied between 65% to 90% of Brazil's cotton textile imports during 1870-1913 (according to figures from the core country's trade statements).

<sup>7</sup> The use of the UK domestic capital good prices, rather than the actual price of capital goods exports to Brazil, is due to a lack of quantum figures in the core countries' Trade Statements. Since the UK was also the main supplier of capital goods to Brazil before World War I and capital goods prices followed similar trends in all core countries before World War I, the use of the UK index in this case is clearly an adequate proxy.

<sup>8</sup> The use of import price data in this case is also an adequate proxy, since as late as 1919, domestic production accounted for only 38% of the aggregate supply of capital goods. This estimate is based on the definition of capital good adopted in Catão (1991, appendix I). It includes, according to Brazil's 1919 census classification, "iron foundries and construction of machinery", "production of cars, vans and wagons", "agricultural implements" and "shipbuilding". Capital good imports include "axes, wheels and accessories for railway cars and wagons", "axes, wheels and accessories for cars and other vehicles", "rails, fish plates and railway accessories", "tubes, pipes and joinings", "surgical and dental instruments and articles", "telegraph and telephone parts and parts for bridges and fences", "mathematical physical and optical instruments and articles" and, finally, all the items under the heading "machinery, apparatus, utensils and tools".

### 3. The weight system

In order to be consistent at an aggregate level, a weight system needs to discount intermediate consumption as well as to consider the participation of foreign trade into the domestic composition of commodity flows.<sup>9</sup> On these grounds, the weight of a product  $i$  will be measured as

$$W_i = \frac{(Q_i - X_i) rVA_i + M_i}{W_t} \quad (1)$$

where

$Q_i$  = current value of gross output of  $i$ ;

$X_i$  = current value of the exports of  $i$ ;

$rVA_i$  = the value added coefficient of  $i$ , as defined by the value added in the production of  $i$  divided by its final value;

$M_i$  = current value of  $i$  imports;

$W_t = \sum w_i$ .

The most serious constraint to using (1) as a weighting criterion lies in the scarcity of detailed production data for the pre-1914 years. In particular, comprehensive information on the value added of industrial production was never gathered before the 1919 census. As regards agriculture, the situation is even worse: the earliest figures available on the value added of agricultural activities refer to the year of 1972 (Haddad, 1978, p.72); moreover, data on the current output of important staples such as manioc, wheat and others, began to be systematically collected only from 1919 onwards.

So, one has no alternative other than to calculate (1) on the basis of the 1919 census data and to try and infer a reasonable guess for agriculture's  $rVA$  from its 1972 estimates. According to the latter, the  $rVA$  for crops was 0.86 and 0.92 for silviculture (Haddad, 1978:72). These are clearly lower bounds for the actual  $rVA$ 's in 1919, since agricultural production was then much less mechanized. A compromise solution adopted here is to assume an  $rVA$  of 0.90 for crops and of 0.95 for silviculture.

Now, the accuracy of using 1919 weights to estimate pre-1914 price trends needs to be gauged. Three types of structural change might have biased the weight system employed: first, changes in the intra-sectoral composition of

<sup>9</sup> This is the basic rationale behind the official index of wholesale prices — the so-called IPA-DI, a widely used indicator for the aggregate price level in Brazil since 1947 (for methodological details behind the construction of this index, see Fundação Getulio Vargas, 1990).

domestic production and in the import penetration coefficients; secondly, changes in the value added coefficients; thirdly, shifts in the composition of domestic demand between agricultural and industrial goods.

The first type of bias can be detected by comparing the results of the 1907 industrial census with those of the 1919 census.<sup>10</sup> Although notably incomplete (Brazil, p. XXIV; Silva, 1976, p. 76-7), the 1907 census provides us with valuable information on the participation of key industries, such as sugar, dried meat, beer and cotton textiles in total manufacturing output. These were 11%, 5.2%, 3.1% and 18.2% in 1907, then shifting to 12.7%, 3.8%, 3.2% and 21% in 1919. Such changes are by no means dramatic, thus implying that the manufacturing branches included in our sample grew more or less in line with each other between 1907 and 1919, in spite of the WWI shock.

