Is the Phillips Curve of Germany Spurious?

Quaas, Georg and Klein, Mathias

Universität Leipzig

10 November 2010

Is the Phillips Curve of Germany Spurious?

Georg Quaas / Mathias Klein

It might well be that the German Phillips Curve (Figure 1) and the corresponding regressions (Table 1) are spurious. With “spurious” we mean a correlation, a partial correlation or a regression equation between two variables A and B, for instance between the change of the wage rate (A) und the unemployment rate (B), that does not indicate a causal relationship between A (the effect) and B (the cause) but is produced by another variable (i.e., by an underlying common cause (C), for instance by a country’s real economic activity). This scepticism about the causal essence of correlations and regressions can be extended to almost all important economic relationships, which are formulated by a stochastic equation and estimated by econometric methods, such as the well-known consumption function. The standard interpretation of this equation is that a one-unit change of disposable income causes a change of the amount of consumption equal to the parameter value of the marginal propensity to consume. This cannot only be regarded with sceptical distance, but is theoretically inverted by the Marxian interpretation that labour power’s consumption cost causes the amount of disposable income to be an indicator of its value on the labour market. Of course, the whole relation is controlled by a country’s economic activity – probably a common cause, not of the consumption function only, but also of the production function and of almost all other important econometric equations. Nevertheless, this scepticism has had almost no effect on the development of economic theory, like most of the critiques in the last fifty years testify (Dobusch, Kapeller 2009).

This overall scepticism can be very productive when serving as a driving force in the search for a common cause of a special relationship. But as long as nothing has been found that serves as a reason for classifying a correlation as spurious, the hypothesis that the correlation or regression is indicating a causal relationship can be egitimized by the widely-shared Critical Rationalism as well as other schools of the philosophy of science (Outhwaite 1987).

The German Phillips Curve

Quaas and Klein (2010) estimated in retro-respect several regressions that have been of historical importance as far as they influenced the development and consequently the shape of the modern macroeconomic theory on the price- and wage-setting process. They used data of the German economy from 1950 to 2004 (old system of national accounts), and from 1970 to 2009 (new system of national accounts). The common feature of all tested regressions was a very stable relationship between the wage rate changes on the one hand and the unemployment rate on the other, which was the original finding of Phillips (1958).

Phillips' and especially Lipsey's (1960) core theory that unemployment causes the wage rate to change cannot be refuted by the application of the argument that a nominal variable is not able to influence a real one (Phelps 1967), because the assertion here is that a real variable influences a nominal one. Moreover, Phillips' core assertion is part of the modern theory on wage setting as far as unemployment still plays a crucial role in the wage-setting process.

Nevertheless, very few people are adherents to old Phillips' finding. Theoretical development has gone different ways, generalizing the experiences of stagflation and hyperinflation in certain periods of time and in certain countries. Meanwhile, a broader record of data is available, and those experiences might appear as statistical outliers. In some aspects, "the intellectual framework for analysing the inflationary process […] has come full circle and the Phillips curve is once again central in this framework" (Gruen, Pagan, Thompson 1999, 253), at least for some of us. Accepting that there is no trade-off between inflation and unemployment in the long run does not affect Phillips' original findings. In addition, it is a matter of fact that the data of the German economy can be displayed in a way that is very similar to the statistical relationship discovered by Phillips.

