Monetary Expressions of Labour Time and Market Prices: Theory and Evidence from China, Japan and Korea

Lefteris Tsoulfidis[a♣] and Dimitris Paitaridis[b]

[a]Department of Economics, University of Macedonia, Thessaloniki, Greece; [b]Institute of Labour, Athens, Greece. Names are randomly ordered.

ABSTRACT

This article presents estimates of labour values and prices of production following two approaches: the first, based on the classical and Marxian theory of value and distribution; while, the second is based on the so-called new solution to the transformation problem and its variant the Temporary Single-System Interpretation (TSSI). The major advantage of the latter approach is its simplicity along with the relatively low data requirements. Our empirical findings from the economies of China, Japan and South Korea suggest that both approaches give estimates of labour values and prices of production which are extremely close to each other as well as to actual market prices. On further examination, however, we conclude that our empirical findings are absolutely consistent with the theoretical requirements of the classical approach and contradict those of the TSSI.

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♣ Lefteris Tsoulfidis Lnt@uom.edu.gr

1. Introduction

The theory of value and distribution is where the different economic approaches find common ground and object of analysis. Both classical and (the usual) neoclassical theories seek to explain equilibrium (or long-run) prices using different sets of data. The classical theory uses a set of objective data that include the level and composition of output produced with the technology described by the input-output structure and the real wage, that is, the basket of goods normally purchased by workers with their money wage. By contrast, the neoclassical view uses a rather subjective set of data that include the preferences of individuals, the size and distribution of endowments to individuals, and the available technical alternatives. These theories are antagonistic in the sense that they have the same object of analysis, that is, the determination of equilibrium (natural or long-run) prices. Within the classical approach, however, there is a strand, the TSSI, claiming to fulfil the same objectives in a theoretically consistent way without having to rely on data limitations and complexities of analysis. The focus of this article is the estimation of the monetary expressions of labour values and prices of production according to the classical view and the alternative based on a measure of monetary expression of labour time (MELT) usually associated with the so-called new solution to the transformation problem.

Proponents of the TSSI claim that most treatments of the transformation problem are static and dualistic in the sense that they start off with a system of equations expressed in terms of labour values arriving at prices of production from the solution to a system of simultaneous equations, and in the simultaneity of solution the element of time is spirited away. Furthermore, the TSSI approach uses the concept of the MELT (see Duménil 1983; Foley 1982; Moseley 2011; Moseley and Rieu 2009, and the cited literature) and by emphasizing the net value added, instead of the usual gross output, proposes a solution to the "transformation problem" based on the value of net output evaluated in both labour values to that in terms of prices of production. The equilibrium prices (of production) may be attained through a sequence of steps in calendar time. However, the proponents of this approach, although they put forward a dynamic treatment of the so-called transformation problem, nevertheless leave out of their analysis the development of complex dynamics whereby profit rates differentials lead to

acceleration or deceleration of capital accumulation which, in turn, elicit changes in demand and supply giving rise to new profit rate differentials and so forth, in a never-ending orbit of actual prices around their centre of attraction, the prices of production.

In what follows, although we do not share the claims of the so-called “new solutionists” or the proponents of the TSSI alternative in the sense that neither the classical approach is static or dualistic, nor there is simultaneity in the solution of the so-called transformation problem, because one can introduce the (analytical) time dimension and derive the same results. In effect, the discussion of the transformation problem is originally cast in static terms and the issue at hand is the estimation of an equilibrium mark-up on cost of invested capital.

In our approach, we argue that the difference between the monetary expressions of labour values and prices of production are surprisingly very small. We say "surprisingly very small" because a lot of ink has been spilled over a problem of relatively small quantitative significance, as we already know from Ricardo's numerical examples and his famous 93 per cent labour theory of value. The same argument appears in Marx, of course with many qualifications. In particular, the source of profits, that is, what motivates production is the labour time employed in production and if we assume a price system in terms of labour values, then the surplus value is distributed across sectors in proportion to variable capital. However, in capitalism, with profits as the motive of production, it is understood that in order for capitalists to invest in fixed capital, they need to earn profits proportional to their invested capital. Thus, in assuming an equal profit rate across sectors, we in effect say that exchange takes place in terms of the prices of production, which entail a redistribution of the surplus value produced in the form of profits according to the capital intensity of each industry. The exchange in terms of the prices of production requires unequal rates of surplus value, in order for the industries to make an equal rate of profit. One wonders, how much difference in the prices of production from labour values does this redistribution of surplus value make? Ricardo's and Marx's answer was that the difference between these two sets of prices would be very small as they argued and also showed (or rather assumed) in their representative numerical examples.

This theoretical issue was subjected to empirical testing using data from a number of diverse economies and across time. The results have shown that the difference

regarding the two types of prices is, in fact, minimal and also many researchers found minimal differences of estimated prices from observed market prices. In the first empirical studies, the closeness of the three types of prices was tested using simple regressions and statistics of deviations, all of which were fraught with biases for their dependence on the adopted normalization condition and chosen numéraire (Shaikh 1984; Ochoa 1984). Later studies (Tsoulfidis and Maniatis 2002; Tsoulfidis and Rieu 2006; Tsoulfidis 2008) have shown that the normalization condition does not impact so much on the actual proximity of estimated prices against market prices. In fact, theoretically it has been shown (Mariolis and Tsoulfidis 2010, 2016) that if the relative rate of profit (i.e. the ratio of the economy-wide average rate of profit to the maximum rate of profit) is small, smaller than say fifty per cent, typically found in a number of empirical studies, all measures of deviation biased or not are bound to give quite similar results. In these empirical studies, the relative rate of profit is approximated by the ratio of net operating surplus to net value added.

There is another critique of traditional studies emanating from a strand of the classical theory known as the TSSI that claims an alternative way of estimating the closeness of labour values and prices of production. Freeman (1998) initially, and Kliman (2002, 2004, 2007) subsequently reported that high correlation coefficients between labour values and market prices should be attributed to the size of industries, and once we somehow eliminate the size-bias, the correlation coefficient becomes negligible and not statistically significant. This line of research continued in Diaz and Osuna (2005-6, 2007) who concluded that any efforts to eliminate the size-bias are doomed to fail for we do not have any way of knowing the physical units of measurement and thus the market prices.

In this article, we report our empirical results following the application of both estimating methods and using input-output data for the economies of China, Japan and South Korea. These three neighbouring economies at different levels of development share some similar features and of course are separated by many differences which are expected to be captured in our research. The selected year 2009, a year during the Great Recession that started in the last quarter of 2007 and continues as of the time of writing, may give clues to the severity of crisis in each country and the effectiveness of available economic policies. In addition, we find that the alleged bias in the measures of deviation is relatively small and, therefore, does not affect the results in any qualitatively different

way. The remainder of the article is structured as follows. Section Two briefly reviews the pertinent literature. Section Three discusses the estimation methods of labour values and the prices of production according to the two contending approaches. Section Four presents the results of the analysis and Section Five critically evaluates the two approaches. Finally, Section Six summarizes and concludes.

2. Literature review

The empirical research on the relation between the monetary expressions of labour values, prices of production and market prices using input-output data for many diverse economies or for the same economy over a number of years is extensive. The results, in most cases, have shown that the three types of prices are very close to each other. More specifically, Shaikh (2008, 2016) reports that the mean absolute deviations (MAD) of direct prices (i.e. prices proportional to labour values) or prices of production from market prices in the USA are in the order of 10 per cent. The research for the economies of the United Kingdom (UK) (Cockshott, *et al.* 1995, 1997, 2005) former Yugoslavia (Petrović 1987), Greece (Tsoulfidis and Maniatis 2002), Korea (Tsoulfidis and Rieu 2006), Japan (Tsoulfidis 2008) and China (Mariolis and Tsoulfidis 2009; Montibeler and Sánchez 2014) ascertained the closeness of these three type of prices.

