Review of Political Economy

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/crpe20

Price-Value Deviations and the Labour Theory of Value: Evidence from 42 Countries, 2000–2017

Güney Işıkara & Patrick Mokre

REVIEW OF POLITICAL ECONOMY
https://doi.org/10.1080/09538259.2021.1904648

Routledge
Taylor & Francis Group

Check for updates

Price-Value Deviations and the Labour Theory of Value: Evidence from 42 Countries, 2000–2017

Güney Işıkara[a] and Patrick Mokre[b,c]

[a]New York University Liberal Studies, New York, NY, USA; [b]Austrian Federal Chamber of Labour, Vienna, Austria; [c]The New School for Social Research, New York, NY, USA

ABSTRACT
The relationship between prices and labour values has been the source of fruitful controversy since the earliest Classical Political Economists. The alleged refutation of the labour theory of value was an integral part of the marginalist attack against Classical and Marxist analysis. However, statistical analysis of price-value relationships made possible by the data available since the later 20th century suggest considerable empirical strength of the labour theory of value. We trace the intellectual history of the price-value relationship and its inseparable link to capitalist competition through Smith, Ricardo, Marx and Sraffa. Following Shaikh and Ochoa, we present an empirical model of testing their hypotheses that (1) labour values regulate prices of production and (2) serve as gravitational centres for market prices. The analysis of a large dataset of 42 countries and 15 years reveal only small and stable deviations and thus lend support to the Classical Political Economic analysis. With a sample of over 36,000 price vectors, we provide the most comprehensive empirical application of its class and generalize the results that have been established in the relevant literature.

ARTICLE HISTORY
Received 29 September 2020
Accepted 8 March 2021

KEYWORDS
Price; value; input–output; classical political economics; labour theory of value

JEL CLASSIFICATION
B12; B51; C67; O57; P16

1. Introduction

The question of value and prices is central to any economic theory. Subjective value theory, where prices are the sole product of supply and demand, established itself as dominant within the discipline, hand in hand with marginalism. Classical political economists, however, employ a substantially different approach in which commodity prices are regulated by total labour time socially necessary for production.

Ricardo was the first one to use extensive numerical examples to show that relative prices (of production) differ systematically, yet correspond to relative labour times necessary for production. Marx focused on the dynamic relationship between relative prices of production and labour times, he argued that changes in the former are driven by movements of the latter (Shaikh 2016, pp. 380–381).

Sraffa's work on the changes in prices of production with varying distribution of income and the possibility of re-switching between techniques was an explicit attack on the marginalist framework and triggered the Cambridge Capital Controversies.

CONTACT Güney Işıkara guneyisikara@nyu.edu
Supplemental data for this article can be accessed at https://doi.org/10.1080/09538259.2021.1904648.

However, in his analysis market prices are so closely related to prices of production that he abstracts from the former (Sraffa 1960, pp. 8–9).

This paper deals solely with the relationship between prices proportional to labour values, prices of production, and market prices. The empirical model is based on a Sraffian price model. Using a sample of over 36,000 prices from 42 countries over a period of 18 years, we provide the hitherto most comprehensive collection of market prices and labour values.

2. Theoretical Foundations

Despite their differences in details, classical economists[1] thought that market prices, which fluctuate depending on the conditions of supply and demand, are regulated by deeper-lying structural factors. In Adam Smith, any disproportion between the supply of and demand for a certain good will manifest itself in the form of price movements, which in turn trigger adjustments in the quantity supplied and tend to eliminate the initial excess of supply or demand. Thus, market prices are not arbitrarily high or low. They gravitate toward a central price, which Smith calls the 'natural price' (Smith 1999, pp. 158–159).

Ricardo explicitly models the relationship between relative prices and relative total labour times required for the production of commodities. Even in the most abstract example of two independent producers moving between employments, relative prices will be 'almost exclusively' by relative labour quantities, with the adaption of prices ensured by labour mobility (Ricardo 1951, Chapter I, Section I).

Even at the highest level of abstraction, *competition* (followed by contingent changes in supply and demand) for higher rates of return lead to a turbulent fluctuation of everyday prices around labour values as a centre of gravity. The inclusion of profits by the owners of means of production results merely in a distribution of the value-added among different classes. It does not change the above-established proportionality between total labour times and natural prices in any way (Smith 1999, pp. 150–152).

It is noteworthy that necessary labour denotes the sum of labour in production as well as in the production of all input commodities for the production process. In Section Four of the first chapter of his *Principles,* Ricardo then shows that a change in income distribution will have a different impact on each industry depending on its capital-labour ratio. This is the point of departure for Sraffa. At the same time, Ricardo claims that the effect of a distributional change will be constrained by an upper bound of 7 per cent (Ricardo 1951, p. 36).

The key to Marx's understanding of the price-value relationship is his treatment of profits in the transition from surplus value in Capital's Volume I to the formation of a general profit rate in Volume III. In the former model, he argues that commodities are exchanged at labour values, ie. at prices proportional to socially necessary labour time, where surplus value is proportional to the part of this labour not necessary to reproduce labour as a commodity (Marx 1969, p. 164). In the latter model, competition and capital mobility form a general profit rate, which is added to labour values in exchange (Marx 1991, p. 488). For him, the formation of a money commodity is a logical consequence of commodity production (Weber 2019).

[1]We use this term to mainly refer to Smith, Ricardo, and Marx.

As money is a form of value rather than value, a distinction that Marx formulates as a critique of Ricardo, prices will be proportional but not equal to labour values. Following Shaikh (1977, p. 106) we will call these proportional prices *direct prices*, and refer to *prices of production* when the general profit rate is added. In Marx, prices of production form the centre of gravitation for the inevitable and perpetual circulations of market prices. Against this background, Marx concludes with respect to prices of production that '[t]he law of value governs their movement in so far as reduction or increase in the labour-time needed for their production makes the price of production rise or fall' (Marx 1991, p. 280). When it comes to market prices, Marx asserts that they fluctuate around prices of production in a turbulent fashion (Marx 1991, pp. 280, 488). These will be hypotheses addressed in the empirical section of this paper.

Our empirical inquiry is based on a Sraffian circulating capital model. However, this does not mean that we adopt the Sraffian framework uncritically. The latter treats 'social surplus' (Sraffa 1960, p. 7) as an outcome of productivity gains. This obscures the underlying social relations and struggles over working conditions, and what determines the amount of *surplus labour*, from which the surplus product arises. Without these components, Marx's aim to study the laws of movement in capitalist society must be surrendered.