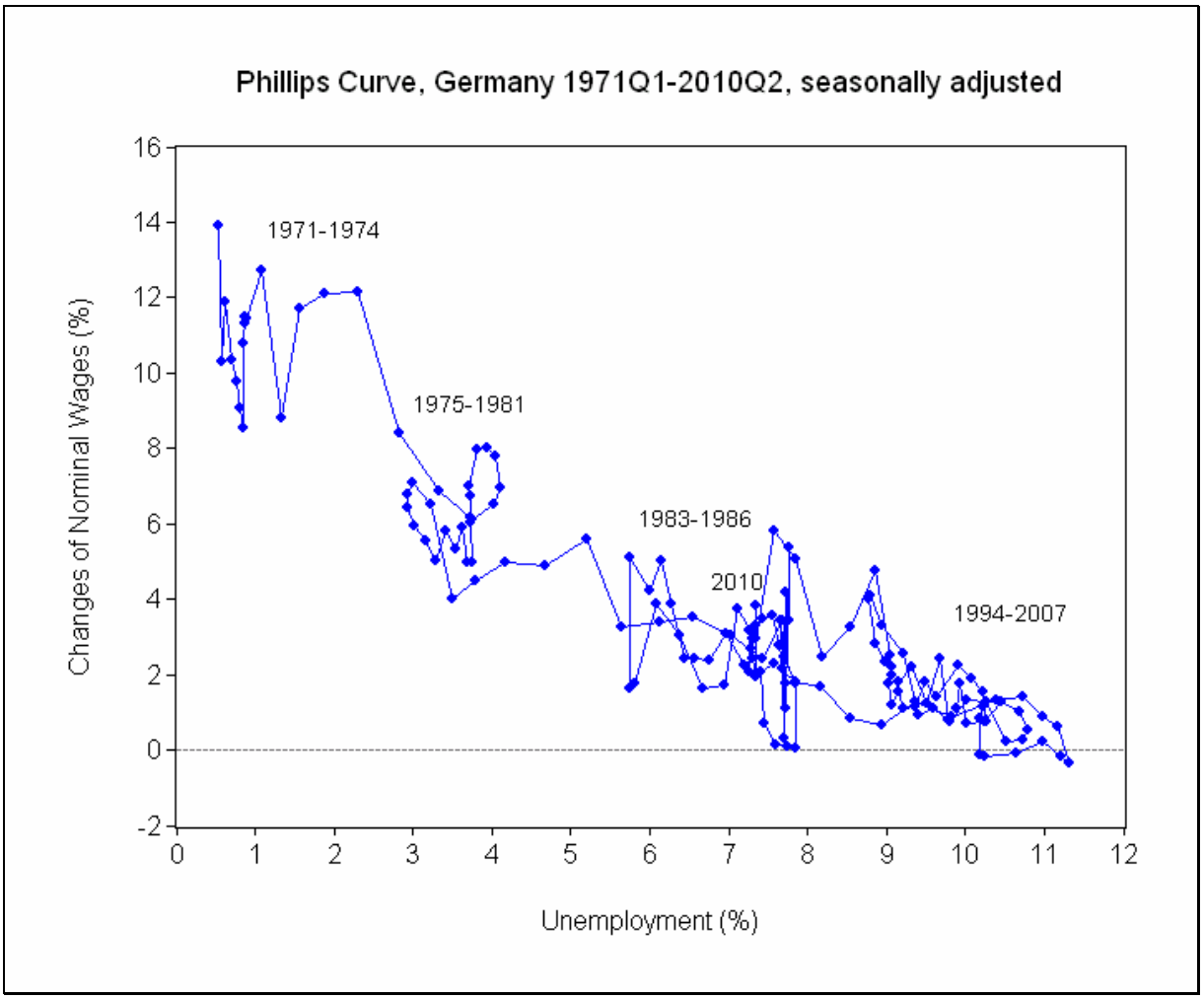

Figure 1: Germany's Phillips Curve, Unification data smoothed.

Statistical evidence is one thing, the theoretical interpretation another. We do not intend to present a new theory to explain the relationship between wage rate changes and unemployment. There are many approaches and explanations that can be found in the theoretical debate about the determinants of wages and prices (Eckstein, Wilson 1962; Kuh 1967; Streit 1972; Galí 2010). At the moment, we are concerned with two reproaches to our study (Quaas, Klein 2010) presented at the 12th INFER Annual Conference 2010, which took place on 3-5 September at the University of Muenster (Westphalia, Germany).

(i) It is likely that there is a high degree of multicollinearity among the explaining variables, in addition to the reported high degree of autocorrelation in the error term. Both render the estimated t-values as too high, and with them the significance of the

parameter estimations as too optimistic. As a consequence, the results should not be theoretically interpreted.
(ii) The wage rate changes are likely of another type of time series compared to the unemployment rate with respect to stationarity. Therefore, the regression by which Quaas and Klein have explained clusters and loops of the German Phillips Curve was probably spurious, simply because the equation might be not consistent (Granger 1981).

Are wage rate changes and unemployment rates co-integrated?

If wage rate changes and the unemployment rate are not co-integrated, serious doubts can be cast on the causal interpretation of the Phillips Curve, especially on the regression explaining wage rate changes by the help of the unemployment rate (among other factors). As a matter of fact, the Augmented Dickey Fuller-test indicates stationarity for the wage rate changes and non-stationarity for the unemployment rate (Table 1). This fact and the high rate of autocorrelation and multicollinearity seem to be very good reasons to doubt the results reported by Quaas and Klein (2010). This is a scepticism that could also be directed against many regression equations that are applied in many forecasting models of a country's economy. Nevertheless, the argument should be taken seriously.

