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TRANSLATION OF WAGES AND THE EXCHANGE RATE – A PRAGMATIC STUDY

Summary: As recent studies show the direct implication of the exchange rate to conversion of goods' prices, assets, GNP, GNP per capita or wages is inappropriate. The paper presents two different studies in case of Poland and the US and between Poland and the UK. The first study compares salaries of scientists in Polish and American universities, the second wages of doctors in different stages of education in Poland and the UK. This has been compared to average prices of chosen goods' basket to study purchasing power of remuneration in healthcare sector in Poland and the UK. The aim of the study is to show that direct implementation of the exchange rate category in translation process is in most cases inappropriate. Instead exchange rate multiplied by the relation between GNP per employee expressed in US dollars can be used.

Key words: exchange rate, translation, conversion, international comparisons.

1. Introduction

The role of exchange rate in the translation of economic values has not been finally explained. That is why many scientists try to solve this difficult theoretical problem. The nature of exchange rate comes from the relation between two different currencies. For instance one can go to the exchange and buy one pound for 5 Polish zlotys. In practice economists started to use this category to translate and compare different economic values, such as assets' prices, GNP or wages. This simplification leads to many problems, especially speaking about fair economic values in the international sense [Jędrzejczyk 2008]. Many workers compare underlie their payments demand on wages of their counterparts in different countries multiplied directly by the exchange rate. Currently in the period of world economic and social globalization these wrong assumptions and methodologies are even less trustworthy. Nevertheless some of Polish emigrants intuitively feel the difference in economic development between Poland and the UK in the meaning of relation between salaries and cost of

living, which is few times greater in the UK than in Poland. Unfortunately scientists do not take into regard this simple and logical motion and still prefer to use exchange rate directly to convert goods' prices wages and assets, which is directly reflected in contemporary accounting standards: International Financial Reporting Standards and US GAAP. This paper arouse for explaining the exchange rate theory based on recent papers of M. Dobija and M. Jędrzejczyk. The negative study, showing the conversion process between wages in education and healthcare sector in Poland, the UK and the USA, reveals theoretical inconsistencies in contemporary understanding of the exchange rate. This constitutes a starting point for the positive analysis of exchange rate theory based on wage productivity, which will not only explain the nature of the exchange rate but will also allow to use modified exchange rate in consolidation process. Scientific method has been based on Popper understanding of knowledge. Finding one counterexample can refute former theory, but it also creates the need of new and better ideas, which in case of the paper is exchange rate modified by the relation between GNP per one employee expressed in US dollars.

2. Wage productivity as a determinant of money value

Exchange rate behaviour can be explained using several theories, such as: law of one price, Purchasing Power Parity (PPP) and International Fisher Effects (IFE). None of them, however, has been universally accepted [Dobija 2003]. It is certain, though, that the law of one price, which constitutes one of the fundamental principles of the PPP theory, lies behind the accounting standards. Once again we may quote the authors who discuss the law of one price and Purchasing Power Parity: "Abstracting from complicating costs, taxes, and tariffs, the law of one price states that the price of any particular good that is traded on world markets will be the same price in every country engaged in trade" [Pakko, Pollard 1996].

According to their research concerning two identical goods we can use the following formula to translate their values. Let us assume that we consider two goods: Polish and American. To translate the value of the Polish good into the American one, we ought to use the algorithm (1):

$$Q_P = e \times Q_A \tag{1}$$

where: Q_P – value of the Polish good,
e – exchange rate,
Q_A – value of the American good.

The proper understanding of the money unit's nature can provide a basis for formulating the exchange rate theory. According to the work of M. Dobija, money should be perceived as a wage receivable and the money unit as a labour unit [Dobija et al. 2005]. Money arises as the result of human work and its productivity decides about the internal and external power of money. Changes in value of internal power of money can be measured by the inflation index and by the exchange rate. As it has

been discussed by many authors and particularly by M. Dobija, we may state that it is the wage productivity that determines the exchange rate between the two countries [Dobija 2004].