The above analyses are based on detailed input-output data and the notion of vertical integration (Pasinetti 1977) which is central to the classical Marxian analyses. As a result of a critique of various aspects of the above analysis, a strand of Marxian economists cast doubt on these results in the sense that they are ridden with bias. These authors estimate the direct prices using national income accounts data. For example, Kliman (2002, 2004) in his study of the United States (US) economy derives estimates of labour values for each industry, which he then multiplied by the respective industry sales and subsequently he regressed the derived vectors of labour values, obtained for each year spanning the period 1977-1997, against the industry sales hypothesizing that the market prices are equal to one (million dollars). Not surprisingly, he finds high correlation coefficients, well above 95 per cent and certainly higher than those reported in similar studies based on input-output data (e.g. Ochoa 1984).

The presence of probable bias in the estimates of correlation coefficients was already known in the first studies (e.g. Ochoa 1984, p. 124). Shaikh (1998 p.233), in order to avoid the possibility of bias, abandoned the estimates based on correlations and opted for the measures of deviations, such as the MAD or the weighted by the gross output MAD (MAWD). Kliman (2002), on the other hand, bundled up in the old type of OLS regressions, tried to correct the alleged "size-induced bias" by scaling down, or in his words by "deflating" both variables (labour values times sales and total sales) by the total (labour and non-labour) cost of production.

This means, formally, by $\mathbf{x}$ we denote the column vector of gross output or total sales of each industry, which is equivalent to saying that, the market prices are equal to the row vector of ones, $\mathbf{e}$, (million dollars). Thus, we may write $\boldsymbol{\lambda}'.*\,\mathbf{x}$, where $\boldsymbol{\lambda}$ is the row vector of labour content (value) per unit of an industry's gross output (sales) such that each industry's $\boldsymbol{\lambda}$ is a figure, usually much smaller than one, multiplied element by element (.*) by the vector of gross output, $\mathbf{x}$, the latter may be thought as multiplied in similar fashion by the row vector of ones, $\mathbf{e}'.*\,\mathbf{x}$.[1] It follows therefore that the correlation coefficient in a regression performed in the above relation, that is, $\boldsymbol{\lambda}$ against the vector of ones, $\mathbf{e}'$, will give a correlation coefficient (nearly) equal to zero, whereas a regression of $\boldsymbol{\lambda}'.*\,\mathbf{x}$ against $\mathbf{e}'.*\,\mathbf{x}$ naturally will give an *R*-square in the range of 80 or 90 per cent, precisely because the *R*-square depends (at least to a great extent, if not exclusively) on the vector $\mathbf{x}$, which appears on both the regressor and the regressand.

If we disregard sales from the above equation, following Kliman's suggestion, and we deflate by the cost of production, that is the sum of constant, c, and variable capital, v. it follows that for each industry we get the term $1 + s(c + v)^{-1}$ regressed against the term $(c + v)^{-1}$, where s is the surplus value produced. Not surprisingly, the correlation coefficients of the two variables for all industries is somewhat improved, but it remains low because we essentially regress the mark-ups on cost $s(c + v)^{-1}$ of each industry against the reciprocal of unit cost $(c + v)^{-1}$.

This new bias in Kliman's deflation method was spotted by Diaz and Osuna (2005-2006, p. 356) who opted for an alternative method based on non-labour cost alone. By

[1] Vectors are indicated in boldface letters and a prime over these letters indicates their transpose. Matrices are indicated in capital and boldface letters.

using national income account data of the Spanish economy, spanning the period 1986-1994, they found a combination of relatively small price-value deviations and high correlations coefficients. Diaz and Osuna (2005-2006, 2007) subsequently performed their own deflation method by using variable capital as the divisor; in this case, we regress $\boldsymbol{\lambda}'./\mathbf{v}'$ against $\mathbf{e}'./\mathbf{v}'$. The R-square in these regressions was around 40 per cent, a result which is attributed to the significance of variable capital appearing on both sides of the above relation.

Diaz and Osuna (2005-6, 2007) proposed an alternative deflation through the cost of the capital stock. In this case, the dot division of vectors of labour values dot divided by the vector of capital stock, $\boldsymbol{\lambda}'./\mathbf{K}'$, is regressed against $\mathbf{e}'./\mathbf{K}'$. Naturally, the correlation coefficients increased, since the numerators are far smaller in comparison to the common denominators. The high correlations were restored to their super high range, that is, in the range of 90 per cent. From these findings, one would expect that Diaz and Osuna (2005-2006, 2007) would rather opt for the use of bias-free measures of deviation; they instead brought into the discussion another challenging issue associated with the physical units of measurement. They argued that since we have no way of knowing the exact physical units of measurement, therefore, we have no way of correctly estimating the labour values and prices of production to compare them between each other and also to market prices. As a consequence, Diaz and Osuna (2007) conclude that they cannot judge the closeness or association of various kinds of estimated prices (be it direct prices or prices of production) and "unknown" market prices.

The idea is that the estimated prices and their comparison with the market prices require the physical units of measurement of output produced. Because we have no way of knowing the exact units of measurement, the whole exercise according to Diaz and Osuna (2009) is deprived of any meaning. In input-output analysis, however, we need not know the exact physical units of measurement; we only need to assume that whatever they are, they do not change during the analysis. Once we stipulate such an assumption then the direct prices and the prices of production are derived as a proportion of market prices, whatever these might be. By way of an example, let us suppose that coffee is sold for five dollars a kilo; the evaluation of the product in dollars amounts to that of one-fifth of a kilo will be equal to one dollar. The physical unit of measurement of coffee becomes

one-fifth of a kilo. Consequently, in input-output analysis, market prices are set equal to one because it is not feasible to collect data on the physical output produced in the economy and for this reason, we simply stipulate the constancy of the physical units of measurement. Leontief (1966 p. 137) for example notes

> [a]ll figures in [an input-output table] can also be interpreted as representing physical quantities of the goods or services to which they refer. This only requires that the physical units in which one measures the entries in each row be redefined as being equal to the amount of output of the particular sector which can be purchased for $1 at prices which prevailed during the interval of time for which the table was constructed.[2]

Once we stipulate the assumption of given physical units of measurement such that market prices are equal to one, the direct prices and prices of production are derived as a proportion to market prices, whatever these might be.

In our view, the difficulties with the TSSI approach and the various associated normalizations (or deflation) methods, is that it treats the prices of production as if they were short-term prices and as such have no actual role to play in market processes. This is something explicitly recognized by Kliman (2004) who side-steps the estimation of the prices of production altogether on the grounds that such prices do not really exist. However, other researchers of the TSSI approach (Diaz and Osuna 2004, 2007) proceed with the estimation of production prices by assuming that they change in each production cycle in order to equalize interindustry profit rates. This, however, is not exactly right because prices of production according to the classical economists and Marx are determined in the long-run by given technology, along with the level of output and its allocation to industries as well as the rate of surplus value determined by the class struggle which is another way to say by the given real wage. Consequently, prices of production as the centres of gravity of market prices can only change if technology and the real wage change. This is so-as-to-speak the standard interpretation that theorizes production prices as a more concrete centre of the gravitation of market prices. Furthermore, prices of production are strictly connected to the monetary expression of labour values, that is, direct prices. As a result, Marx's (1982, ch. 9) famous two equality

[2] For a comprehensive discussion of the same issue and a relevant numerical example (Ochoa, 1984, pp. 58-70) and for a discussion within the context of Leontief's price model (Miller and Blair, 2009, ch. 2).

conditions (i.e. total values are equal to the total prices of production and total profits are equal to the total surplus value produced)—required for the logical consistency of the Marxian system of prices—hold.

It goes without saying these so-called "invariance conditions" do not hold if one accepts successive productive periods as the TSSI approach does. The establishment of prices of production reallocates the surplus value produced according to the capital intensity of each industry relative to the average. More specifically, we expect that industries, whose capital intensity is greater (lower) than the economy-wide average capital intensity, receive greater (lower) profits than the surplus value they produce. If this crucial consistency condition is violated then the theoretical status of production prices and their deviation from labour values is in serious trouble in both approaches.

Although theoretically the choice is already made in favour of the classical or standard model, nevertheless, we want to subject both competing approaches to, in our view, two crucial tests.[3] First, we want to assess the proximity of the two types of estimated prices with respect to market prices, and second, we want to test the consistency of the two estimating methods with respect to the allocation of surplus value to various sectors in proportion to the capital intensities of industries relative to the economy's (weighted) average. Our estimates for the economies of China, Japan and Korea, three major economies with high quality and available input-output data collected on the basis of common methodology, industry detail, year and currency (USD), form an ideal testing ground for the predictive content of the labour theory of value in its classical version and, at the same time, it will contrast these findings with those of the New Solution and its variant the TSSI approach. Furthermore, the use of data on capital stock will shed additional light on the issues involved.