With reference to changes in the import penetration coefficients, they were no doubt dramatic in the case of manufacturing production during the 1870-1913 period. This is because of the intense import substitution process then going on (Fishlow, 1972; Suzigan, 1986). In the case of the textile sector, for example, the share of imports in domestic supply was 26.5% in 1912, then falling to 13.7% in 1920 (both being import peak years).<sup>11</sup> However, a weight system defined as in (1) is neutral to the import substitution bias insofar as it takes into consideration the imported component of supply.

Changes in the value added coefficients of the different manufacturing branches also seem to have been quite mild. For example, the *rVA* relative to cotton textiles — the country's most important individual industry — moved from 0.44 in 1919 to 0.38 in 1939 and then up again to 0.46 in 1949 (Haddad, 1978, p. 85). For other important industries, such as beer, meat, leather and skins their *rVA*'s remained practically unaltered between 1919 and 1949 (Haddad, 1978, p. 94, 103 and 123).

In short, it would of course be desirable to have quinquennial or decennial production census information for the period 1870-1913, based on which one could update (1). In the absence of those, the use of 1919 census data is the best one can do. In any case, the foregoing considerations about changes in output and value added shares between the censuses of 1907, 1919 and 1939, do suggest that 1919 weights may constitute a reasonable proxy for the average compositional structure of

<sup>10</sup> An assessment of the extent of structural changes in agriculture before 1919 is not feasible, since the 1919 census was the first one to cover agricultural production.

<sup>11</sup> The 1912 value was computed by taking output figures from Haddad (1978) and import figures from Brazil, SEEF (1912), whereas the 1920 share was compiled from Fishlow (1972, table III).

### Cadre 1

#### Agriculture

	%		%		%
Wcotton =	4.16	Wcoffee =	6.22	Wmate-tea =	0.85
Wrice =	12.19	Wpinewood =	1.08	Wcocoa =	0.69
Wrubber =	0	Wbeans =	10.34	Wsugar-cane =	12.72
Wwheat =	7.59	Wtobbaco =	2.96		
Wmanioc =	3.30	Wcorn =	37.90	Total =	100

#### Industry

	%		%		%
Wsugar =	5.30	Wdried meat =	2.90	Wmatches =	2.30
Wbrandy =	2.42	Wbeer =	5.46	Wbutter =	0.67
Wrice proc. =	1.46	Wcement =	3.15	Wgrease =	0.80
Wcod fish =	2.39	Wleather & skins =	3.20	Wcap.goods =	13.57
Wlard =	1.45	Wmanioc flour =	3.92	Wpasta =	0.75
Wtar =	1.10	Wwheat-flour =	8.52	Wtextile =	27.75
Wkerosene =	4.10	Wwine =	2.38	Wcoffee proc. =	1.30
				Wcigaretts =	5.61
				Total =	100

the domestic industry during the 1870-1913 period. The weight figures thus estimated are as the cadre 1.<sup>12</sup>

The products listed in the two sub-samples above account for 84.5% of domestic agricultural production and 62% of the domestic manufacturing production in 1919. So, they are both representative of these sectors. As regards mining, government and transportation activities, a lack of data prevented us from taking them into consideration. In any case, the three together accounted for a relatively small share of GDP at the time, so that their exclusion does not greatly affect the aggregate price estimate. With reference to commerce, its production and price trends Brazil have been historically calculated by combining the indices relative to agriculture, industry and total imports (Haddad, 1978, p. 149). As such, it is implicitly represented in the index.

Thus, the aggregation of the price indices relative to the agriculture and industry sub-samples provides us with an indicator which is highly repre-

<sup>12</sup> Goods such as candles, rubber, olive oil, tea, turpentine and vinegar were not considered because their weights were negligible (less than 0.3%).

sentative at a macroeconomic level. The aggregation was performed on the following expression:

$$P = \frac{WTagr * Pagr + WTind * Pind}{WTagr + WTind} \quad (2)$$

where  $WTagr = (Qagr - Xagr)rVAagr + Magr$  and  $WTind = (Qind - Xind)rVAind + Mind$ .