The logic underlying of the basic issues fundamental for the theory is as follows. It is the work costs parity and effects parity that impact the value formation of the exchange rate. In a hypothetical case, in which we conduct a comparative analysis between economies with a similar wage productivity, this would mean in practice a similar GNP creation by the currency costs of work in both countries. So as a result we could say that the law of one price is acceptable in this example. If we focus on two engines manufactured in Germany and the USA we will find out that the exchange rate computes their value correctly.

But in the case of systems with a different wage productivity, it is not as obvious. Let us consider the economies of Poland and the USA. Assuming the equivalence of both economies, the value of the Product Q manufactured by Polish and American workers in the same time would be equal to (2):

$$\frac{Q_A}{Q_P} = \frac{(Q \times N)_A}{(Q \times N)_P} \Rightarrow \frac{AP_A}{AP_P} = ER\left(\frac{\$}{\text{zł}}\right) \tag{2}$$

where: A – American,
P – Polish,
N – average quantity of money units paid for the working time unit,
AP – average pay,
ER – exchange rate.

In practice, however, this kind of situation happens very rarely, that is why the above shown formula must be corrected with the equating parameter U [Jędrzejczyk 2003] (3):

$$\frac{Q_A}{Q_P} = \frac{1}{U} \Rightarrow \frac{(Q \times N)_A}{(Q \times N)_P} = \frac{AP_A}{AP_P} = ER\left(\frac{\$}{\text{zł}}\right)\frac{1}{U} \tag{3}$$

where U is treated as a relation between Polish and American real *GNP* expressed in dollars per one employee (*GNPRE*). The implementation of the *GNP* per employee (*GNPRE*) allows the comparison of working costs according to the formula (4):

$$\frac{AP_A}{AP_P} = ER\left(\frac{\$}{\text{zł}}\right) \times \frac{GNPRE_A\,[\$]}{GNPRE_P\,[\$]} \tag{4}$$

so:

$$AP_P = AP_A \times ER\left(\frac{\$}{\text{zł}}\right) \times \frac{GNPRE_A\,[\$]}{GNPRE_P\,[\$]} \tag{5}$$

The consequences of the above shown formula from the point of view of the exchange rate theory are significant. First of all it is apparent that the comparative

analysis of wages without applying the *U* coefficient is incorrect. This simple type of equation can be used only in the case of countries with a very similar wage productivity and main macroeconomic ratios. What is more important, it is the relation between inflation and wage productivity that determines the price of one currency with regard to another. Thus (6):

$$ER\left(\frac{\text{zł}}{\$}\right) = \frac{PDP_{P/A}}{WPP_{P/A} \times ER_0[\$ / \text{zł}]} \tag{6}$$

where: $PDP_{D/A}$ – inflation parity measured through the *GNP* deflator,
$WPP_{D/A}$ – wage productivity parity,
P – Poland,
A – USA.

From this equation, we can formulate a conclusion that the right form of Purchasing Power Parity is expressed by the formula (7):

$$ER_n = ER_{n-1} \times \frac{RWP_n^*}{RWP_n} \tag{7}$$

where: RWP_n^* – real wage productivity abroad in period *n*,
RWP_n – domestic real wage productivity in period *n*,
ER_{n-1} – previously recorded exchange rate.

Thus it is not the relation between the work costs, but the relation between wage productivity that decides about the exchange rate level (external power of money). However, for the purposes of the paper the last formula is crucial. This means that wages cannot be translated or compared with the direct use of the exchange rate in case of countries with different wage productivity. Only wage productivity parity close to one can guarantee appropriate direct use of the exchange rate to translate value in different currencies. This parity is far from one according to case of Poland in comparison to the USA and the United Kingdom, which from the start suggest the outcome of forthcoming case studies. The results has been shown in two separate studies.