3. Labour values and prices of production

The TSSI estimating method for labour values and production prices emphasizes the presence of both time and disequilibrium and by doing so insists on the dynamic nature of both. The two types of prices require different time dimensions according to this

[3] For a theoretical critique along the classical lines of both the new solution to the transformation problem and the TSSI see Petri (2015) and the literature cited there.

approach as has been argued by Kliman (2002), Mohun (2004) and Veneziani (2004). In order to carry out these estimations, we need data on the cost of intermediate inputs plus the constituent components of value added, that is, wages and gross profits. Furthermore, we need data on total employment, in terms of the number of employees or total working hours (see the Appendix for data set). In what follows, we estimate both labour values and production prices with the employment of capital stock following the two methods of estimation (the classical and the TSSI) and the results are compared in an effort to draw useful conclusions about the desirability of both estimation methods.

The crucial step in this enterprise is to translate the labour time magnitudes into direct prices through the device of the MELT. For the latter, following the procedure suggested by Diaz and Osuna (2005-2006), we divide the sum of the gross output of the total economy by the amount of labour time that has been employed. The difficulty lies in the conversion of the constant capital (intermediate inputs and depreciation) measured in dollars (monetary terms) to labour time employed. This reduction is carried out through the concept of dated quantities of labour time. More specifically, the constant capital of the current period is divided by the MELT of the previous period. Thus, we may write:

$$MELT_t = (c_t + v_t + s_t) / [(c_t/MELT_{t-1}) + h_t]$$

where h denotes the total hours employed in a year and t stands for years.

However, if the current $MELT_t$ depends on the $MELT_{t-1}$ of a year ago and that on the $MELT_{t-2}$ and so forth, the theoretical limit to this recursive process is the expression of all non-labour inputs to (current and past) labour time. In our effort to eliminate the possible biases in the estimation of the Chinese, Japanese and Korean $MELT$[4], we went back ten years, which should be adequate enough judging from the fact that Diaz and Osuna (2005-2006 and 2007) went back seven years. Crucial in these estimations is that in the start year the ratio of value added to currently employed labour time is used, a method inspired by the followers of the so-called "new solution" to the "transformation problem" (Foley 1982; Duménil 1983, *inter alia*). Subsequently, the so derived $MELT$ is

[4] In effect, in a thought experiment, we went back in time expressing all the material inputs of the previous stage of production plus labour time up until we ended up at the time period (sufficiently long), where everything may be expressed in terms of living labour time.

used to transform constant capital into labour values, which are augmented with living labour in order to estimate the labour value contained in gross output, which in the next round is used for the estimation of the $MELT$. Repeating the process, any possible deviations are minimized if not eliminated as long as new living labour is added to the product.

A comparison of the two estimating methods will reveal their advantages and disadvantages and so a choice between them could be made on the basis of theoretical consistency and predictive content. It goes without saying that we do not rule out a priori the possibility that the two approaches may give quite similar results. The decisive criterion for the evaluation of each method is the relative accuracy of the predictions of market prices in combination with their theoretical consistency. If both approaches predict equally well and are both theoretically consistent with their fundamental premises, then naturally both approaches can be used for the same purpose. However, if we have to choose between them, the more parsimonious is preferred to the more complex. Prices of production are estimated by bringing into the analysis the economy's uniform rate of profit which is estimated as shown in Table 1 below.

INSERT TABLE 1 HERE

Turning now to the classical and Marxian approach based on input-output data and estimating methods, we begin with the labour values, $\boldsymbol{\lambda}$, that is, the total (direct and indirect) labour requirements per unit of output produced. More specifically, the labour values are derived from the solution of the following system of equations in matrix form:

$$\boldsymbol{\lambda} = \mathbf{l}[\mathbf{I} - \mathbf{A} - \mathbf{D}]^{-1}$$

Where, $\boldsymbol{\lambda}$ is the row vector of labour values or vertically integrated labour input coefficients, $\mathbf{A}$ is the square matrix of input-output coefficients, $\mathbf{D}$ is the square matrix of depreciation coefficients, $\mathbf{l}$ is the row vector of adjusted for skills direct labour coefficients and $\mathbf{I}$ is the identity matrix. Furthermore, we scale the so-estimated labour values to prices proportional to values, that is, we equate the sum of labour values

expressed in money terms (direct prices) to the sum of market prices according to the usual condition of the transformation problem. That is, $\mathbf{v} = \boldsymbol{\lambda}(\mathbf{ex})/(\boldsymbol{\lambda}\mathbf{x})$ where $\mathbf{v}$ is the row vector of direct prices, $\mathbf{e}$ is the row vector of ones identified with the market prices and $\mathbf{x}$ is the column vector of gross output. With this normalization, the equality between the gross output evaluated in direct prices ($\mathbf{vx}$) to the gross output evaluated in market prices ($\mathbf{ex}$) will always hold true. In other words, the proposed normalization condition of prices maintains the value of money constant. In effect, the ratio $(\mathbf{ex})/(\boldsymbol{\lambda}\mathbf{x})$ represents the corresponding MELT with the difference that now it is estimated in terms of vertical integration analysis and the same time period.

The prices of production are estimated from the following equation:

$$\mathbf{P} = \mathbf{Pbl} + \mathbf{PA} + \mathbf{PD} + r\mathbf{PK}$$

where $\mathbf{P}$ is a row vector of relative prices of production, $\mathbf{b}$ is the column vector of the basket of goods that workers normally consume with their money wage, w=$\mathbf{Pb}$, and r is a scalar representing the economy's uniform rate of profit. Both prices of production (the left-hand side eigenvector) and the rate of profit (corresponding to the maximal eigenvalue) are estimated from the solution of the following eigenequation:

$$\mathbf{P}\mathrm{r}^{-1} = \mathbf{PK}[\mathbf{I} - \mathbf{A} - \mathbf{bl} - \mathbf{D}]^{-\mathbf{1}}$$

The resulting left hand side eigenvector is normalized such that $\mathbf{p} = \mathbf{P}(\mathbf{ex}/\mathbf{px})$.

In our analysis, we use input-output data for China, Japan and Korea for the year 2009. The source of our data is the World Input-Output Database which provides data to the detail of 34 industries cast in terms of current dollars.[5] In our estimation, besides the matrix of input-output coefficients, we use the vectors of employment and consumption of workers' coefficients. A novel feature of our investigation is the construction of matrices for depreciation and capital stock coefficients from the same source of available

[5] The data were accessed on March 15, 2016, and the link is http://www.wiod.org and the documentation is in Timmer, *et al.* (2015).

data. The detailed discussion of the construction of the matrices and vectors used in our analysis can be found in the Appendix.

4. Results and their evaluation

The vectors of labour values (or direct prices), $\mathbf{v}$, and prices of production, $\mathbf{p}$, according to the two estimating methods are displayed in Table 2 below. We have also estimated the TSSI direct prices and prices of production as presented in Table 1. The first two columns of Table 2 report the estimates of labour values and prices of production, for each of the three economies, according to the classical estimating method and the next two columns report the TSSI estimates of direct prices and prices of production for the same economies for the year 2009.

INSERT TABLE 2 HERE

Table 2. Estimates of the two competing approaches, China, Japan and Korea 2009[6]

The deviations of direct prices and prices of production are estimated through the $MAD = n^{-1}(\mathbf{v} - \mathbf{e})\mathbf{e}'$, that is, the average absolute deviations of n direct prices (or prices of production) from market prices and the $MAWD = (\mathbf{v} - \mathbf{e})\mathbf{x}(\mathbf{ex})^{-1}$, that is, the percentage absolute deviations of prices of production (or labour values) from market prices weighted by each sector's share of total output. These two are the most frequently used summary statistics of deviation; it has been argued by Steedman and Tomkins (1998) that both of these statistics along with a number of others suffer from a certain degree of bias stemming from the applied normalization condition. The size of the bias, theoretically speaking, might be serious. This is the reason that Steedman and Tomkins (1998) proposed a measure of deviation independent of the normalization condition, the d statistic defined as $d = [2(1 - \cos\theta)]^{1/2}$, where θ is the angle between the two vectors in comparison. Thus, it is interesting to compare the proximity of values and prices of

[6] Industry 19 in the case of China contains no data and with total output equal to zero. As a result, we disregarded this industry in the case of China. For the nomenclature of industries see Table A2 in the Appendix.

production with respect to market prices judging from data for real economies and, by doing so, obtain a more precise idea of the extent of the suspected bias. The results are displayed in Table 3 below.