Neo-Ricardian authors raise a popular critique of Marx's theory of prices when they argue that price movements can be studied without any reference to labour values, and exploitation is sufficiently captured by appropriation of the surplus product (rather than the distinction between the reproduction of labour power and production of surplus product) (Hodgson 1980; Steedman 1977). However, we argue that the labour theory of value (or, the law of value) does not serve only as an instrument to study prices and distribution, but the key in an integrated theoretical framework aiming to study the historical specificity of the capitalist mode of production (Savran 2012).

2.1. Empirical Literature on Price-Value Deviations

Thanks to the increasing availability of input–output data in the past decades which is well suited for empirical applications of classical political economics (Kurz and Salvadori 2000), the literature investigating systematic relations between direct prices (DP), prices of production (PP), and market prices (MP) has been gradually growing.

In a seminal work, Shaikh (1984, pp. 71–79) makes use of 25-order Italian input–output data for 1959 and 1967, and 1947 tables for the US with 190 industries. He finds the DP-PP and DP-MP deviations to be in the range of 17–19 and 20–25 per cent, respectively. Ochoa's (1989) and Chilcote's (1997, pp. 140–141) analyses of the US economy for the period 1947–72 and 1958–87 find similar magnitudes, as do Cockshott and Cottrell (1997, pp. 547–548) and Cockshott, Cottrell, and Michaelson (1995, pp. 107–109) for the UK, Tsoulfidis and Maniatis (2002, pp. 360–361) and Tsoulfidis and Mariolis (2007, pp. 428–429) for Greece.

It is notable that analyses employing fixed capital models retrieve substantially lower deviations between market, production and direct prices, albeit require a more comprehensive collection of input–output, capital stock and depreciation matrices. This is presented in Cheng and Li (2020) along with a comprehensive overview of the empirical literature. Interested readers can also see Cockshott and Cottrell's (1997) and Soklis' (2009) work for a comparison of labour values with alternative value bases.

3. Model and Data

3.1. The Model

Given the size of our sample, we have no other choice than employing a circulating capital model that leaves out fixed capital and depreciation matrices due to data availability. It goes without saying that fixed capital models yield more accurate results. However, the quantitative differences are not large, and would definitely not lead to any change in our qualitative conclusions (for comparisons, see Shaikh 2016, Ch.9; Tsoulfidis and Tsaliki 2019, Ch.4; Cheng and Li 2020).

To retrieve direct prices and production prices, we use input–output tables (IOTs), i.e., records of payment flows between industries. Each element z_{ij} of the square flow matrix $\mathbf{Z} = \{z_{ij}\}$ records the flow of payments from industry i to industry j (Miller and Blair 2009, p. 3). The gross output vector $\mathbf{X} = \{x_j\}$ is equal to the column sums of Z, plus value added in each industry, from which we construct the gross output diagonal matrix $\hat{\boldsymbol{X}} = \text{diag}\ (x_1, x_2, \ldots, x_n)$. Then $\mathbf{A} = \{a_{ij}\} = \boldsymbol{Z}\hat{\boldsymbol{X}}^{-1}$ is the normalized flow matrix. It records the inputs (measured in money prices) required to produce a dollar's worth of output.

The $\mathbf{A}$ matrix represents the technical production coefficients under two key assumptions, namely, (i) the industrial technology assumption (Miller and Blair 2009, p. 192) that all commodities produced in one industry have the same input structure, and (ii) the circulating capital model assumption (Shaikh 2013, p. 99), i.e., that inputs represent the capital use of an industry.[2]

The direct labour vector $\mathbf{l}$ represents the cost of employment for each industry. Following Shaikh (2013, p. 98), we correct the labour vector for skill by normalizing it by the national average wage $\bar{w} = \frac{\mathrm{W}}{\mathrm{L}}$, where W is the national sum of employee's compensation and L stands for aggregate employment. The skill-adjusted direct labour coefficient for the j-th sector l'_j is thus calculated as follows:

$$l'_j = \frac{1}{\bar{w}} \times \frac{W_j}{X_j} = \frac{w_j}{\bar{w}} \times \frac{L_j}{X_j}$$

where W_j is the wage-bill of the j-th sector, and $\frac{w_j}{\bar{w}}$ is a rough approximation of its workers' relative skills (Shaikh 2013, p. 98; Mokre and Rehm 2020).

Prices proportional to labour values, i.e., direct prices p_d represent the vertically integrated labour embodied in one dollar's worth of output. To calculate direct prices, we first multiply the skill-adjusted direct labour vector $\boldsymbol{l'}$ by the Leontief inverse and obtain the total labour vector $\boldsymbol{v}$:

$$\boldsymbol{v} = l' + vA$$

$$\boldsymbol{v} = l'(I - A)^{-\mathbf{1}}$$

The total labour vector $\mathbf{v}$ is measured in worker-hours. To make it commensurable with prices of production and market prices, we must express it in money terms. To do so, we first calculate the average value-price ratio (the average labour value of one dollar) in the

[2]Where use tables $\mathbf{U}$ and make tables $\mathbf{V}$ are available rather than flow tables $\mathbf{Z}$, we construct the diagonal commodity output matrix $\hat{Z} = \text{diag}(z_1, z_2, \ldots, z_n)$ and calculate the coefficients matrix $A = V\hat{Z}^{-1}U\hat{X}^{-1}$ (BEA 2017).

economy:

$$\alpha = \frac{\sum_j v_j x_j}{\sum_j x_j}$$

In a final step, we obtain the vector for direct prices $\boldsymbol{p}_{\mathbf{d}}$ (measured in dollars) by dividing the total labour vector $\mathbf{v}$ by the average value price ratio α.

