

Experimental Evidence on the Benefits of Eliminating Exchange Rate Uncertainties and Why Expected Utility Theory causes Economists to Miss Them

Robin Pope,* Reinhard Selten,** Sebastian Kube*** and Jürgen von Hagen****†

* Center for European Integration Studies (ZEIb),
Bonn University, Walter Flex Str 3, D-53113 Bonn, Germany,
Tels +49-228-731887, 4462880; Faxes +49-228-731809, 4462881
<http://webserver.econ1.uni-bonn.de/>, <http://www.zei.de/> Robin.Pope@uni-bonn.de

** Experimental Economics laboratory, Bonn University

*** University of Karlsruhe

**** Center for European Integration Studies, Bonn University

Abstract

Conclusions drawn about exchange rate management typically follow expected utility theory and ignore the costs that uncertainty generates for governments, central banks, firms and unions in: (i) discovering available acts, (ii) choosing among them; and (iii) existing until learning the outcome of the chosen risky/ uncertainty act. Allowing for these costs involves the stages of knowledge ahead framework, Pope (1983, 1995, 2005). A laboratory experiment suggests that (i), (ii) and (iii) together outweigh the advantages of having a flexible exchange rate as an instrument for managing a country's employment, interest rate, price level and international competitiveness goals.

Overview

Flexible exchange rates afford the official sector an additional macroeconomic instrument for dealing with shocks introduced by demand and supply factors and unreasonable unions, but at the cost of introducing exchange rate uncertainty. Empirically estimating whether the extra instrument is worth its cost is hampered by many recognized factors. It is also hampered by a little recognized factor, use of expected utility theory. Under this theory (or any of its standard rank dependent generalizations), the future: 1, begins with a decision over a given choice set; and 2 is as if decisionmakers parachute from making a risky choice into certainty. This abstraction excludes most exchange rate uncertainty effects since it excludes (i) Simonian uncertainty in discovering which acts are available to us, (ii) Manne-Janis uncertainty in making a good choice out of our available acts; and (iii) Keynesian uncertainty which is experienced during the interim

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between making a decision under risk/ uncertainty and learning its outcome. The stages of knowledge ahead framework of Pope (1983, 1995, 2005) allows more reasonable decision procedures that take into account the benefits and costs of uncertainties experienced in prior to learning the outcome of risk taking, in stages (i), (ii) and (iii).

Our laboratory experiment is designed to obtain insights on the effects of eliminating exchange rate uncertainties without needing to exclude effects (i), (ii) and (iii). It also designed to free us from some of the data limitations that econometric estimates of exchange rate uncertainty face even when not even implicitly using an expected utility approach. Players had roles as central bankers, governments, employer and union representatives who bargain over wages, and firms who trade in goods and assets. Our findings suggest that eliminating exchange rate uncertainty improves the performance of the government and the central bank in achieving their objectives for employment, the interest rate, the price level and international competitiveness. These results contrast with widespread concerns that introducing the EURO would loosen union discipline, increasing nominal wages and worsening employment and inflation. Rather they suggest that (i), (ii) and (iii) – uncertainties in finding acts (strategies), choosing amongst them, and having an interim between action and learning the outcome – are a set of costs that together outweigh gains from the official sector having an extra macroeconomic instrument.

Part 1 gives a brief summary of the evolution of theorising and empirical findings on exchange rate management. Part 2 describes our experimental set-up. Part 3 presents our results.

1 Exchange Rate Management

Some economists see find exchange rate variations as too wild at present, to be curbed, eg with better international financial architecture, eg Kenen (2001), or to be generally deterred a Tobin tax, or partially eliminated by joining the currency of one's major trading partner, eg Courchene (199a, 199b, 1999c), or even entirely eliminated by a single world money in order to save on transactions costs, eg Mundell (1961, 2003). Others find those who find variable exchange rates desirable. In the Bretton Woods era, amongst those who saw variable, preferably "clean" or "freely" floating exchange rates as desirable, a prime argument was that this would be "equilibrating". A "clean" or "freely" floating exchange rate is defined as one in which the country's central bank gears its monetary management exclusively to domestic goals (typically an inflation goal), and completely ignores any potential impact its monetary policy might have on the exchange rate, eg Carew (1985). While such a definition is widespread, it is internally inconsistent: any domestic goal, inflation or employment or ...) will be indirectly affected by the exchange rate via export and import effects impinging on domestic prices and employment. The

notion of a “free” float in short stems from closed economy modeling imperfectly translated over into an open economy setting.