INSERT TABLE 3 HERE

Clearly, the three measures of deviation convey approximately the same picture with respect to the degree of closeness of the estimated prices of the two competing approaches. Starting with the standard approach, we observe that the summary statistics of deviation for the Chinese, Japanese and Korean economies are in line with those estimated for a number of other countries (See Mariolis and Tsoulfidis 2016, ch.4). Turning now to the TSSI estimates, we observe that both production and direct prices are in effect closer to the unit or, what amounts to the same thing, market prices. Finally, from the data of Table 3, one cannot ignore the fact that the usual measures of deviation (MAD, $MAWD$), although they suffer from a certain (to our view very small) degree of bias, are nevertheless extremely close to the alternative and bias-free d −statistic. There are some other statistics of deviations which pretty much give the same answer with the above. They are bound to give the same answer because of the relative rate of profit, that is, the ratio of the average rate of profit over the maximal rate of profit in the three countries is small in the case of Japan and Korea are estimated (in parenthesis the average rate of profit) at 21.31 per cent (5.6 per cent) and 24.27 per cent (6.8 per cent), respectively, whereas China is 47.2 per cent (30.7 per cent). These relative rates of profit are considered low enough and under these circumstances it has been shown that the usual measures of deviations are bound to give pretty much the same answer (Mariolis and Tsoulfidis 2010, 2016, ch.4).

Diaz and Osuna (2007) argued that, even though one could get eliminate the bias imposed by the normalization condition using the d or other similar statistics, in their view, one should dispense with all the measures of deviation, simply because all of them depend on the choice of physical units of measurement, which whenever they change affect market prices. While we do not take issue with the mathematical logic of these two researchers, their conclusions are nevertheless derived simply because they violate the

fundamental assumption of input-output tables, that is, the physical units of measurement are fixed and so it is not permissible to experiment freely with different physical units of measurement.[7]

5. Evaluation of the two approaches

Since both approaches give quite comparable results in terms of their proximity to market prices, one wonders whether the new approach is preferred to the classical Marxian one. In our view, the defining test is to determine which of the two approaches is consistent with the basic requirements of the theory that prices of production will be higher (lower) than direct prices (i.e., the monetary expression of labour values) in the industries whose capital intensity is higher (lower) than the economy-wide average. Of course, we do not want to rule out the case of industries whose composition of capital might be nearly equal to the economy's average and the differences between prices of production from value might be minimal and in the limiting case zero.

Figure 1 displays the price of production–labour values deviations of both approaches as well as the deviations of each industry's composition of capital from the economy's average. More specifically, the notation is as follows: p-d denotes the deviations between prices of production and the monetary expression of labour values, that is direct prices according to the classical Marxian approach; VICC stands for the difference of vertically integrated composition of capital (evaluated again in terms of prices of production of the classical approach) from the average composition of capital (Pasinetti 1977). The estimations for the VICC for each industry were carried out as follows:

$$\mathbf{pK}[\mathbf{I}-\mathbf{A}-\mathbf{D}-\mathbf{bl}]^{-1}./\mathbf{pbl}[\mathbf{I}-\mathbf{A}-\mathbf{D}-\mathbf{bl}]^{-1}$$

where the symbol, ./, indicates element by element (or dot) division. The weighted by sales average vertically integrated capital-intensity was estimated by

[7] Frohlish (2011) argues that Diaz and Osuna (2007 and 2009) derive the alleged bias of the physical units of measurement by the inappropriate use of logarithms and their properties which are applicable to pure numbers.

$$(\mathbf{pK}[\mathbf{I}-\mathbf{A}-\mathbf{D}-\mathbf{bl}]^{-1}\mathbf{x})/(\mathbf{pbl}[\mathbf{I}-\mathbf{A}-\mathbf{D}-\mathbf{bl}]^{-1}\mathbf{x})$$

INSERT FIGURE 1 HERE

The upper panel of the graphs in Figure 1 refers to China and the middle panel to Japan whereas the bottom panel refers to the Korean economy. In each panel of graphs, the left-hand side displays the classical and Marxian estimating methods and the right-hand side is the TSSI estimating method. The difference between the prices of production and direct prices of each and every one of the 34 industries is shown on vertical axis for each of the six graphs; whereas the difference between the vertically integrated compositions of capital of each of the 34 industries from the economy-wide vertically integrated composition of capital is displayed on the horizontal axes of the graphs of Figure 1.

A visual inspection of the graphs suggests that they display quite a good fit, which appears to be consistent with the theoretical requirements according to which the price-value deviations are of the same direction and proportional in size to the deviation of capital intensities from the average capital intensity (horizontal axis). The goodness of the fit in the estimates of the two approaches can be judged by the pretty high coefficients of determination which ranges between 87 and 97 per cent. On further examination, however, we discover that the performance of the classical estimating method in the case of Japan (middle panel of graphs) can be improved, if we eliminate an obvious outlier which appears for the same industries in each and every one of our six graphs in Figure 1.

Thus, in the case of Japan, by eliminating the outlier of industry 29 (Real Estate Activities), the performance of the classical model improved appreciably as this can be judged by its R-square which increased to 95.7 per cent and superseded the performance of the TSSI; when the same industry's outlier was removed from the TSSI estimates, the R-square increased to only 91.5 per cent. In similar fashion, in the case of the Korean economy, the elimination of the obvious outlier gave an R-square 94.5 per cent for the classical model, whereas the performance of the TSSI model, this time, deteriorated as the R-square dropped to 64.2 per cent!

Turning now to the top pair of graphs and considering China, basically the same picture is evident; in particular, by removing the unquestionably problematic Real Estate

industry, we observe that the R-square of the classical model drops slightly from 95.5 per cent to 94 per cent, whereas the removal of this industry from the TSSI model reduces the R-square to 89 per cent. These results not only show the superior performance of the classical Marxian model but also cast doubt about the true performance of the TSSI model.[8]

In effect, the results displayed in Table 4 lend overwhelming support to the classical Marxian estimating method whereas the TSSI, despite the super high R-squares, failed the crucial test of consistency. The classical model not only gives extremely good approximations to market prices as this can be judged by the relatively high R-square in a cross-sectional analysis, but moreover, the sign of the differences between the prices of production and labour values (which show the degree of transfer of surplus value in the form of profit across industries) are fully consistent with the requirements of the classical theory. More specifically, we observe that in all of the 34 industries, the signs of transfers, positive or negative, are absolutely consistent and they are also proportional, as they ought to be, to the size differences in the capital intensities.