As regards prices of production, in a Sraffian circulating capital framework, any price can be broken down into unit labour costs, unit material costs, and profit per unit of capital. This is expressed as follows:

$$\boldsymbol{p}_{\mathbf{p}} = w\boldsymbol{l}' + \boldsymbol{p}_{\mathbf{p}}\boldsymbol{A} + r\boldsymbol{p}_{\mathbf{p}}\boldsymbol{A}$$

$$\boldsymbol{p}_{\mathbf{p}} = w\boldsymbol{v} + r\boldsymbol{p}_{\mathbf{p}}\boldsymbol{H}$$

where $\boldsymbol{p}_p$ is the (n x 1) vector of prices of production for a given profit rate r, and $\mathbf{H}$ stands for the total (direct and indirect) capital coefficient matrix $\boldsymbol{A}(I - A)^{-\mathbf{1}}$, i.e., the vertically integrated capital requirements per dollars' worth of output. Following Sraffa (1960, p. 22), the relationship is expressed with the profit rate and real wage as functions of the maximum profit rate (i.e., the profit rate for zero wages), $r' = \frac{r}{R}$ and $w = 1 - \frac{r}{R}$.

$$\boldsymbol{p}_{\mathbf{p}} = (1 - r')\boldsymbol{v}(\boldsymbol{I} - Rr'\boldsymbol{H})^{-\mathbf{1}}$$

Finally, market prices are given by the elements of the normalized gross output vector $\mathbf{X}$ in the input–output tables. What we compare in the following section is, strictly speaking, the distance not between the three set of prices, but the gross output vector evaluated once at direct prices, once prices of production, and once market prices. The gross output vector evaluated in market prices is given by the empirical gross output vector $\boldsymbol{X}$. The other two vectors are calculated through the steps explained by Shaikh (2013, pp. 98–99).

3.2. Data and Ignored Industries

We retrieve the input–output tables, employment, output, import, compensation and gross operating surplus data from harmonized IOTs for 42 countries over 15 years (2000–2014), found in the World Input–Output Database WIOD (Dietzenbacher et al. 2013; Temurshoev and Timmer 2011), as well as more detailed national tables for Australia, Canada, Britain, Mexico and the United States, which we use to assess the plausibility of our results (Australian Bureau of Statistics 2019; Bureau of Economic Analysis 2019: Instituto Nacional de Estadística y Geografía 2019; Office for National Statistics Great Britain 2019; Statistics Canada 2019).[3] We omit fictitious industries from the dataset, as well as all observations from Taiwan which reports negative operating surpluses for all available years.[4]

[3]We include additional IOTs only if they recorded 100 or more industries, as compared to the harmonized 55 industries structure in the WIOD (Timmer et al. 2015).

[4]The criteria for omissions are listed in Online Appendix A, which is available as attachment to the online article. Similarly, Online Appendix B (and Tables B1 and B2) are only available in the online version of the paper.

3.3. Metrics of Deviation

To inspect the relationship between prices, we use two measures of deviation that are established in the literature: the mean average weighted deviation in percentages (MAWD), and the classical measure of distance (CD). Both metrics average over the deviation between any two pairs of prices p_1 and p_2 (where p_1 might denote direct prices, -p_2 prices of production, etc.). Note that the multiplication with output vector X_j weighs the contribution of each industry by gross output. Also note Mariolis and Tsoulfidis' (2010) insight that different metrics of deviation generally reveal similar directions of deviation between price vectors, albeit the interpretation of their numerical value:

$$\text{MAWD} = \sum_{j}^{N} \frac{|p_{1j}X_j - p_{2j}X_j|}{p_{2j}X_j}$$

$$\text{CD} = \sum_{j}^{N} \frac{p_1}{p_2} \frac{X_j}{\sum_j^N X_j}$$

MAWD has been used in a number of investigations, as summarized in Table 1 in Cheng and Li (2020, p. 117). As it is defined in percentages, the measure is scalable. The classical measure of distance has the advantage that its key element $q_{12} = \frac{p_1}{p_2}$ has an intuitive interpretation of how much of the price in the numerator remains unexplained by the price in the denominator, if the former is larger than the latter. The definitions correspond to Shaikh (2016, pp. 392–395).

4. Results

4.1. Deviations Between the Three Set of Prices

We find that deviations between direct prices and market prices are generally small, and the intervals mostly correspond to the findings in the literature where available (for comparison, see Table 1 in Cheng and Li 2020, p. 117). Table 1 presents the mean average weighted deviation in percentages (MAWD) and the classical measure of distance (CD) for both direct-market price and direct-production price relationships obtained from harmonized WIOD tables.

The relationship between direct and market prices is concerned with the Marxist hypothesis that actual market prices are regulated by socially necessary labour times (exchange values). In Table 1, the vast majority of mean average weighted deviations (MAWD) between market prices (MP) and direct prices (DP) lie between 10–25 per cent, with Cyprus, Denmark, Mexico and Turkey as outliers.

The relation between production prices (PP) and direct prices (DP) corresponds to Ricardo's famous assertion that vertically integrated labour values would explain about 93 per cent of production prices where the dynamics of profit rate equalization are operating. Here, the MAWD concentrate around 10 per cent, with outliers being Croatia, Korea, Luxemburg and Malta (15.3, 18.8, 26.3, and 21.8 per cent, respectively). It is notable that in many countries the deviation lies within the 7-per cent-range raised by

Table 1. Deviations between direct (DP) and market prices (MP), and direct and production prices (PP). Authors' own calculations based on World Input–Output Tables.

			MP/DP		PP/DP	
Country	Industries	Years	MAWD	CD	MAWD	CD
AUS	53	2000–2014	0.1558	0.2026	0.0701	0.0789
AUT	53	2000–2014	0.1709	0.1357	0.1080	0.1171
BEL	53	2000–2014	0.1127	0.1249	0.1296	0.1518
BGR	53	2000–2014	0.1993	0.2093	0.1008	0.1189
BRA	53	2000–2014	0.1739	0.2080	0.0409	0.0589
CAN	53	2000–2014	0.1603	0.1947	0.1029	0.1065
CHE	53	2000–2014	0.1101	0.1494	0.1161	0.1327
CHN	53	2000–2014	0.1470	0.1651	0.1099	0.1581
CYP	53	2000–2014	0.2730	0.2428	0.1052	0.1357
CZE	53	2000–2014	0.1350	0.1280	0.0674	0.0758
DEU	53	2000–2014	0.1384	0.1148	0.0932	0.1051
DNK	53	2000–2014	0.2875	0.2821	0.1043	0.1262
ESP	53	2000–2014	0.1549	0.1458	0.1332	0.1563
EST	53	2000–2014	0.1445	0.1506	0.0940	0.1031
FIN	53	2000–2014	0.1871	0.1652	0.1180	0.1482
FRA	53	2000–2014	0.1203	0.1102	0.1307	0.1348
GBR	53	2000–2014	0.1762	0.1510	0.0837	0.0844
GRC	53	2000–2014	0.2097	0.2078	0.0355	0.0371
HRV	53	2000–2014	0.1781	0.1926	0.1535	0.1571
HUN	53	2000–2014	0.1240	0.1344	0.1040	0.1181
IDN	53	2000–2014	0.2313	0.2867	0.0570	0.0583
IND	53	2000–2014	0.2056	0.2432	0.0573	0.0668
IRL	53	2000–2014	0.2160	0.2887	0.1041	0.1413
ITA	53	2000–2014	0.1278	0.1079	0.1284	0.1293
JPN	53	2000–2014	0.2215	0.2026	0.1331	0.1430
KOR	53	2000–2014	0.2041	0.2247	0.1876	0.2210
LTU	53	2000–2014	0.2091	0.2312	0.0331	0.0376
LUX	53	2000–2014	0.1905	0.1998	0.2627	0.2909
LVA	53	2000–2014	0.1488	0.1353	0.0720	0.0920
MEX	53	2000–2014	0.4113	0.9718	0.1219	0.1470
MLT	53	2000–2014	0.1496	0.1163	0.2175	0.2778
NLD	53	2000–2014	0.2626	0.2683	0.0661	0.0721
NOR	53	2000–2014	0.2434	0.5602	0.0321	0.0331
POL	53	2000–2014	0.1735	0.1777	0.0470	0.0487
PRT	53	2000–2014	0.2206	0.2116	0.1252	0.1488
ROU	53	2000–2014	0.1852	0.1875	0.0354	0.0379
RUS	53	2000–2014	0.0968	0.2376	0.0304	0.0594
SVK	53	2000–2014	0.1635	0.1682	0.0743	0.0780
SVN	53	2000–2014	0.1260	0.1143	0.1382	0.1471
SWE	53	2000–2014	0.1746	0.1629	0.0575	0.0622
TUR	53	2000–2014	0.2946	0.3207	0.0537	0.0754
USA	53	2000–2014	0.1778	0.1892	0.0510	0.0493