In our view, the main point of the Phillips Curve is the hypothesis that there is a linear or curve linear inverse relationship between the changes of the wage rate and the unemployment rate – in the long run. If this is the case, both variables are necessarily different in nature with respect to stationarity. When unemployment rates are rising, the changes of the wage rate become smaller. By and large, this was the case in Germany until recently, but the picture of data points makes a judgement difficult (Figure 1).

The following steps are undertaken to create a much clearer picture of the German Phillips Curve.

(i) We eliminated the effects of the German unification from the data by replacing the wage rate changes of 1990 by a moving average between 1989 (the old, smaller Germany) and 1991 (the united Germany).

(ii) We separated the long-term tendency from the cyclical component of the relevant time series by the help of the HP-filter.

(iii) We regressed the long-term tendency separately from the cyclical component to see the different paths by which unemployment (UE) influences the change of the wage rate (WR_CH).

The different curves are presented in Figure 2 and the results are reported in Table 1.

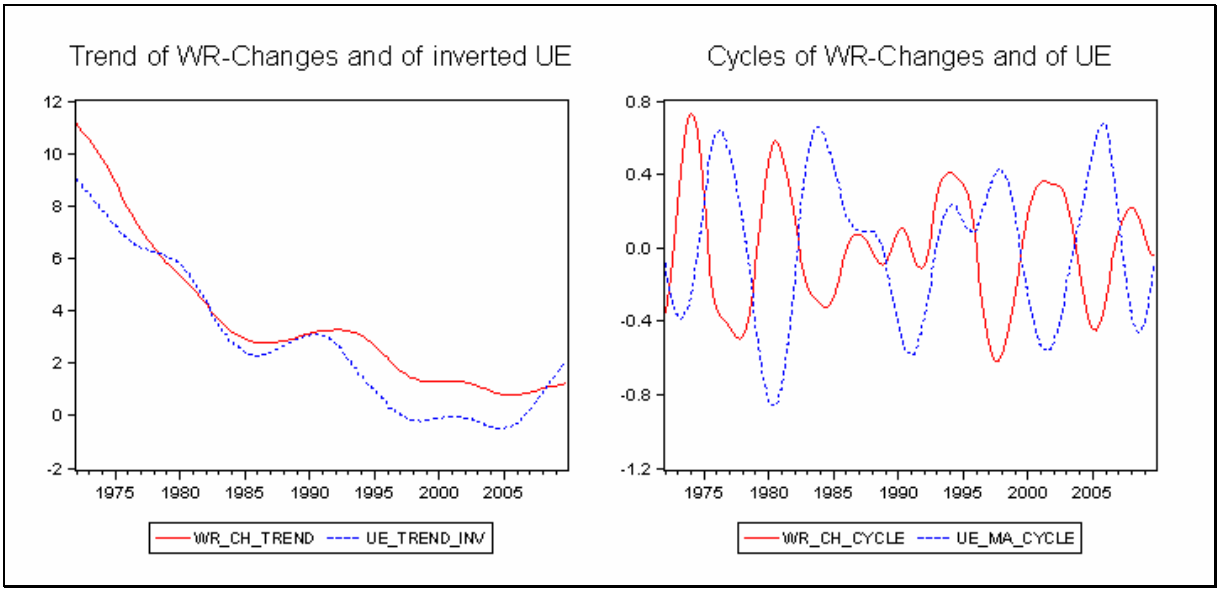

Figure 2: Trend and Cycles of Wage Rate Changes (WR_CH) and of Unemployment Rate (UE).

It turns out that the wage rate changes, and the inverse of the unemployment rate (taken in a simplified linear version) are both stationary and therefore co-integrated. In the long run, the lowering of wage-rate enhancements (changes) can be statistically explained by the rising unemployment rate.