The results for the three economies in 2009 corroborate with absolute consistency the theoretical requirements of the classical model. The same is not true however for the TSSI approach. For example, in the Chinese economy nine industries (7 - 14 and 16) display signs opposite to those expected from the economic theory, whereas in the Japanese economy, we observe that in industries 3, 7, 10, 12 and 33 the price value differences are opposite of the theoretically expected sign. For example, a positive difference in the capital intensity of Industry 3 is translated into a negative difference between the price of production and direct price. This is equivalent to saying that for industries whose capital intensity is higher (lower) than the average (indicated in the last row of Table 4) they transfer surplus value in the form of profits to the industries with capital intensity lower (higher) than the economy's average. Such a result is contrary to the logic of capital and of course, cannot be reconciled with either Ricardo or Marx. The

[8] We also tried regressions with percentage changes in both price-value deviations and VICC and the results were 100% consistent with the classical model and the shortcomings of the TSSI model remained the same.

wrong signs appear also in the case of the Korean economy with 4 out of 34 industries the deviations being of the wrong sign (industries 1, 8, 9 and 12) as shown in Table 4.[9]

INSERT TABLE 4 HERE

Table 4. Price-value deviations and compositions of capital[10]

6. Conclusions

This article has investigated the question of the proximity of labour values and prices of production with market prices using data from the input-output tables for China, Japan and Korea, three countries with data readily available that make possible the estimations according to the classical and the TSSI approaches. The empirical analysis showed that both the classical and the TSSI approaches give quite good estimates of labour values and the prices of production as this can be judged by their proximity to market prices. The results are comparable to those derived for the Canadian economy in a similar exercise with the use of a circulating capital model (Tsoulfidis and Paitaridis 2009). A salient feature of the current study is the use of fixed capital stock for the three countries using a rather novel method through which we construct the matrix of capital stock and depreciation coefficients (see the Appendix). Thus, the more realistic description of the economy, with the inclusion of the matrices of depreciation and capital stock coefficients as well as the homogenization of the employment coefficients, yields results which at first sight are supportive of both the classical and the TSSI approaches. However, on closer examination we find that the visually better graphical performance of the TSSI did not pass the test of logical consistency for the direction and size of deviations, a decisive test that also failed in the case of the circulating capital model of Canada. By contrast, the performance of the classical approach was extremely good on all counts.

A salient feature of our research is the treatment of fixed capital stock along with depreciation that makes our estimates much more realistic. Furthermore, we purposefully

[9] The results with circulating capital were very similar and are available on request by the authors. In effect, most of the discussions in this literature take place in terms of circulating capital for reasons that have to do either with the lack of adequate data on the matrix of fixed capital stock and the many zero rows that appear in such a matrix that actually imposes its form on its vertical integrated expression that give rise to minimal subdominant eigenvalues (for details see Mariolis and Tsoulfidis 2016a and 2016b).

[10] For the nomenclature of industries see Table A2 in the Appendix.

selected the same year 2009, the same methods of computation and evaluation for the three economies; as a consequence, the derived results may give us clues as to the effectiveness of economic policies in the face of the ongoing global economic crisis of 2007. In particular, the by far (five times) higher rate of profit of the Chinese economy relative to the Japanese and Korean economies makes China more resilient to the dire consequences of the global crisis. Thus, in the case of China, the various policies of keeping the rate of interest low might be consistent with both extremely high growth rates and also with the development of various kinds of bubbles with which the economy may not be able to manage. By contrast, the Japanese and Korean economies because of their low (much lower than China's) average rate of profit, the effectiveness of the application of similar monetary policies is limited with respect to promoting economic growth (especially in the case of Japan) and the risk of developing bubbles is much higher in these two economies compared to China.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix 1: A note on the data

The input-output tables of the Chinese, Japanese and Korean economies are available from the World Input-Output Data the link is http://www.wiod.org and were accessed on March 15, 2016, the database is at the 34 sectors level of detail. The matrix of input-output coefficients, **A**, is obtained by dividing element-by-element the inputs of each industry by its gross output. The vector of direct labour coefficients, **l**, is estimated using the wage bill of each sector (the product of annual wage times the number of employees) the same data base is the provider of the industry wages. The problem with this estimation is that the self-employed population is not accounted for. For this purpose, we created an index of self-employment calculated by the ratio of the total hours worked by persons engaged (the number of employees plus the self-employed) to the total hours worked by employees. The information on hours of work (in millions) is available in the same database for Japan and Korea but not for China for which we have only data for persons engaged. We created the index of self-employment using data from the

International Labour Organization (ILO) http://laborsta.ilo.org for 14 sectors level of detail.

In order to account for the differences in skills across industries, we divided the annual wage of each industry by the economy's minimum wage, the so-derived ratio is in turn multiplied by the employment and so we derive the homogenized industry employment. This reduction, of course, is only meaningful when the relative wages express the differences in skills and intensity of labour, that is, employed in each sector of the economy, we do know that this may not be necessarily true as other factors such as unionization and gender may affect the market outcome. The ratio of the adjusted for skills total employment (employees plus self-employed) by the industry total output gives the vector of the homogenized employment coefficients, $\mathbf{l}$.

For the estimation of the real wage we assume that the minimum annual money wage is allocated over the basket of wage goods normally purchased by workers. Thus, we may write

$$\mathbf{b} = \left(\frac{PCE_j}{\sum PCE_j}\right) w_{min}$$

where $\mathbf{b}$ is the column vector of the basket of commodities (the real wage) normally purchased by workers with their minimum money wage, w_{min}, and PCE stands for personal consumption expenditures of workers on goods purchased from industry $j = 1, 2, \ldots, 34$. Hence, the term in the above parenthesis stands for the share of each good in the total workers consumption expenditures (Ochoa, 1989; Mariolis and Tsoulfidis, 2016).

The vector of capital stock for the 34 industries in constant 1995 prices for the period 1995-2011 is provided in the world input-output database http://www.wiod.org along with the necessary documentation for each country. The vector of capital stock of the year 2009 was dot divided by the respective investment deflator (1995) and the capital stock in current prices that we obtained was subsequently divided by the current output. The matrix of fixed capital stock coefficients was derived from the product of the column vector of investment shares of each industry times the row vector of capital stock per unit of output (see also Montibeler and Sánchez 2014). The resulting new matrix of

capital stock coefficients **K** possess the properties of the usual capital stock matrices derived and employed in the hitherto empirical studies (see Mariolis and Tsoulfidis 2016, and the literature cited there). The idea is that the investment matrices contain many rows with zero elements (consumer goods and service industries do not produce investment goods) and so the subdominant eigenvalues will be substantially lower (indistinguishable from zero) than the dominant which is another way to say that the equilibrium prices are determined almost exclusively by the dominant eigenvalue. The same is true with our case whose maximal eigenvalue will not be different from that we would obtain had we used a matrix of investment shares, while the difference between the dominant and the subdominant ones (which are nearly zero) is at maximum.

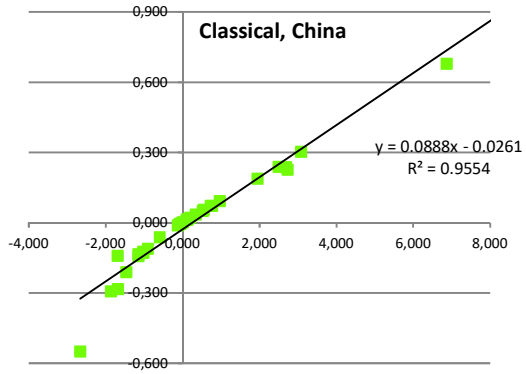
In similar fashion, the matrix of depreciation, **D**, was estimated as the product of the column vector of investment shares of each industry times the row vector of depreciation per unit of output. Data for depreciation by industry is not available in the world input-output database, so we used data from other sources, namely from the database of Structural Analysis of the OECD (STAN) https://stats.oecd.org/Index.aspx?DataSetCode=STAN08BIS for Korea and from the database of the Research Institute of Economy, Trade and Industry (RIETI) http://www.rieti.go.jp/en/ for China and Japan. In order to minimize the effects of any possible methodological differences between databases, we estimated the ratio of depreciation to gross value added by industry for each country from the OECD and RIETI data sets and then we multiplied it by the corresponding gross value added data that is available in the world input-output database.

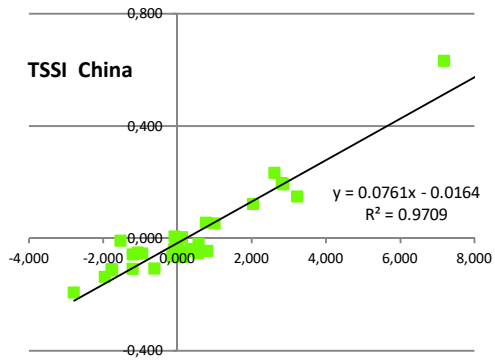
In Table A1 below we display the required data for the estimation of the MELT of the three economies.