Ricardo. Table 2 reports the same results for the more detailed tables we obtained, which are in line with the results from WIOD data.

With the exception of Mexico, the MP-DP deviations are distributed around the interval of 20–25 per cent according to both measures. When it comes to the distance between production and market prices, the results are less than (or slightly above) 10 per cent in four of the six cases. Mexico stands out as a strong outlier in terms of both comparisons.

In conclusion, our analysis based on both harmonized WIOD tables and non-harmonized national statistical tables does not suggest that either Ricardos' or Marx's hypothesis can be rejected, providing support to the classical argument that labour values have a regulatory function for prices of production and thereby for market prices. The strong

Table 2. Deviations between direct (DP) and market prices (MP), and direct and production prices (PP). Authors' own calculations based on national statistical agencies.

			MP/DP		PP/DP	
Country	Industries	Years	MAWD	CD	MAWD	CD
AUS	183	2001–2016	0.2738	0.2779	0.0369	0.0374
CAN	210	2015	0.1853	0.2097	0.0673	0.0865
GBR	97	2000–2017	0.2498	0.2618	0.1569	0.1321
JPN	105	2011–2015	0.2809	0.2287	0.1165	0.1104
MEX	261	2008–2013	0.4647	0.8084	0.2111	0.2285
USA	396	2007–2012	0.2557	0.3327	0.0850	0.0941

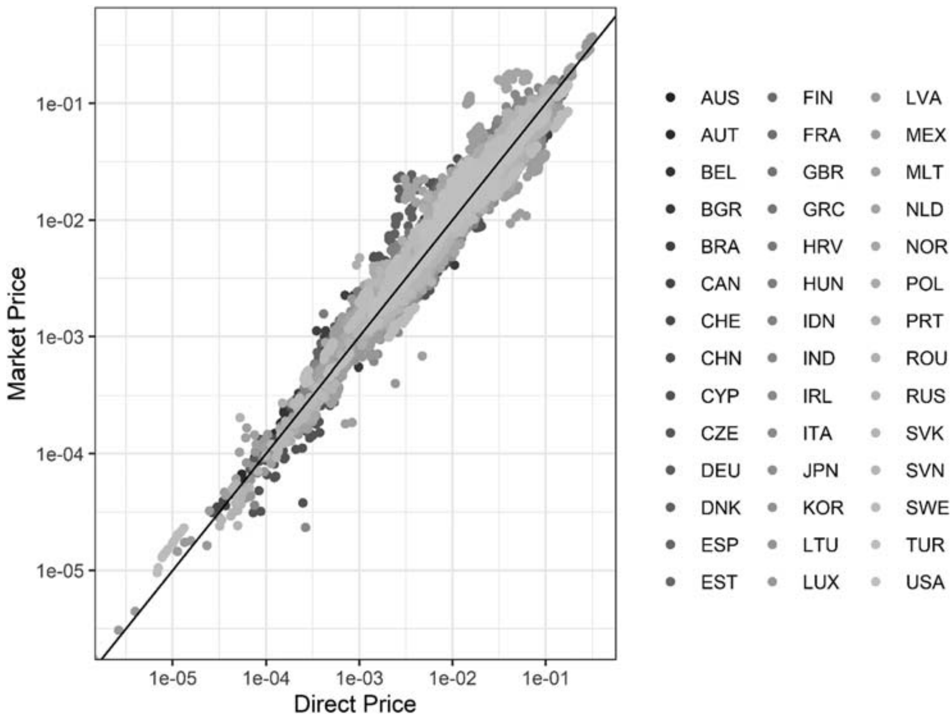

Figure 1. Almost linear relationship between direct (DP) and market prices (MP). Authors' own calculations based on World Input–Output Tables, 42 countries, 2000–2014. Note that observations are colour-coded per country.

linear relationship between direct and market prices, and direct and production prices is illustrated in Figures 1 and 2, respectively.[5]

4.2. Capital Intensity, Import Shares, and Energy Industries

Our empirical findings are consistent with the theoretical anticipation that socially necessary labour times regulate commodities' prices of production in a turbulent

[5]It should be noted that the cross-sectional plots summarize the relationships for all countries and years, which have quite different economic dynamics regulating the individual outcomes. The plots are meant to illustrate the intuition rather than provide a solid ground for interpretation of the results.