3. Former study – wages comparison on the basis of human capital model

This recent study shows the possible way of comparing wages between two countries. In Poland employees very often convert the remunerations in the same sectors using exchange rate directly and treat the figure acquired in this way to set their pay demands [Jędrzejczyk 2009]. However, this way of thinking as mentioned above in inappropriate. Human capital theory should be used to the right comparison of the pays. Using the basic capital theory the expected remuneration of the professors'

assistant with the 3 year experience has been computed. The data in Table 1 contains Polish and American employee pay.

The ninth row of Table 1 presents the value of cost of labour per one month in Poland and in the US computed with the human capital model. The values considering four person family are very similar. To estimate the net pay in Poland 40% of taxes have been subtracted. The results of the comparison are shown in the last row of Table 3. The lower range of Polish pay accounts for 1815 PLN, the upper 2185 PLN. As for the US the estimated pay accounts for 1692 USD. Exchange rate if used to the calculation of Polish pay would bring wrong and misleading value, which would be 5080 PLN. It is worth stressing that this number is completely wrong and cannot be accepted.

Table 1. Average pay estimation of the Professors' Assistant with 3 year experience in Poland and the USA

Values	Poland (in PLN)		USA (in USD)
	From	To	From 350 to 450
Living costs	500	600	400
Education costs	300	400	800
Experience factor	15%		15%
Experience (years)	3		3
Human Capital (H)	453.772	546.330	423.141
Yearly cost of labour (H*8%)	36.301	43.706	33.851
Monthly cost of labour	3.025	3.642	2.821
Net pay	1.815	2.185	1.692

Source: own estimation and computations.

This situation is caused by the wage productivity difference between Poland and the USA. The relation of hourly or monthly pays would be the good estimation of the exchange rate only in a situation when the wage productivity difference between two countries is minimal or none. We can include the difference in wage productivity using the relation of real GDP per one employee in US dollars. Then for the right estimation of the average exchange rate for the given period the relation of hourly pays can be used (v) (8):

$$\overline{ER}\left[\frac{\text{zł}}{\$}\right] \approx \frac{v_P[\text{zł}]}{v_A[\$]} \times \frac{GDPRE_A\,[\$]}{GDPRE_P\,[\$]} \tag{8}$$

where: $\overline{ER}$ (PLN/USD) – average exchange rate for the given period.

Therefore it is possible to calculate real Polish *GDP* per employed person in *US* dollars (9):

$$GDPRE_P[\$] = \frac{GDPRE_A[\$]}{ER\left[\frac{\text{zł}}{\$}\right] \times \frac{v_A[\$]}{v_P[\text{zł}]}} \tag{9}$$

In Table 2 the results of computations are shown. The numbers are grouped by the wage productivity. In the first 2 columns there are countries with similar wage productivity. In the last three the countries with much lower wage productivity.

Table 2. Exchange rate estimation including wage productivity differences. Data from the year 2005 (useful data is available after certain period of time)

		Wage productivity parity		Lack of wage productivity parity		
		USA	UK	Czech	Hungary	Poland
		(USD)	(GBP)	(CZK)	(HUF)	(PLN)
1	Average hourly pay	16.5	9.51	136.76	1199.5	19.5
2	Relation of average hourly wages	1	0.5764	8.2885	72.697	1.1818
3	Average exchange rate observed	1	0.582	23.96	199.6	3.236
4	The difference between observed exchange rate (3), and the hourly wages relation (2) (in %)	–	0.96%	65.4%	63.6%	63.5%
5	GDP per one employee in PPP ($)	63942		23339	23689	23565
6	GDP relation per one employee (U)	1		2.7397	2.6992	2.7134
7	Exchange rate calculated with the use of pay relation and GDP relation (2)*(6)	–		22.708	196.22	3.2067
8	The difference between observed exchange rate, and wages relation with real GDP per one employee included (in %)	–	**0.96%**	**5.23%**	**1.69%**	**0.90%**

Source: own estimation and computations.