INSERT TABLE A1 HERE

INSERT TABLE A2 HERE

Figure 1. Price-value deviations vs. capital intensity in China, Japan and Korea


Classical, China
y = 0.0888x - 0.0261
R² = 0.9554
0,900
0,600
0,300
0,000
-0,300
-0,600
-4,000
-2,000
0,000
2,000
4,000
6,000
8,000


TSSI China
y = 0.0761x - 0.0164
R² = 0.9709
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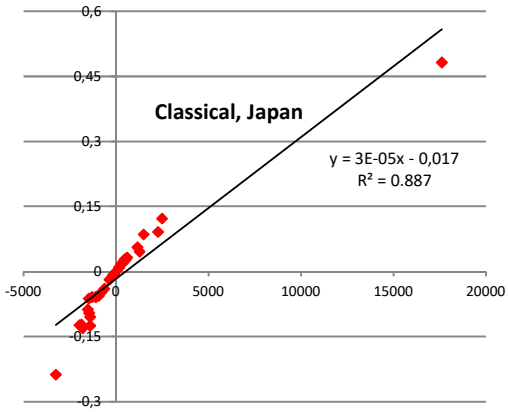
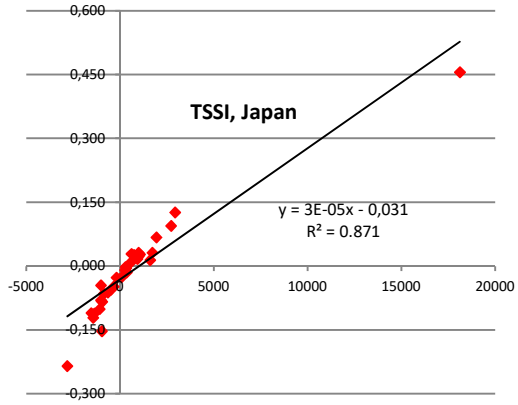
0,400
0,000
-0,400
-4,000
-2,000
0,000
2,000
4,000
6,000
8,000


Classical, Japan
y = 3E-05x - 0,017
R² = 0.887
0,6
0,45
0,3
0,15
0
-0,15
-0,3
-5000
0
5000
10000
15000
20000


TSSI, Japan
y = 3E-05x - 0,031
R² = 0.871
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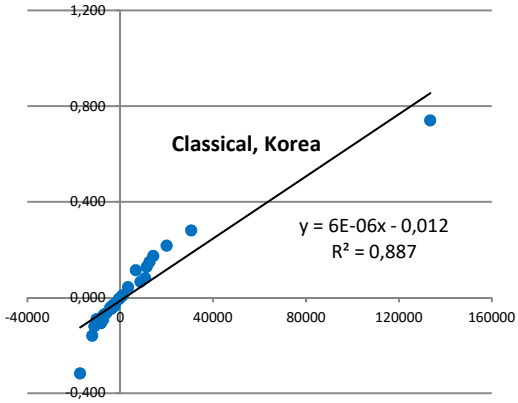
0,300
0,150
0,000
-0,150
-0,300
-5000
0
5000
10000
15000
20000


Classical, Korea
y = 6E-06x - 0,012
R² = 0,887
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0,800
0,400
0,000
-0,400
-40000
0
40000
80000
120000
160000

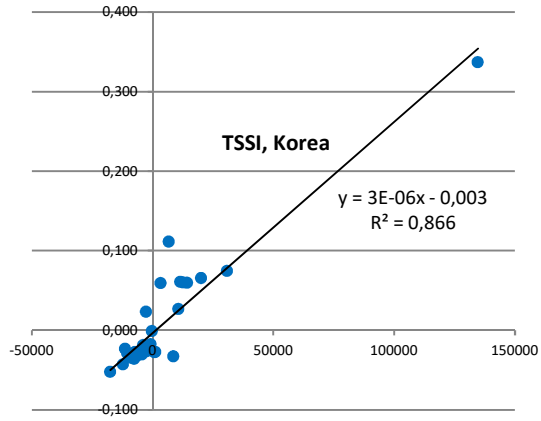
TSSI, Korea
y = 3E-06x - 0,003
R² = 0,866
0,400
0,300
0,200
0,100
0,000
-0,100
-50000
0
50000
100000
150000

Table 1. The TSSI estimation of labour values and prices of production

Variable Notation	**Variable Name**
1	Net Capital Stock
2	Consumption of fixed capital
3	Intermediate inputs
4=2+3	Non-labour costs
5	Labour costs
6=5+4	Total costs
7	Net Profit
8=2+7	Gross Profit
9=7+5	Net final income
10=8+5	Gross final income
11=10+3	Total production valued at market prices
11/6	Proxy to market price (cost deflated)
12=7/1	Rate of profit
13=Σ7/Σ1	Uniform rate of profit
14=6+13*1	Total production valued at production prices
14/6	Proxy to production price (cost deflated)
15=4/MELT(-)	Non-labour costs measured in work hours (millions)
16	Millions of labour hours (adjusted)
17=15+16	Labour value of the total production
18=Σ11/Σ17	MELT(+)

19=17*18	Total production valued at direct prices
19/6	Proxy to direct price (cost deflated)

Table 2. Estimates of the two competing approaches, China, Japan and Korea 2009[11]

	China				Japan				Korea			
	v	**p**	**TSSI v**	**TSSI p**	**v**	**p**	**TSSI v**	**TSSI p**	**v**	**p**	**TSSI v**	**TSSI p**
1	1.875	1.324	1.386	1.194	1.054	1.139	1.073	1.141	1.310	1.272	1.148	1.171
2	0.873	0.945	0.886	0.942	0.979	1.011	1.031	1.058	0.689	0.769	0.693	0.719
3	1.311	1.100	0.970	0.961	0.899	0.895	0.911	0.897	1.101	1.072	0.994	0.968
4	1.123	1.011	1.025	0.971	1.380	1.275	1.322	1.237	0.954	0.916	0.992	0.970
5	1.150	1.020	1.019	0.965	1.153	1.113	1.127	1.100	1.040	1.007	1.046	1.022
6	1.101	0.977	0.997	0.947	1.110	1.054	1.102	1.047	1.101	1.055	1.015	0.988
7	0.972	0.973	0.998	0.973	0.977	0.971	0.988	0.983	1.180	1.072	1.077	1.044
8	0.845	0.917	1.008	0.963	0.664	0.710	0.694	0.726	0.691	0.757	1.015	0.982
9	0.903	0.938	0.995	0.957	0.928	0.956	0.969	0.992	0.787	0.797	0.981	0.954
10	0.918	0.939	1.014	0.967	1.103	1.092	1.096	1.086	0.906	0.863	0.986	0.956
11	0.883	0.937	0.982	0.962	1.036	1.067	1.036	1.068	0.992	0.985	1.019	1.001
12	0.839	0.888	1.002	0.947	0.992	0.984	0.999	0.997	0.841	0.848	0.983	0.955
13	0.873	0.883	0.999	0.946	1.022	1.043	1.010	1.032	1.003	0.921	1.027	0.991
14	0.852	0.866	1.024	0.958	1.111	1.131	1.071	1.095	0.943	0.912	0.987	0.965
15	0.896	0.884	1.022	0.958	1.017	1.026	1.002	1.012	1.011	0.924	1.031	0.997
16	0.840	0.833	0.823	0.830	1.100	1.118	1.101	1.127	0.998	0.932	1.014	0.983
17	0.885	1.187	1.015	1.165	0.904	1.027	0.896	1.021	0.833	1.113	0.998	1.072
18	0.961	0.898	1.046	0.938	1.145	1.022	1.145	1.035	1.085	0.980	1.044	1.010
19	-	-	-	-	1.198	1.076	1.207	1.086	0.984	0.863	0.889	0.866
20	0.726	0.720	0.708	0.669	0.831	0.772	0.851	0.786	0.925	0.853	0.839	0.811
21	0.726	0.723	0.708	0.673	1.060	0.972	1.087	0.986	0.949	0.913	0.888	0.864
22	1.068	0.933	0.897	0.840	0.986	0.927	1.018	0.956	1.124	1.079	1.052	1.033
23	0.858	1.096	0.876	1.109	1.086	1.114	1.100	1.117	1.025	1.153	1.052	1.113
24	0.797	1.034	0.867	1.064	0.889	0.945	0.967	0.981	0.988	1.205	0.971	1.036
25	0.872	1.060	0.978	1.101	0.992	1.001	0.927	0.956	1.074	1.223	1.076	1.136
26	0.858	0.950	0.879	0.932	1.635	1.511	1.666	1.513	1.116	1.290	1.079	1.138
27	0.750	0.976	0.772	0.964	0.741	0.833	0.725	0.820	1.110	1.108	1.032	1.031
28	0.767	0.624	0.685	0.575	0.781	0.719	0.782	0.737	0.809	0.718	0.795	0.766
29	0.726	2.197	0.769	2.225	0.503	0.985	0.477	0.933	0.505	1.245	0.512	0.848
30	1.004	1.018	1.011	1.015	1.203	1.107	1.183	1.102	1.153	1.196	0.985	1.044
31	1.532	1.249	1.285	1.170	1.326	1.196	1.302	1.191	1.535	1.648	1.297	1.408
32	1.426	1.132	1.205	1.068	1.344	1.106	1.356	1.121	1.671	1.354	1.331	1.278
33	1.138	0.995	1.108	1.000	0.953	0.934	0.970	0.944	1.206	1.046	1.095	1.052
34	0.893	1.571	0.883	1.515	1.104	1.057	1.105	1.057	1.169	1.075	1.063	1.032