		Change of Wage Rates							
		1 Total				2 Trend		3 Cycle	
	ADF Stats	-2,46 (-1,94)				-3,35 (-1,94)		-6,16 (-1,94)	
	- -	Simple		Best-Fit		Simple	Best-Fit	Simple	Best-Fit
Variable \ Method		OLS	ML	OLS	ML	OLS	OLS	OLS	OLS
Unemployment Rate	0,10 (-1,94)	-0,92*** (-24,11)	-0,89 (-24,11)	-0,60*** (-11,67)	-0,58 (-11,67)	- -	- -	- -	- -
Trend of Unemployment Rate	0,85 (-1,94)					- -	- -	- -	- -
A Constant minus Trend of Unemployment Rate, lagged	-3,45 (-1,94)					0,91*** (47,43)	0,88*** (44,84)		- -
Cyclical Component of Unemployment Rate	-2,73 (-1,94)					- -		-0,52*** (-10,89)	-0,46*** (-9,86)
Inflation, lagged	-2,02 (-1,94)			0,30*** (3,75)	0,22 (3.75)				
Change of Import Prices, lagged	-3,22 (-1,94)			-0,07** (-2,79)	-0.13 (-2.79)				
Change of Export Prices	-1,85 (-1,94)			0,17*** (4,35)	0.18 (4,35)	- -	- -	- -	0,03*** (5,19)
Change of Productivity	-2,51 (-1,94)			0.31*** (5,04)	0,20 (5,04)	- -	0,12*** (3,84)		-0,02* (-2,30)
Change of Profits	-4,41 (-1,94)			-0.04*** (-3,33)	-0,13 (-3,33)				
Adjusted R^2	- -	0,79	0,79	0,86	0,87	0,94	0,94	0,44	0,52
Durbin-Watson Stats	- -	0,74	--	0,87	--	0,01	0,07	0,07	0,11

Table 1: Estimation results for Wage Rate Changes, Trend and Cycles of Wage Rate Changes, Maximum-Likelihood estimates are standardized.

It could be argued that any falling (or rising) time series should also be capable of explaining the falling series of wage rate changes. Therefore, we put all theoretically relevant candidates of time series with a similar trend in the regression. It turned out that only the long-run tendency of the inflation rate is capable of replacing the unemployment rate as an explanation of wage rate changes. But this is no surprise,

because inflation has been considered a proxy of wage rate changes long before, namely since Samuelson and Solow (1960).

Relevant determinants of wage rate changes

A second result consists in another stable inverse (asymmetric) relationship between wage rate changes and the unemployment rate on the level of cyclical components of both time series. There is an exception of some years around the German unification, which does not fit into this scheme. Whereas in the regression of the long-term tendency, time lags can be introduced that correspond to the hypothesised causal order; time lags play almost no role in the explanation of the cyclical component.

Quaas and Klein (2010) reported a best-fit regression that was capable of explaining clusters and loops of the German Phillips Curve. In Table 1 is reported which of the explaining variables plays a significant role on the level of the long-term tendency and on the level of the cyclical component. There is a short-term residuum (after subtracting the long-term tendency and the cyclical component) that cannot be explained by any of those variables. Interestingly, exactly this is the domain – the short run – where others hypothesise a relationship of the kind Phillips has proposed.

In the best-fit regression, the single variable with the most (negative) influence is the unemployment rate. Although we include five other variables, the unemployment rate has kept its significant influence. This result could be an indication for a stable long-run relationship between the unemployment rate and the changes of the nominal wages. The estimation results of the trend and the cyclical component confirm this observation, even though the cyclical component is not as well explained as the trend component. But this is in line with Phillips' discovery of a long-term relationship.

Besides the unemployment rate, the rate of change of labour productivity seems to be a further important variable for the wage-setting process. This variable keeps its significance in the equation of the cyclical and the trend component, while others lose their relevance (for example the inflation rate).

In economic literature, there is a broad consensus that money wages are affected by prices reflecting living cost. On average, a change in consumer prices of one unit

causes an increase of wages of about 0.30 about one year later. But inflation does not play a role in the determination of the trend or the cyclical component of the rate of change of wage rates.

A variable that is important not only for wage changes in total but also for its cyclical component is the change of export prices. It reflects the special conditions of an open economy like the German one. The positive sign sounds plausible with the following background: A short-term change in export prices does not reduce immediately the quantity of exports, but enhances the revenue. This also seems to be profitable for employees.

We also tested the influence of import prices, or more precisely, a one year lag of it. Because import prices have an influence on living cost, this information is already included in the inflation index, the interpretation of this channel is as follows: Higher import prices mean higher production costs for firms, and this reduces the leverage for higher wages. But the import prices have no significant influence on the trend or cyclical regression equations.

The same is true for the influence of profit changes on wages. Profits have a significant negative influence on wage changes in total, but this does not hold for the trend or the cyclical component.