Before applying (2) to the data, a last problem must be dealt with. The agricultural figures reported in the 1919 census refer to the 1919/20 agricultural year. Since we are concerned with the period during which the crops were effectively traded, the census figures must be considered as if they refer to the calendar year of 1920. In this case, the value of industrial output must also be relative to the year of 1920. This is available in Haddad (1978, p. 157). The respective value added coefficients can be taken from the 1919 census, whereas foreign trade data for 1920 can be found in Brazil — SEEF (1925).

Using these 1920 figures,  $WTagr$  and  $WTind$  were estimated as equal to 45%, and 55%, respectively. Yet, one should be careful in taking these shares as representative of the pre-1914 period, since  $WTagr$  and  $WTind$  have undergone dramatic changes in the course of the country's economic development. A better proxy for the pre-1914 years must be sought. The best we can do in this respect is to use Haddad's (1978, p. 154 and 157) value added figures to re-estimate  $WTagr$  and  $WTind$  for 1907.<sup>13</sup> Taking Haddad's 1907 estimates together with the official foreign trade figures for that year, one finds that  $WTagr = 56\%$  and  $WTind = 44\%$ . These shares are no doubt more representative of the 1870-1913 period as a whole and were, therefore, used in the aggregation procedure.<sup>14</sup>

The level and growth rates of the final price index are depicted in graphs 1a and 1b, respectively.

In order to gauge the extent to which the system of weights employed affects the final estimate, an unweighted index was also plotted.<sup>15</sup> As one can see, the two indicators reveal similar trends for most of the period, with both displaying a between 1877 and 1888, a price upswing during 1888-98, a deflation until

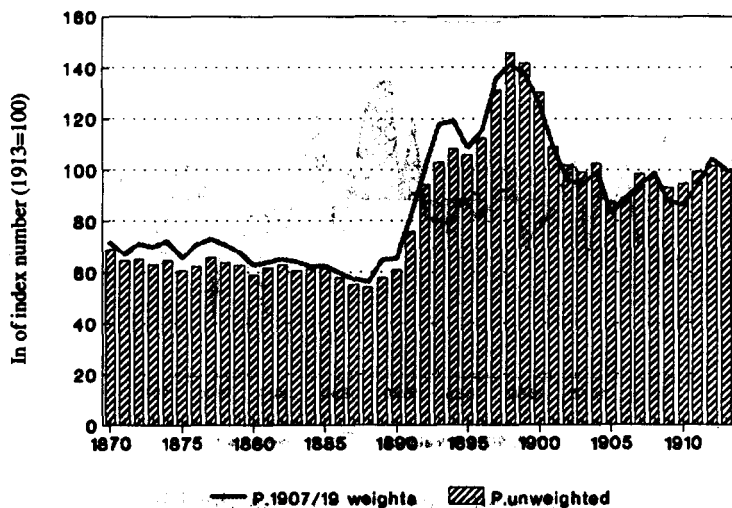
<sup>13</sup> For this is the first year for which estimates of both the final value and the value added in manufacturing are available.

<sup>14</sup> In fact, the use of the 1907 shares rather than the 1919 ones does not affect the conclusions of this work. The indices based on these two different weighting criteria proved to be very highly correlated ( $r=0.999$ ) and present similar cyclical turning points.

<sup>15</sup> Such an unweighted index includes goods such as candles, olive oil, rubber, tea, turpentine and vinegar, which were excluded from the weighted index because their respective weights were nearly zero.



**Graph 1a**  
**Brazil: Wholesale price level, 1870-1913**



the mid-1900s, then followed by a recovery till 1912.<sup>16</sup> Yet, the unweighted index failed to capture the mild inflation of the 1870-77 period,<sup>17</sup> displayed a sharper upswing over 1888-98 (graph 1a) and a few different turning points in its growth rate pattern (graph 1b). This is because the unweighted index underplays the outstanding importance of staples such as beans, corn and rice in the representative consumption basket during the period. These were non-tradable goods whose prices diverged dramatically from those of tradable commodities which constituted the bulk of our sample.<sup>18</sup> By not taking into consideration this important piece of information, the unweighted index misrepresents the aggregate impact of distinct sectoral price trends.