[11] Industry 19 in the case of China contains no data and with total output equal to zero. As a result, we disregarded this industry in the case of China. For the nomenclature of industries see Table A2 in the Appendix.

Table 3. Measures of % deviation

	Classical Estimation		TSSI Estimations	
China 2009				
Measures of Deviation	Direct Prices	Prices of Production	Direct Prices TSSI	Prices of Production, TSSI
MAD	18.8%	15.8%	10.6%	14.5%
MAWD	19.6%	15.4%	8.9%	12.1%
d	25.1%	26.1%	15.6%	26.1%
Japan 2009				
MAD	15.2%	10.8%	14.7%	10.4%
MAWD	16.7%	9.9%	16.0%	9.6%
d	20.1%	14.6%	19.8%	14.1%
Korea 2009				
MAD	15.4%	15.5%	8.9%	8.9%
MAWD	16.4%	15.5%	8.1%	7.8%
d	21.2%	18.8%	14.4%	13.1%

Table 4. Price-value deviations and compositions of capital

	China				Japan				Korea			
	p-v	**VICC POP**	**p-v TSSI**	**VICC TSSI**	**p-v**	**VICC POP**	**p-v TSSI**	**VICC TSSI**	**p-v**	**VICC POP**	**p-v TSSI**	**VICC TSSI**
1	-0.551	-2.661	-0.193	-2.784	0.085	1489	0.067	1935	-0.037	-2601	0.023	-2624
2	0.071	0.741	0.056	0.775	0.032	607	0.027	1050	0.081	10696	0.026	10793
3	-0.211	-1.459	-0.009	-1.526	-0.004	-80	-0.014	360	-0.029	-2383	-0.027	-2405
4	-0.112	-0.902	-0.054	-0.944	-0.105	-1397	-0.084	-961	-0.038	-3623	-0.023	-3656
5	-0.129	-1.019	-0.054	-1.066	-0.039	-624	-0.027	-186	-0.033	-2928	-0.023	-2955
6	-0.124	-1.018	-0.050	-1.065	-0.056	-929	-0.055	-492	-0.046	-3816	-0.027	-3851
7	0.001	0.008	-0.024	0.009	-0.006	-110	-0.005	330	-0.108	-8306	-0.033	-8381
8	0.072	0.770	-0.045	0.806	0.046	1275	0.032	1720	0.066	8677	-0.033	8756
9	0.034	0.345	-0.038	0.361	0.028	553	0.023	995	0.010	1152	-0.027	1162
10	0.021	0.203	-0.047	0.212	-0.011	-180	-0.010	259	-0.043	-4341	-0.031	-4380
11	0.054	0.553	-0.020	0.578	0.031	550	0.032	992	-0.007	-659	-0.018	-665
12	0.049	0.530	-0.054	0.555	-0.008	-155	-0.002	285	0.007	802	-0.028	810
13	0.010	0.107	-0.053	0.112	0.021	379	0.022	821	-0.082	-7468	-0.036	-7535
14	0.013	0.138	-0.067	0.145	0.020	322	0.024	764	-0.031	-3027	-0.023	-3054
15	-0.012	-0.123	-0.064	-0.128	0.009	157	0.010	598	-0.087	-7852	-0.034	-7923
16	-0.007	-0.072	0.006	-0.076	0.018	295	0.027	737	-0.066	-6012	-0.032	-6066
17	0.302	3.089	0.150	3.231	0.123	2486	0.126	2935	0.280	30589	0.074	30866
18	-0.063	-0.591	-0.108	-0.619	-0.123	-1977	-0.110	-1543	-0.105	-8798	-0.035	-8878
19	-	-	-	-	-0.122	-1868	-0.122	-1434	-0.121	-11192	-0.023	-11293
20	-0.006	-0.077	-0.039	-0.080	-0.059	-1303	-0.065	-867	-0.072	-7122	-0.027	-7187
21	-0.003	-0.033	-0.035	-0.035	-0.088	-1520	-0.101	-1085	-0.036	-3456	-0.024	-3487
22	-0.135	-1.143	-0.057	-1.195	-0.059	-1100	-0.062	-663	-0.046	-3725	-0.019	-3759
23	0.238	2.507	0.234	2.623	0.028	473	0.017	915	0.128	11387	0.060	11490
24	0.237	2.687	0.197	2.811	0.056	1164	0.014	1609	0.217	20012	0.065	20193
25	0.188	1.953	0.123	2.042	0.009	173	0.029	614	0.149	12636	0.060	12751
26	0.092	0.969	0.052	1.013	-0.125	-1401	-0.153	-965	0.174	14193	0.060	14322
27	0.226	2.733	0.192	2.859	0.092	2268	0.095	2716	-0.002	-186	-0.001	-188
28	-0.143	-1.685	-0.110	-1.763	-0.062	-1462	-0.045	-1026	-0.091	-10240	-0.029	-10332
29	1.471	18.337	1.456	19.18	0.482	17610	0.456	18113	0.740	133517	0.337	134724
30	0.014	0.122	0.004	0.127	-0.096	-1458	-0.081	-1022	0.043	3407	0.059	3437
31	-0.283	-1.673	-0.115	-1.750	-0.130	-1804	-0.111	-1370	0.113	6713	0.111	6774
32	-0.294	-1.866	-0.137	-1.952	-0.238	-3245	-0.235	-2816	-0.317	-17309	-0.053	-17465
33	-0.144	-1.141	-0.108	-1.194	-0.019	-361	-0.026	78	-0.160	-12077	-0.043	-12187
34	0.678	6.874	0.632	7.190	-0.047	-786	-0.048	-348	-0.094	-7335	-0.031	-7401
AVG		3.963		4.344		4918		4495		24976		25201