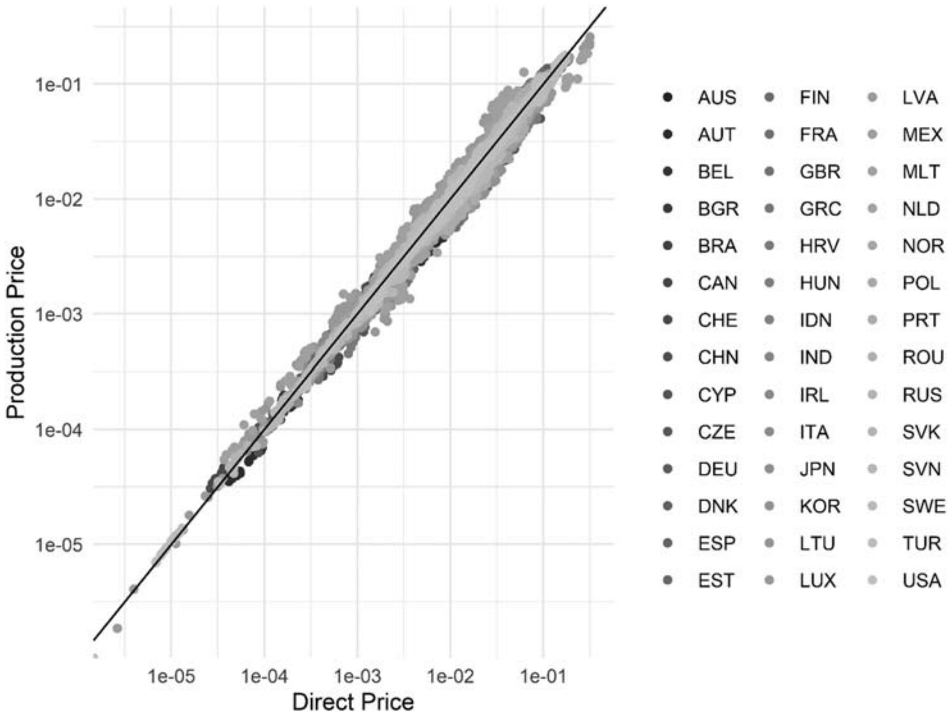

Figure 2. Almost linear relationship between direct (DP) and production prices (PP). Authors' own calculations based on World Input–Output Tables, 42 countries, 2000–2014. Note that observations are colour-coded per country.

equalization process, and through the mediation of prices of production, labour times constitute the basis of market prices. When interpreting the results, one has to keep in mind that the presence of persistent deviations does not run counter to the classical argument. Quite the contrary, the law of value asserts itself in and through these deviations. Only due to these deviations, reflecting differential profit rates and arbitrage opportunities resulting from competition, can the market mechanism systematically allocate new investment in line with the labour values acting as centre of gravity.

Differences in sectoral capital-labour ratios are the most important driver of price-value deviations, as we discussed in Section Two. Table 3 presents the distribution between 20-per cent-quantiles of MP/DP deviations (measured by the classical measure of distance, printed in columns) and capital intensity (rows) of all WIOD observations (i.e., one observation per country and year).

The table shows a strong relationship between the highest quintiles: 48 per cent of the observations in the highest price deviation quintile are also in the highest capital intensity quintile (see the bottom right cell). This suggests that exceptional values of capital intensity tend to go hand in hand with large price-value deviations in a non-linear fashion, rather than that the former explain the latter.

Table 4 is constructed in the same fashion for DP/PP deviations and capital intensity. The anticipated strong relationship between high deviations and high capital intensities is not clear in this table. What the table does demonstrate, however, is that capital

Table 3. Distribution of direct-market price deviations and capital intensity 20% quantiles, by country and year.

		Direct-market price deviations (20% quantiles)				
		1	2	3	4	5
Capital Intensity (20%Quantiles)	1	15.20	32.00	29.60	5.60	17.60
	2	24.60	18.25	23.02	22.22	11.90
	3	13.49	27.78	24.60	23.81	10.32
	4	29.37	9.52	15.87	32.54	12.70
	5	16.54	12.60	7.09	15.75	48.03

Notes: Data: World Input–Output Database, own calculations. Direct/Market Price deviations in rows, capital intensity in columns. Rows sum up to 100%, the first cell can be read as '15.2% of the observations in the smallest 20% quantile of direct-market price deviations are also in the smallest 20% quantile of capital intensity.'

intensities close to the median (third row) are strongly associated with moderate deviations. About 80.16 (56.35) per cent of deviations are gathered in the lowest three (two) quantiles of DP/PP deviations.

Another relevant vantage point for deviations is international trade. Unequal exchange between countries is one of the possible channels where the deviation between surplus value produced and profits appropriated domestically could manifest itself. In Table 5, we present the quintile relationships between average price deviations (MP/DP, again measured by the classical measure of distance) and the import share in gross output (ISGO). For MP/DP deviations the effect is not very pronounced. Yet still, more observations among the highest 20 per cent of deviations are from the fifth quintile of import share observations (30.7 per cent).

However, Table 6 suggests a close relationship between large PP/DP deviations and import shares in gross output. Among the largest 20 per cent of deviations, 41.7 per cent are associated with the largest ISGO quintile. In addition to unequal exchange, there is another possible explanation of this relationship. The empirical labour vectors we employ in the calculation take only domestic labour costs into account, which are then normalized by the domestic average wage $\bar{w}$. Therefore, a larger share of imports implies that a key element in calculating the skill-adjusted labour vector, and thus direct prices are represented with less precision (Shaikh 2013, p. 98).

An equally important point to remember is that labour values act as an anchor for production prices and market prices only in the context of commodities that are reproducible at a large scale. Extractive industries can be understood as an instance of value transfer between economic circuits, given the fact that they are grounded in land

Table 4. Distribution of direct-production price deviations and capital intensity 20% quantiles, by country and year.

		Direct-production price deviations (20% quantiles)				
		1	2	3	4	5
Capital Intensity (20% Quantiles)	1	36.80	11.20	8.00	21.60	22.40
	2	15.08	18.25	11.11	37.30	18.25
	3	23.02	33.33	23.81	4.76	15.08
	4	12.70	21.43	20.63	21.43	23.81
	5	11.81	15.75	36.22	14.96	21.26

Notes: Data: World Input–Output Database, own calculations. Direct/Production Price deviations in rows, capital intensity in columns. Rows sum up to 100%, the first cell can be read as '36.8% of the observations in the smallest 20% quantile of direct-production price deviations are also in the smallest 20% quantile of capital intensity.'

Table 5. Distribution of direct-market price deviations and import shares of total output 20% quantiles, by country and year.

		Direct-market price deviations (20% quantiles)				
		1	2	3	4	5
Import share in output (20% quantiles)	1	8.0	23.2	16.0	25.6	27.2
	2	10.3	19.0	20.6	28.6	21.4
	3	29.4	14.3	27.8	19.8	8.7
	4	33.3	15.1	20.6	18.3	12.7
	5	18.1	28.3	15.0	7.9	30.7

Notes: Data: World Input–Output Database, own calculations. Direct/Market Price deviations in rows, import share of total output in columns. Rows sum up to 100%, the first cell can be read as '8% of the observations in the smallest 20% quantile of direct-market price deviations are also in the smallest 20% quantile of import share in total output.'