#### 4. A comparison with the previously existing indices

The two existing indicators for which annual figures are available throughout 1870-1913 are those by Lobo et alii (1971)<sup>19</sup> and by Contador

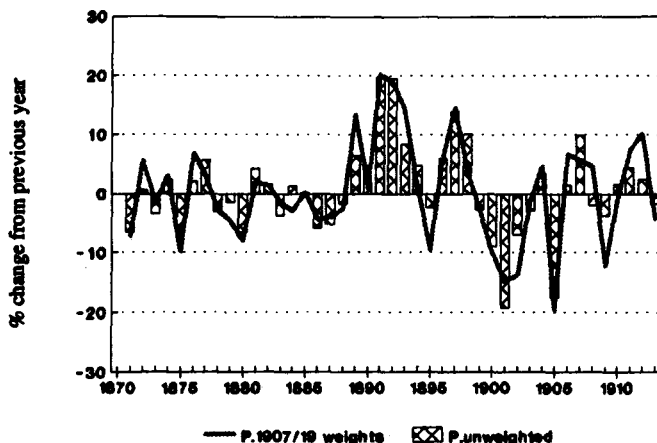
<sup>16</sup> Such a similarity in long-term trends is corroborated by the high correlation coefficient between the two indicators ( $r=0.99$ ).

<sup>17</sup> The 1870-77 price inflation also shows up in the Lobo et alii (1971) index. See below.

<sup>18</sup> See Catão (1991) for the causes of this differential growth pattern of agricultural non-tradable commodities *vis-à-vis* that of tradable goods.

<sup>19</sup> I shall only consider here the Lobo et alii indice based on the 1919 weights, rather than

**Graph 1b**  
**Brazil: Growth rates of wholesale prices, 1870-1913**



& Haddad (1975) — the latter being based on the PPP.<sup>20</sup> As graph 2 shows, there are some disparities between these two indices and the one proposed here. Comparing the latter with that of Lobo et alii (1971), two major differences stand out. First, the Lobo et alii index appears to be considerably more volatile in the short-run, with price spikes in 1875-77 and in 1885 and a dramatic downturn during 1885-88. Secondly, the Lobo et alii indicator contains a clear inflationary bias over the long-run: it displays a price plateau, rather than a deflation, during 1877-85, and sharper upswings during 1870-77 and 1888-98.<sup>21</sup> Apart from these two main contrasts and minor year-to-year divergences, both indices provide a case for long upswings in the national price level during the periods of

on the 1856 and the 1949 weights. The reason for not using the weight system of 1856 is that it is based on the expenditure pattern of workers of a single industrial firm, therefore lacking representativeness. In particular, it contains an unacceptably high share of non-tradable goods in its composition. The 1949 weight system, on the other hand, is inadequate for being too far apart from the period under consideration.

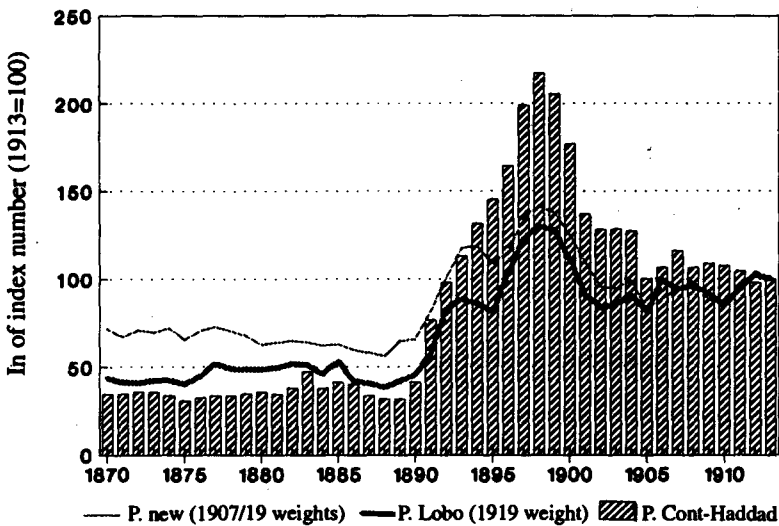
<sup>20</sup> Other authors' indices cover only sub-periods such as 1880-87 (Buescu, 1973), 1870-88 and 1886-1903 (Eisenberg, 1974). With reference to Mattoso (1973), its index is presented only under the form of graphs, thus making difficult the comparison with our index. In any case, apart from marked divergences on a year-to-year basis, all these indices point to trends similar to those described above — namely, a price inflation between the early and the late 1870's and between the late 1880's and the late 1890's, intermingled with periods of deflation or price levelling out.