Table A1: Monetary measures and hours worked in millions

China									
Inds.	Intermediate Inputs	Depreciation	Value Added	Wages	Capital Stock	Employment millions of hours	Employees millions of hours	Ratio	Wages including S.E.
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8=6/7**	**9=4*8**
1	2492023	168220	3522600	3340990	2792800	469432	424504	1,11	3708499
2	1704951	155860	1478704	521106	2056459	26110	25564	1,02	531528
3	4027874	137873	1294099	392961	1844109	34415	33352	1,03	404750
4	3534388	96973	913261	381005	990665,2	50505	48945	1,03	392435
5	746093	10861	183622	77735	203980,9	14692	14239	1,03	80067
6	939862	26031	272030	98306	270649,7	18874	18291	1,03	101255
7	1225433	62891	390981	132084	503240,9	23505	22779	1,03	136047
8	1443416	44714	312609	91275	366642,3	2715	2631	1,03	94013
9	4370828	173826	1135471	327830	1310062	25367	24584	1,03	337665
10	1939374	61212	446075	149402	518798,5	24689	23927	1,03	153884
11	1993585	101886	753926	264231	932526,7	23859	23122	1,03	272158
12	7244539	309043	1777955	497728	1626227	28504	27623	1,03	512660
13	3575922	113201	1070671	394410	1008307	32175	31182	1,03	406242
14	8283255	217368	1594483	525941	1409506	48034	46550	1,03	541719
15	3096115	81797	748611	294712	687533,1	15841	15352	1,03	303553
16	360460	8010	217825	47548	210818,2	17949	17395	1,03	48974
17	2357887	366017	933672	237360	2942999	9949	9762	1,02	242107
18	7440057	122528	2239883	1142874	916427,8	131065	119939	1,09	1245733
19	-	-	-	-		-	-	-	-
20	1593474	159091	2401612	580381	1030003	31008	29137	1,06	615204
21	329651	32912	496835	120067	222924,7	83408	78374	1,06	127271
22	1182633	87115	711817	196649	378657,1	42973	40380	1,06	208448
23	887940	175834	955598	285695	2289417	46602	43640	1,07	305694
24	410539	61045	331761	80761	785881,6	5044	4724	1,07	86414
25	224405	13583	73819	19586	235294	2515	2355	1,07	20957
26	464818	54005	293501	62436	410040,9	4917	4605	1,07	66807
27	585504	156847	852409	188988	1497766	14482	13562	1,07	202217
28	798489	36237	1772758	460474	230225,8	9650	7704	1,25	575593
29	371813	923489	1865471	202710	11783741	3505	3477	1,01	204737
30	1836487	293149	1261704	538073	1599404	7709	7648	1,01	543454
31	1053715	159031	1283128	1112896	1292952	30518	29783	1,02	1135154
32	851281	108411	1081293	848230	795179,4	44446	43356	1,03	873677
33	1080538	54868	564593	378183	392617,6	14007	13457	1,04	393310
34	997347	82801	817909	270603	4692310	217283	206159	1,05	284133

The MELT for the year 2009 was estimated at 1.926yuan per labour hour.

Japan									
Inds.	Intermediate Inputs	Depreciation	Value Added	Wages	Capital Stock	Employment million of hours	Employees million of hours	Ratio	Wages including S.E.
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8=6/7**	**9=4*8**
1	6189286	1718550	6187374	593826	43685854	5048	757	6.67	3960820
2	2486482	213150	528524	296736	3562424	92	89	1.03	305638
3	22795591	1349845	13200218	6128192	33586120	2715	2598	1.04	6373320
4	2238831	176585	1326584	1278366	5973687	916	693	1.32	1687443
5	252995	7590	114958	76245	594057	64	43	1.49	113605
6	2561946	186451	1152860	850947	2848219	567	486	1.17	995608
7	6367491	810442	5114192	2861213	20079862	1557	1450	1.07	3061498
8	10565259	487843	5782751	244669	11083425	30	30	1.00	244669
9	18765116	2382263	7284176	3046734	31882166	688	685	1.00	3046734
10	9831305	860733	3140612	2440597	15310437	1066	996	1.07	2611439
11	4041365	575897	1908692	1065678	11477561	439	407	1.08	1150933
12	34964967	3578463	12840886	6331697	44095875	2750	2543	1.08	6838233
13	12666957	1655810	6876776	3868694	35755072	1490	1437	1.04	4023442

14	23103304	4418094	10644247	6207634	59266678	2408	2339	1.03	6393863
15	30254858	2493368	9452360	5171732	42263569	1939	1907	1.02	5275166
16	2542580	151966	676292	470016	5932167	356	266	1.34	629821
17	14040052	4845422	10542211	2342452	75308205	850	850	1.00	2342452
18	33087419	4826344	27879873	19015651	33559298	10357	8386	1.23	23389251
19	6085786	715071	4685871	3653125	6446355	779	624	1.25	4566407
20	16233116	3834560	35610199	16468735	58325086	5433	5063	1.07	17621546
21	8137697	1904177	20095258	11696269	51635142	8445	6520	1.30	15205149
22	14694711	2166162	13443808	6517548	26555024	7145	5362	1.33	8668338
23	7649702	2075935	12746669	8677857	72313311	5067	4709	1.08	9372086
24	4627525	489990	2378457	1215426	10274550	250	247	1.01	1227581
25	1889677	342971	1409942	610366	6025256	72	72	1.00	610366
26	2553309	621549	3561929	5061496	18075842	692	681	1.02	5162726
27	5634294	3244980	10251225	1942781	42534808	1124	1114	1.01	1962209
28	15464230	3706398	24140770	8398213	25630953	2552	2465	1.04	8734141
29	9239562	19668375	59818459	2582846	630505675	1808	1528	1.18	3047758
30	35846327	7582456	37298053	27195058	106879578	10416	8943	1.16	31546267
31	18314847	18575717	40921030	29576822	79477143	7973	7972	1.00	29576822
32	2781573	3659759	18608340	16498747	19239760	3648	3638	1.00	16498747
33	16385361	3442086	26040900	14643248	88095485	9454	8826	1.07	15668275
34	15731518	4117945	23683571	13605985	85024019	7667	5988	1.28	17415661

The MELT for the year 2009 was estimated at 1071 yen per labour hour.

Korea									
Inds.	Intermediate Inputs	Depreciation	Value Added	Wages	Capital Stock	Employment (million of hours)	Employees (million of hours)	Ratio	Wages including S.E.
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8=6/7**	**9=4*8**
1	27137129	2470221	26614994	2849651	145933926	3730	367	10.15	28923956
2	1629084	270201	2220545	584008	7234507	43	38	1.12	654088,8
3	68945063	1986170	13070073	6210223	31749267	602	500	1.20	7452268
4	31941070	1326153	11610452	6767861	26909120	766	636	1.20	8121433
5	3742704	98309	899996	676455	3003670	75	62	1.20	811746,5
6	4779405	172656	1374321	861577	2978661	89	74	1.20	1033892
7	24448311	1433337	10551212	8432024	17423066	501	416	1.20	10118429
8	103717068	1497422	5538814	1416810	13581974	123	102	1.20	1700173
9	109764143	4859307	23519662	9257683	44866478	448	373	1.20	11109220
10	33425925	2068511	12002816	6203612	14842039	724	601	1.20	7444334
11	21735702	2049971	10168002	6089540	27673999	323	269	1.20	7307447
12	214797706	9214361	42201294	15789326	79231000	1371	1139	1.20	18947191
13	74296791	3341748	23665826	15616362	21712112	1131	940	1.20	18739635
14	197603444	12663726	62444499	30056204	146823822	2074	1723	1.20	36067445
15	167021425	7436181	45036514	29338608	57005412	1439	1195	1.20	35206329
16	13481611	551298	4494719	2858608	6410464	278	231	1.20	3430330
17	46282996	9660120	18380485	4293134	242398947	216	152	1.42	6096251
18	115848679	4733398	66576643	43020949	82617720	4100	2887	1.42	61089748
19	3444243	509329	5305526	2417512	6179459	554	390	1.42	3432866
20	21860840	1447024	33674523	14733785	27578339	3114	2193	1.42	20921974
21	34817491	3262535	44784818	20525241	52682995	4550	3204	1.42	29145842
22	46156187	1343759	23237775	15623271	67204508	5195	3659	1.42	22185044
23	27425632	3382743	18296398	10625963	165036225	1322	931	1.42	15088867
24	15694133	1423302	10469990	5032580	94440867	746	525	1.42	7146263
25	7072875	1201389	4718511	2699790	42561667	276	194	1.42	3833701
26	10009481	1685025	6677602	3862921	60232960	460	324	1.42	5485348
27	28239690	7276997	19152463	7942348	68215846	582	410	1.42	11278134
28	53293329	3862804	65035458	22842672	33104212	1609	1133	1.42	32436594
29	25533554	13589561	73427904	6616243	1174396057	1390	979	1.42	9395066
30	42668367	4359371	67574272	39314133	406119950	3984	2806	1.42	55826069
31	30790897	19735927	63706558	46089727	565604901	1818	1280	1.42	65447412
32	16418860	5097750	63448698	55200219	72536740	3448	2428	1.42	78384310

33	34915440	4281351	43092090	29422874	35500697	1699	1197	1.42	41780480
34	32746137	4120037	35862563	22813297	50855804	4838	3407	1.42	32394881

The MELT for the year 2009 was estimated at 4576 won per labour hour.