Table 6. Distribution of direct-production price deviations and import shares of total output 20% quantiles, by country and year.

		Production-Market Price Deviations (20% Quantiles)				
		1	2	3	4	5
Import share in output (20% quantiles)	1	24.8	16.0	35.2	18.4	5.6
	2	37.3	16.7	11.9	23.0	11.1
	3	19.8	22.2	18.3	18.3	21.4
	4	7.9	23.0	23.8	24.6	20.6
	5	9.4	22.0	11.0	15.7	41.7

Notes: Data: World Input–Output Database, own calculations. Production/Market Price deviations in rows, capital intensity in columns. Rows sum up to 100%, the first cell can be read as '24.8% of the observations in the smallest 20% quantile of production-market price deviations are also in the smallest 20% quantile of import shares in total output.'

property. Table 7 presents the correlation coefficients between the MP/DP and MP/PP distances as captured by the classical measure, mean capital intensity, share of imports in gross output, and energy industries' share[6] in gross output on the country level, i.e., one observation per country and year.

On the national level, the correlation between MP/DP deviations and capital intensity seems to be weak (0.1), while the relationship of energy industries' share in gross output is positive with MP/DP deviations (0.11), but negative with PP/DP deviations (−0.17).[7]

Table 8 demonstrates the same statistical relations on the industry level, this time using the absolute distance in percentages between MP/DP and MP/PP as measures of deviation (because we cannot average over the highest level of disaggregation in the data).

The relationship between the MP/DP ratio and industrial capital intensity seems to be significantly weaker (0.02). On the industry level, the positive correlation between energy industries' share in output and the MP/DP attains the maximum possible level, reaching a value of 1. Moreover, the correlation between the MP/PP ratio and energy industries' share turns positive (0.10).[8]

A closer inspection reveals that, for energy industries, market prices are systematically and substantially higher than both direct prices and prices of production. The difference

[6]In the WIOD sample, we approximate energy industries' output as the output sum of the following industries: 'B' for mining and quarrying, 'C19' for manufacture of coke and refined petroleum products, and 'D35' for electricity, gas, steam and air conditioning supply.

[7]Both results are significantly different from zero with Pearson product-moment tests rejecting insignificance at a p-value below 0.01.

[8]Both results are significantly different from zero at a 0.01 p-value according to Pearson product-moment test.

Table 7. Correlation of price deviations, capital intensity and import share and energy industries' share of output, by country and year.

	Market/ Direct Price	Market/ Production Price	Profit-Wage Ratio	Capital Intensity	Import Share of Output	Energy Industries' Share of Output
Market/Direct Price	1.00	−0.07	0.74	0.10	0.03	0.11
Market/Production Price	−0.07	1.00	−0.20	0.05	0.50	−0.17
Profit-Wage Ratio	0.74	−0.20	1.00	0.07	−0.15	0.21
Capital Intensity	0.10	0.05	0.07	1.00	−0.16	0.30
Import Share of Output	0.03	0.50	−0.15	−0.16	1.00	−0.20
Energy Industries' Share of Output	0.11	−0.17	0.21	0.30	−0.20	1.00

Note: Data: World Input–Output Database, own calculations.

Table 8. Correlation of price deviations, capital intensity and import share and energy industries' share of output, by industry.

	Market/ Direct Price	Market/ Production Price	Profit-Wage Ratio	Capital Intensity	Import Share of Output	Energy Industries' Share of Output
Market/Direct Price	1.00	0.10	0.73	0.02	0.28	1.00
Market/Production Price	0.10	1.00	0.06	0.26	0.18	0.10
Profit-Wage Ratio	0.73	0.06	1.00	0.05	0.25	0.73
Capital Intensity	0.02	0.26	0.05	1.00	0.16	0.02
Import Share of Output	0.28	0.18	0.25	0.16	1.00	0.28
Energy Industries' Share of Output	1.00	0.10	0.73	0.02	0.28	1.00

Note: Data: World Input–Output Database, own calculations.

between market prices and direct prices is positive for 88.9 per cent of the corresponding 1890 observations; for the difference between market prices and production prices the same is true in 90.8 per cent of all cases. For comparison, among the non-energy industries, the corresponding values are 47.9 and 52.8 per cent, respectively. The mean difference between market and direct prices in energy industries is 0.008, between market and production prices it is 0.01. The corresponding values in non-energy industries are −0.0005 and −0.0006.

5. Concluding Remarks

The question of what determines natural and market prices was of great interest for classical political economists. They all mulled over the role of labour expended in the production of commodities albeit with certain important differences. This interest found its manifestation especially in Ricardo's and Marx's work, who formulated the theoretical claims addressed from an empirical viewpoint in this paper.

To estimate the empirical importance of price-value deviations, we collected input–output tables for 42 countries over 15 years and calculated approximate direct (labour) prices, production prices, and market prices. While we were able to work with harmonized data presented in the World Input–Output Database, additional national statistical sources provide additional precision to the estimation as much as the consistent results between sources suggest general applicability of the methodology, while emphasizing the advantage of the much larger dataset. This corresponds to a sample of over 36,000 price vectors as well as supplementary data on capital and labour intensity, employee compensation, industrial profit rates and import shares in gross output. Our results hence represent the most comprehensive empirical application of its class and generalize the results that have been established in the relevant literature.

We found that the empirical deviations between direct and market prices are concentrated in the range of 10–25 per cent, suggesting the Marxist argument that labour values regulate market prices cannot be rejected on this basis. Furthermore, the role of direct prices in explaining production prices is even more pronounced in almost all countries in the sample, where the deviations hover around 10 per cent, suggesting the credibility of Ricardo's and Marx's assertion that relative labour requirements regulate relative production prices.

When interpreting the results, it is crucial to keep in mind that in a turbulent process of competition, which gives rise to the tendency of profit rate equalization, deviations between the three set of prices (resulting primarily from capital-labour ratios) is an expected outcome rather than a refutation of our theoretical claims. In fact, new investments are allocated by the capitalist market thanks to profit rate differentials manifested in the permanent gravitational movement of prices.