In summary, the two variables that are significant in the explanation of the trend component of the wage changes are the (inverse of the) unemployment rate and the rate of change of productivity. For the cyclical component, it is the unemployment rate, the change of productivity and the rate of change of the export prices that are statistically significant.

In Table 2, we put the variables in an order according to the standardized parameter values they received in the estimation of the best-fit equation. For instance, the single variable with the highest influence after unemployment was productivity.

As can be seen in Table 2, there are only minor changes of the estimates based on standardised variables, and consequently only minor changes on the rank order of the variables compared to Quaas and Klein (2010).

Rank order	Quaas / Klein 2010 study	Present study
1	Unemployment	Unemployment
2	Productivity	Inflation
3	Inflation	Productivity
4	changes of export prices	changes of export prices
5	changes of import prices	changes of import prices
6	changes of profit	changes of profit

Table 2: Corrected ranking of the variables according to their influence.

Conclusion

The problem of multicollinearity is reduced (Intriligator 1978, 267-268) when fewer variables are used in a regression. This reduction is necessary when trend and cyclical component of the Phillips Curve are explained separately. It turns out that this does not affect the decisive role the unemployment rate plays in the explanation of wage rate changes. Admittedly, autocorrelation is very high in the regressions on the level of the trend and of the cyclical component. Therefore, t-statistics may be misleading. As we said in the introduction, we cannot exclude that the reported best fit regression is spurious, but the allegedly missing co-integration of wage rate changes and unemployment rate is not a valid argument to sustain this scepticism.

References

Dobusch, L. / Kapeller, J. (2009), Why is Economics not an Evolutionary Science? New Answers to Veblen's Old Question, *Journal of Economic Issues* 43, 867-898.

Eckstein, O. / Wilson, T. A. (1962), The Determination of Money Wages in American Industry, *Quarterly Journal of Economics* 76, 379-414.

Galí, J. (2010), *The Return of the Wage Phillips Curve*.

Granger, C. W. J. (1981), Some Properties of Time Series Data and their USE in Econometric Model Specification, *Journal of Econometrics* 16, 121-130.

Gruen, D. / Pagan, A. / Thompson, C. (1999), The Phillips curve in Australia, *Journal of Monetary Economics* 44, 223-258.

Intriligator, M., *Econometric Models, Techniques and Applications*. Amsterdam 1978.

Kuh, E. (1967), A Productivity Theory of Wage Levels – An Alternative to the Phillips Curve, *Review of Economic Studies* 34, 333-360.

Lipsey , R. G. (1960), The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1862-1957: A Further Analysis, *Economica* 27, 1-31.

Outhwaite, W., *New Philosophies of Social Science*. London 1987.

Phelps, E. S. (1967), Expectations of Inflation and Optimal Unemployment over Time, *Economica* 34, 254-281.

Phillips, A. W. (1958), The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957, *Economica* 25, 283-299.

Quaas, G. / Klein, M. (2010), Clusters and Loops of the German Phillips Curve. *MPRA-Paper* #23094, published at 06-06-2010, http://mpra.ub.uni-muenchen.de/23094/

Samuelson, P. A. / Solow, R. M. (1960), Analytical Aspects of Anti-Inflation Policy, *American Economic Review* 50, 177-194.

Streit, M. E. (1972), The Phillips curve: Fact or fancy? — The example of West Germany, *Review of World Economics* 108, 607-633.

Data Sources

StBA, Volkswirtschaftliche Gesamtrechnung, Fachserie 18, Reihe S.21, Revidierte Ergebnisse 1970-2004, March 2005.

StBA, Volkswirtschaftliche Gesamtrechnungen, Fachserie 18, Reihe 1.5, Inlandsproduktsberechnung, Lange Reihen ab 1970, Februar 2010.

StBA, Volkswirtschaftliche Gesamtrechnungen, Fachserie 18, Reihe 1.2, Inlandsproduktsberechnung, Vierteljahresergebnisse, Zusatztabellen, Tabelle Unverketteten Volumenangaben, Mai 2010.

Agentur für Arbeit, Aktuelle Daten - Arbeitslose nach Rechtskreisen. http://www.pub.arbeitsamt.de/hst/services/statistik/detail/a.html

Agentur für Arbeit, Zeitreihen – Arbeitslosigkeit in Deutschland seit 1950. http://www.pub.arbeitsamt.de/hst/services/statistik/detail/z.html

Definitions, Indicators, and Data

www.forschungsseminar.de/phillips.htm