Exchange rate calculated on the basis of the average hourly pays is acceptable in case of countries with similar wage productivity (the USA and the UK). But in case of other countries (Poland, the Czech Republic and Hungary) the difference is remarkable and accounts approximately for 65%. After implementing the relation of real GDP per one employee the differences between estimated and real exchange rate is acceptably low (0.9 to 5.3%).

On the basis of Table 2 the calculation of average exchange rate for the year 2005 has been made. The result shows that the average exchange rate should account for 3 zł 21 gr per one US dollar. From the Polish National Bank Archives we know that average exchange rate in the year 2005 fluctuated at about 3 zł 20 gr. The research shows that average pay relation including real GDP per one employee in US dollars can be the good estimator of the exchange rate value. It confirms the general motion

of the paper that the exchange rate behaviour can be explained by the wage productivity differences.

However, in fact there is no need of using wage productivity theory and sophisticated models to prove that direct use of the exchange rate in case of wages in different countries is inappropriate both in economic and finance theory and everyday practice.

4. The relation between wages and costs of living – the healthcare case

The first step of the pragmatic study, which includes purchasing power of remunerations starts with the estimated wages of doctors in Poland and in the UK. Doctors' wages has been divided into several separate groups. The first group contain wages of young doctors just after studies. Three next rows of Table 3 present wages during doctors' training. The last group contains specialists just after degree exam. It is clearly visible that average salaries of doctors are quite similar. Of course depending on the professional profile wages can vary from 3500 to 8800 PLN. In the UK average monthly pay after degree exam is equal to 7000 GBP.

Table 3. Monthly wages estimation of doctors. Data from the year 2010

Jobs	Poland (in PLN)		United Kingdom (in GBP)	
Young doctor just after studies	2000	3200	2000	2400
Doctor 2 years after studies	2440	4500	2200	2500
Doctor 4 years after studies	2920	5000	3500	4000
Doctor 6 years after studies	3000	5800	5500	6000
Specialists	3500	8800	7 000	

Source: Polish data come from http://gazetapraca.pl and has been confirmed by Cracow doctors. UK data have been acquired by Anna Jędrzejczyk M.D.

It is clearly visible that the direct application of the exchange rate to convert value of English doctor will not estimate monthly wage of Polish doctor. From this point of view exchange rate is not applicable to convert wages between Poland and the UK. But this motion is commonly known in healthcare sector, where UK remunerations multiplied by the current exchange rate constitutes pay demands of Polish specialists.

Therefore the second step of planned survey is necessary. In Table 4 different prices of products in Poland and the UK are gathered. Prices of identical or very similar goods have been used to estimate the exchange rate on the line-by-line basis. The results are presented in the last column. The aim of the study is to compare

Table 4. Exchange rate estimation between Poland and the UK with basic consumer products

Item	Polish price	UK price	Estimated exchange rate
Dove soap 100g.	2.99 PLN	0.54 GBP	5.54
Heinz ketchup 570g.	5.19 PLN	1.47 GBP	3.53
Lettuce	2.99 PLN	1.00 GBP	2.99
Tomatoes 1kg	3.99 PLN	1.58 GBP	2.53
Nescafe Gold 200g.	26.99 PLN	5.89 GBP	4.58
Rice 1kg	4.49 PLN	1.20 GBP	3.74
White bread 800g.	4.99 PLN	1.00 GBP	4.99
Butter 250 g.	2.85 PLN	0.58 GBP	4.91
Head & Shoulders 500ml	16.99 PLN	3.00 GBP	5.66
Aquafresh Mint 100ml	7.99 PLN	2.00 GBP	4.00
Pepsi 2l.	4.89 PLN	1.36 GBP	3.60
Mineral water 6x1.5l.	10.14 PLN	3.00 GBP	3.38
Carlsberg 1l.	6.50 PLN	3.04 GBP	2.14
Tesco orange juice1l.	2.59 PLN	0.90 GBP	2.88
Total	**103.58 PLN**	**26.56 GBP**	**3.90**

Source: own estimation. London prices from 30.03.2011, Tesco. Cracow prices: Tesco from 30.03.2011.