Other than oscillations caused by competition, there are two further possible sources that might magnify empirically measured deviations: (i) the process of gathering, aggregating and harmonizing the data (especially in the sophisticated imputation underlying the WIOD data), and (ii) economic mechanisms circumventing the regulation of prices by between-industry competition. We discuss the potential impact of the WIOD harmonization on price-value deviations in Online Appendix B. Comparison of separate correlation analysis between WIOD and national statistical agencies' data in Online Appendix Tables B1 suggest that the effect is negligible.

Our correlation analysis suggests that, on the national level, there is a positive relationship between energy industries' share in national output and MP/DP deviations, while the correlation with PP/DP deviations is negative. On the industrial level, the correlation between MP/DP deviations and energy industries' share reaches the maximum possible level, and it turns positive for PP/DP deviations. In our view, this correlation between extractive industries' share in gross output and price-value deviations might point to a transfer of value between the circuits of capital and rent, which could serve as an interesting point of departure for further research to be conducted at a greater level of disaggregation. Similarly, the relationship between differences in inter-industry capital-labour ratios and price-value deviations could be studied with more detailed national input–output tables.

These results are not only of historical interest but indicate that classical political economists had a profound understanding of the dynamics of competition in investment, pricing and growth. Marginalist price theory seeking to replace it ultimately boils down to individual utility and preferences, failing to provide any measurable and testable hypotheses. The empirical strength of the labour theory of value suggests that it provides an important point of departure to explain more complex phenomena using the tools of classical political economics.

Acknowledgements

We thank the anonymous reviewers for their careful reading of our paper and their many insightful comments. We also thank Anwar Shaikh, Persefoni Tsaliki and Lefteris Tsouldfis for their instruction and advice as well as William Paul Cockshott for very helpful comments on an earlier version of this paper.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

References

Australian Bureau of Statistics. 2019. 'Main Features — Main Features.' Accessed June 20, 2019. https://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/5209.0.55.001Main%20Features12016-17?opendocument&tabname=Summary&prodno=5209.0.55.001&issue=2016-17&num=&view=.

Bureau of Economic Analysis. 2017. 'Mathematical Derivation of the Total Requirements Tables for Input-Output Analysis.' Accessed March 6, 2020. https://www.bea.gov/system/files/2018-04/total-requirements-derivation.pdf.

Bureau of Economic Analysis. 2019. 'Input-Output Accounts Data.' Accessed June 10, 2019. https://www.bea.gov/industry/input-output-accounts-data.

Cheng, H., and M. Li. 2020. 'Do Labour Values Explain Chinese Prices? Evidence from China's Input-Output Tables, 1990–2012.' *Review of Radical Political Economics* 52 (1): 115–136.

Chilcote, E. B. 1997. 'Interindustry Structure, Relative Prices, and Productivity: An Input-Output Study of the U.S. and O.E.C.D. Countries.' PhD diss., New School for Social Research.

Cockshott, P., and A. Cottrell. 1997. 'Labour Time Versus Alternative Value Base: A Research Note.' *Cambridge Journal of Economics* 21 (4): 545–549.

Cockshott, P., A. Cottrell, and G. Michaelson. 1995. 'Testing Marx: Some New Results from UK Data.' *Capital & Class* 19 (1): 103–130.

Dietzenbacher, E., B. Los, R. Stehrer, M. Timmer, and G. de Vries. 2013. 'The Construction of World Input-Output Tables in the WIOD Project.' *Economic Systems Research* 25 (1): 71–97.

Hodgson, G. 1980. 'A Theory of Exploitation Without the Labor Theory of Value.' *Science & Society* 44 (3): 257–273.

Instituto Nacional de Estadística y Geografía. 2019. 'Matriz de Insumo Producto.' Accessed June 10, 2019. https://www.inegi.org.mx/temas/mip/.

Kurz, H. D., and N. Salvadori. 2000. '"Classical" Roots of Input-Output Analysis: A Short Account of Its Long Prehistory.' *Economic Systems Research* 12 (2): 153–179.

Mariolis, T., and L. Tsoulfidis. 2010. 'Measures of Production Price – Labour Value Deviation and Income Distribution in Actual Economies: A Note.' *Metroeconomica* 61 (4): 701–710.

Marx, K. 1969. *Theories of Surplus Value. Part II*. London: Lawrence & Wishart.

Marx, K. 1991. *Capital. A Critique of Political Economy. Volume Three*. London: Penguin Books.

Miller, R. E., and P. D. Blair. 2009. *Input-Output Analysis: Foundations and Extensions*. New York: Cambridge University Press.

Mokre, P., and M. Rehm. 2020. 'Inter-Industry Wage Inequality: Persistent Differences and Turbulent Equalization.' *Cambridge Journal of Economics* 44 (4): 919–942.

Ochoa, E. M. 1989. 'Values, Prices, and Wage-Profit Curves in the US Economy.' *Cambridge Journal of Economics* 13 (3): 413–429.

Office for National Statistics Great Britain. 2019. 'UK Input-Output Analytical Tables.' Accessed June 10, 2019. https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/datasets/ukinputoutputanalyticaltablesdetailed.

Ricardo, D. 1951. *The Works and Correspondence of David Ricardo, Volume I. On the Principles of Political Economy and Taxation*. Edited by P. Sraffa. Cambridge: Cambridge University Press.