<sup>21</sup> That the Lobo et alii (1971) estimate is more volatile is not surprising, since it is based on a limited basket of foodstuff goods, whose production is more subject to weather shocks and speculative short-term movements.

1870-77 and 1888-98 and for downswings in 1877-88 and 1898-1905/6.<sup>22</sup>

With reference to the Contador-Haddad index, its divergences from the new index are much more marked.<sup>23</sup> The former fails to capture the mild inflation of 1870-77 and the 1877-83 price downswing. On the other hand, the PPP-based indicator exaggerates the magnitude of the 1888-98 inflation as well as that of the ensuing deflation. In this sense, the PPP-based index appears to constitute a misleading indicator of domestic price trends in pre-1914 Brazil.

**Graph 2**  
Brazil: alternative price indicators, 1870-1913



To sum up, the wholesale price index estimated above is far superior to the existing ones as regards both commodity coverage and weighting criterion. Although the *direction* of its long-term movements are similar to those displayed by the Lobo et alii (1971) index throughout 1870-1913 and by the PPP-based price index after 1885, the new price index provides more reliable measures of the magnitude of these fluctuations as well as of the precise year of their cyclical turning points.

<sup>22</sup> Overall, the correlation coefficient between the two indicators is  $r=0.92$ .

<sup>23</sup> Correspondingly, its coefficient of correlation with our new index is lower than that of Lobo et alii index — namely,  $r=0.88$ .

## Appendix 1

**Table 1**  
**Brazil's new wholesale price index**  
**(1913=100)**

1870	71.57	1881	63.87	1892	101.01	1903	94.33
1871	66.78	1882	64.86	1893	117.48	1904	99.07
1872	70.82	1883	63.97	1894	118.95	1905	82.71
1873	69.79	1884	62.14	1895	108.53	1906	88.60
1874	72.04	1885	62.29	1896	115.46	1907	94.00
1875	65.53	1886	59.66	1897	135.26	1908	98.61
1876	70.36	1887	57.36	1898	141.37	1909	87.85
1877	72.71	1888	55.96	1899	137.49	1910	86.72
1878	70.67	1889	64.72	1900	125.17	1911	93.66
1879	67.66	1890	65.29	1901	108.94	1912	104.28
1880	62.64	1891	81.86	1902	95.70	1913	100.00

**Table 2**  
**Brazil's industry/agriculture terms-of-trade**  
**(1913=100)**

1870	100.72	1881	88.63	1892	89.26	1903	110.60
1871	98.24	1882	86.13	1893	76.22	1904	109.77
1872	91.07	1883	91.38	1894	81.32	1905	105.78
1873	91.01	1884	89.85	1895	94.27	1906	89.40
1874	84.52	1885	89.92	1896	95.19	1907	97.96
1875	87.54	1886	94.06	1897	81.91	1908	95.34
1876	81.29	1887	85.54	1898	90.10	1909	104.84
1877	80.06	1888	90.62	1899	110.80	1910	107.26
1878	80.85	1889	79.68	1900	108.23	1911	96.58
1879	83.32	1890	87.25	1901	99.30	1912	95.75
1880	90.07	1891	88.20	1902	105.37	1913	100.00

## Resumo

Embora existam vários indicadores do nível de preços para a economia brasileira antes da I Guerra Mundial, a qualidade destes é extremamente precária. Muitos deles são derivados de uma cesta muito limitada de produtos e carecem de um sistema de ponderação representativo; outros são baseados em pressupostos teóricos não comprovados empiricamente, como a teoria do poder de compra da moeda (PPP). Este artigo apresenta um novo índice de preços por atacado com base numa cesta muito mais ampla de mercadorias e num sistema de ponderação macroeconomicamente representativo, derivado do primeiro censo nacional de produção em 1919. O novo índice fornece, portanto, uma medida consideravelmente mais precisa do padrão histórico da inflação brasileira durante o período 1870-1913. Tal medida é claramente importante para uma avaliação rigorosa das diversas hipóteses relativas ao crescimento e a estabilidade macroeconômica do País desde fins do século XIX.

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