Polish and English purchasing power of one currency unit, which can be a measure of real wage adequacy.

The last row of the table reveals, that exchange rate estimated on the basis of randomly chosen basket of goods is equal to 3.90 PLN/GBP. The average exchange rate at that day on the monetary market was 4.5471 PLN/GDP. It is worth stressing that in case of Poland and the United Kingdom exchange rate cannot be used directly to convert prices and wages, what is the general motion from Table 3 and 4. It confirms the thesis that in case of countries with different wage productivity exchange rate cannot be used directly to convert prices of goods, assets, GNP or wages.

The relation between wages in the above study is close to 1 PLN/GBP whereas the average relation between products' prices is 3.90 PLN/GBP. Unfortunately the relation between prices of goods is also distorted by the speculative pricing, in which manufacturers calculate the price on the different markets using exchange rate, which is obviously wrong. The study published in 2009 basing on the data from 2007 revealed the same relation equal to 3,35 PLN/GBP. After 4 years it is noticeable that average price level in Poland has raised especially due to the rising transport costs.

The study, however, shows that generally doctors in Poland earn less than their UK counterparts, but the difference is not that radical as pay demands based on direct exchange rate application to remunerations of English doctors. Apart from that it is worth mentioning that not every source of income of Polish doctors is formally

revealed. The data in the study show wages of Polish doctors including their night work, but do not show the wages of English doctors. What is more doctors in Poland can work in couple of hospitals or consulting rooms (especially after degree exam), whereas in the UK it is not so common. These circumstances of course should not be taken into account in case of wages comparisons especially in case of purchasing power of earned money by a particular employee. Considering the specificity of Polish healthcare the general conclusion can be formulated that Polish doctors' purchasing power of monthly income is much worse in comparison to doctors in the UK.

5. Conclusion

Converting the value of goods' prices, wages and GNP is still unclear in economic practice. As proposed in the paper, the direct use of exchange rate to international comparisons is only possible and reasonable in case of countries with identical or similar wage productivity. There is no doubt that this wage productivity parity does not exist between Poland and the UK. The healthcare case, in spite of many underlying systemic differences also confirms the general thesis. Translation of wages especially in the context of pay demands on the Polish healthcare work market is highly inappropriate. This is also visible in comparison to exchange rate estimation between zloty and pound based on the basket of randomly chosen goods on the Polish and English markets.

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TRANSLACJA WYNAGRODZEŃ A KURS WALUTOWY – STUDIUM PRZYPADKU

Streszczenie: Artykuł prezentuje konsekwencje luki w teorii kursu walutowego używanego między innymi do konwersji szeroko rozumianych kosztów wynagrodzeń. Rozważania poparto stosownymi obliczeniami i kontrprzykładem dowodzącym tezy, że bezpośrednie zastosowanie kursu walutowego do przeliczania wynagrodzeń w przypadku krajów o zróżnicowanej produktywności pracy nie znajduje zastosowania. Jako metodę wzorcową zastosowano oszacowanie płacy na podstawie modelu kapitału ludzkiego w Polsce i w Stanach Zjednoczonych w odniesieniu do pracownika naukowego oraz w Polsce i w Wielkiej Brytanii w odniesieniu do lekarza. Z przeprowadzonego eksperymentu wynika, że bezpośrednie zastosowanie kursu walutowego do konwersji wynagrodzeń w dwóch krajach o różnych walutach nie prowadzi do dobrego przybliżenia wartości płac. Skorygowanie kursu walutowego o wskaźnik niemianowany, będący relacją realnego PKB na jednego zatrudnionego w dolarach amerykańskich w badanych krajach, pozwala jednak na dobre przybliżenie wartości kosztów wynagrodzeń za granicą. Tezę potwierdzono również porównaniem relacji wynagrodzeń do możliwości nabywczych poszczególnych pracowników w badanych krajach.