Savran, S. 2012. 'Neo-Ricardianism.' In *The Elgar Companion to Marxist Economics*, edited by B. Fine, A. Saad-Filho, and M. Boffo. Cheltenham: Edward Elgar.
Shaikh, A. 1977. 'Marx's Theory of Value and the Transformation Problem.' In *The Subtle Anatomy of Capitalism*, edited by J. G. Schwartz. Santa Monica: Goodyear Publishing.
Shaikh, A. 1984. 'The Transformation from Marx to Sraffa.' In *Ricardo, Marx, Sraffa. The Langston Memorial Volume*, edited by E. Mandel and A. Freeman. London: Verso.
Shaikh, A. 2013. 'The Empirical Linearity of Sraffa's Critical Output-Capital Ratios.' In *Classical Political Economy and Modern Theory: Essays in Honour of Heinz Kurz*, edited by N. Salvadori, C. Gehrke, I. Steedman, and R. Sturn. New York: Routledge.
Shaikh, A. 2016. *Capitalism: Competition, Conflict, Crises*. New York: Oxford University Press.
Smith, A. 1999. *The Wealth of Nations. Books I–III*. London: Penguin Books.
Soklis, G. 2009. 'Alternative Values Bases and Prices: Evidence from the Input-Output Tables of the Swedish Economy.' *Journal of Applied Input-Output Analysis* 15 (1): 21–39.
Sraffa, P. 1960. *Production of Commodities by Means of Commodities*. London: Cambridge University Press.
Statistics Canada. 2019. 'Input-Output tables, Inputs and Outputs, Detailed Level, Basic Prices, Table 36-10-0415-01.' Accessed June 15, 2019. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610041501.
Steedman, I. 1977. *Marx After Sraffa*. London: New Left Books.
Temurshoev, U., and M. P. Timmer. 2011. 'Joint Estimation of Supply and Use Tables.' *Papers in Regional Science* 90 (4): 863–882.
Timmer, M. P., E. Dietzenbacher, B. Los, R. Stehrer, and G. de Vries. 2015. 'An Illustrated User Guide to the World Input-Output Database: The Case of Global Automotive Production.' *Review of International Economics* 23 (3): 575–605.
Tsoulfidis, L., and T. Maniatis. 2002. 'Values, Prices of Production and Market Prices: Some More Evidence from the Greek Economy.' *Cambridge Journal of Economics* 26 (3): 359–369.
Tsoulfidis, L., and T. Mariolis. 2007. 'Labour Values, Prices of Production and the Effects of Income Distribution.' *Economic Systems Research* 19 (4): 425–437.
Tsoulfidis, L., and P. Tsaliki. 2019. *Classical Political Economics and Modern Capitalism. Theories of Value, Competition, Trade and Long Cycles*. Cham: Springer Nature.
Weber, I. M. 2019. 'On the Necessity of Money in an Exchange-Constituted Economy: The Cases of Smith and Marx.' *Cambridge Journal of Economics* 43 (6): 1459–1483.

Appendix C. Market price/production price deviations

Table C1. Deviations between direct (DP) and market prices (MP), direct and production prices (PP) as well as market and production prices. Authors' own calculations based on World Input–Output Tables.

			MP/DP		PP/DP		MP/PP	
Country	Industries	Years	MAWD	CD	MAWD	CD	MAWD	CD
AUS	53	2000–2014	0.1558	0.2026	0.0701	0.0789	0.2141	0.2583
AUT	53	2000–2014	0.1709	0.1357	0.1080	0.1171	0.2775	0.2398
BEL	53	2000–2014	0.1127	0.1249	0.1296	0.1518	0.2527	0.2894
BGR	53	2000–2014	0.1993	0.2093	0.1008	0.1189	0.2820	0.3238
BRA	53	2000–2014	0.1739	0.2080	0.0409	0.0589	0.2072	0.2594
CAN	53	2000–2014	0.1603	0.1947	0.1029	0.1065	0.2695	0.3107
CHE	53	2000–2014	0.1101	0.1494	0.1161	0.1327	0.2276	0.2807
CHN	53	2000–2014	0.1470	0.1651	0.1099	0.1581	0.2049	0.2612
CYP	53	2000–2014	0.2730	0.2428	0.1052	0.1357	0.3663	0.3722
CZE	53	2000–2014	0.1350	0.1280	0.0674	0.0758	0.1853	0.1904
DEU	53	2000–2014	0.1384	0.1148	0.0932	0.1051	0.2299	0.2130
DNK	53	2000–2014	0.2875	0.2821	0.1043	0.1262	0.4198	0.4310

(*Continued*)

Table C1. Continued.

Country	Industries	Years	MP/DP		PP/DP		MP/PP	
			MAWD	CD	MAWD	CD	MAWD	CD
ESP	53	2000–2014	0.1549	0.1458	0.1332	0.1563	0.2765	0.3047
EST	53	2000–2014	0.1445	0.1506	0.0940	0.1031	0.2237	0.2422
FIN	53	2000–2014	0.1871	0.1652	0.1180	0.1482	0.2983	0.3202
FRA	53	2000–2014	0.1203	0.1102	0.1307	0.1348	0.2770	0.2496
GBR	53	2000–2014	0.1762	0.1510	0.0837	0.0844	0.2543	0.2284
GRC	53	2000–2014	0.2097	0.2078	0.0355	0.0371	0.2206	0.2218
HRV	53	2000–2014	0.1781	0.1926	0.1535	0.1571	0.3263	0.3478
HUN	53	2000–2014	0.1240	0.1344	0.1040	0.1181	0.2095	0.2525
IDN	53	2000–2014	0.2313	0.2867	0.0570	0.0583	0.2217	0.2938
IND	53	2000–2014	0.2056	0.2432	0.0573	0.0668	0.1970	0.2508
IRL	53	2000–2014	0.2160	0.2887	0.1041	0.1413	0.2959	0.4659
ITA	53	2000–2014	0.1278	0.1079	0.1284	0.1293	0.2524	0.2285
JPN	53	2000–2014	0.2215	0.2026	0.1331	0.1430	0.3814	0.3565
KOR	53	2000–2014	0.2041	0.2247	0.1876	0.2210	0.4137	0.5068
LTU	53	2000–2014	0.2091	0.2312	0.0331	0.0376	0.2050	0.2349
LUX	53	2000–2014	0.1905	0.1998	0.2627	0.2909	0.3559	0.5180
LVA	53	2000–2014	0.1488	0.1353	0.0720	0.0920	0.1970	0.2040
MEX	53	2000–2014	0.4113	0.9718	0.1219	0.1470	0.4183	1.0095
MLT	53	2000–2014	0.1496	0.1163	0.2175	0.2778	0.2933	0.4133
NLD	53	2000–2014	0.2626	0.2683	0.0661	0.0721	0.3353	0.3500
NOR	53	2000–2014	0.2434	0.5602	0.0321	0.0331	0.2575	0.5825
POL	53	2000–2014	0.1735	0.1777	0.0470	0.0487	0.2094	0.2057
PRT	53	2000–2014	0.2206	0.2116	0.1252	0.1488	0.3687	0.3739
ROU	53	2000–2014	0.1852	0.1875	0.0354	0.0379	0.2006	0.2088
RUS	53	2000–2014	0.0968	0.2376	0.0304	0.0594	0.1198	0.2994
SVK	53	2000–2014	0.1635	0.1682	0.0743	0.0780	0.2095	0.2318
SVN	53	2000–2014	0.1260	0.1143	0.1382	0.1471	0.2402	0.2474
SWE	53	2000–2014	0.1746	0.1629	0.0575	0.0622	0.2234	0.2180
TUR	53	2000–2014	0.2946	0.3207	0.0537	0.0754	0.2709	0.2880
USA	53	2000–2014	0.1778	0.1892	0.0510	0.0493	0.2296	0.2411