Since the demise of Bretton Woods, progressively fewer have found the arguments of “freely” floating exchange rate changes being equilibrating so persuasive. This has not been primarily, through a recognition of the mix-up of open and closed economy thinking, but from a growing appreciation of five other considerations. First, the equilibrating arguments stemmed from theorizing lacking a stock demand for currencies, and more people have come to view this as flawed, that demand for currencies also has a major asset –stock– dimension. Second, what constituted the equilibrium to be achieved by exchange rate variation was rather routinely defined as a zero current account balance, and this too progressively more have come to view as flawed: for decades some countries continue with a negative current account balance, either because so attractive to foreign investors (eg Australia), or because a reserve currency and making greater earnings on their foreign investments than do foreigners investing with them (eg the US). Third exchange rates have changed far more frequently in the last 35 years than was imagined by those advocating an end to Bretton Woods, and in ways hard on common sense grounds to describe as equilibrating anything. Fourth, theoretical models of exchange rate variations as equilibrating have not performed out of sample better than a random walk when the observation units are less than two year averages, Pagan. Each new exchange rate crisis generates a new generation of theorizing on equilibrating “fundamentals”, that explain ex post, but get replaced with another generation when the next crisis appears. Fifth, from the empirical evidence, it is hard to establish that countries attempting “free” floats have fared better, been closer to an equilibrium path, than those pursuing very “dirty” floats, even pegging their exchange rates, von Hagen and Zjiou (2005), and even case studies evidence of “dirty” floaters and peggers faring better in global or regional disequilibrium downturns.

But while advocacy of flexible exchange rates as equilibrating has declined, rather few support Mundell in advocating a shift to a single world currency, or even a revival of Bretton Woods, or the imposition of a Tobin tax. Much of the hesitancy to move in these directions stems from a concern that countries lose a macroeconomic instrument in surrendering their right to a variable exchange rate. The argument in so using the exchange rate is in essence an argument in using it as it was repeatedly used in the 1930s in a beggar-thy-neighbour manner of attempting to export elsewhere unemployment, and occasionally in a beggar-thy-neighbour manner of attempting to export elsewhere inflation. In each case, the exchange rate change is expressed euphemistically – as avoiding importing unemployment, importing inflation.

When the argument is put so bluntly, and with the recognition of its repetitive nature, its anti-social and at best negative sum game nature at the international level is apparent. However, the

argument is not normally expressed in its repetitive form. Instead, it is typically analysed as a single event that befalls a single economy in the whole world, with no other country ever doing anything in retaliation, or in the future. This is because, as shown in the perceptive surveys, Kenen (2002b) the situation is typically analysed as in Mundell (1961).

In the Mundell 1961 world, which in turn builds on Swan (1952), only one country *once* ever faces a shock. That shock is unanticipated. There are no shocks ever after, so moving the exchange rate once to adjust for a shock generates no future exchange rate uncertainty, and since there are no capital flows either (as accords almost with that era of highly restricted capital movements), there is a new equilibrium to reach, and there can be circumstances of sticky nominal wages in which the exchange rate is a simple swift mechanism for getting to the new equilibrium. Rather little attention has been paid to the work of Flemming and Mundell with models including capital flows. These render exchange rate variation more problematic, even in the case of the world only ever facing one shock and thus one exchange rate change ever.

There has been a reluctance on the part of many economists to believe that there could be uncertainty costs. This is partly through a misunderstanding of what hedging can accomplish. There is an ignorance of lack of availability of hedging for small firms over the extended time horizons involved in trade and direct investment. Big firms do it by exotic derivatives often. But the situation is so complex, that they sometimes go broke through their hedge intended as a safety net, eg the zinc multinational Pasminco met this fate a couple of years ago. Further as Kenen notes (personal communication), at the time of hedging, the firm generally does not know how much to hedge, not knowing yet the foreign demand for its good (if exporting), or its own demand (if importing).

The reluctance of many to believe that there could be uncertainty costs associated with exchange rate changes or anything else is also partly due to the way expected utility theory and its standard generalisations ignore the periods until after the uncertainty is past in the ways described in the overview. As a consequence, under that theory, there are no costs in ascertaining available acts (strategies), none in choosing the best amongst them), and each outcome of each risky act being evaluated is evaluated “as if certain”, even though in fact risky, Friedman and Savage (1948). For this to be plausible, and thus for expected utility theory to have an axiomatic base and not be arbitrary, all the periods considered have to be after the risk is past, Samuelson (1952). Explorings of dropping the assumption of exchange rate certainty – of permitting an anticipation of shocks – within an expected utility framework, thus have to ignore its axiomatic constraint on all the periods being after the uncertainty is passed, eg Obstfeld (2001).

There have been explorings of exchange rate uncertainty at the experimental level, which does not impose such a framework, eg Noussair and Plott (1995, 1997). These, like the theoretical studies, point to scope for some uncertainty costs. This is likewise the case in econometric efforts to get at the issue, though here studies have been hampered by the normal data problems: insufficiently long time series to determine trade and capital flow effects. Trade effects of relative price changes such as those emanating from exchange rate changes lag price changes by over a year, Pope (1981), and those of direct capital investment would have even longer lags. But over the decades needed to get a satisfactory time series, much else will have changed muddying the econometric estimates. The result has been a concentration on whether day to day or week to week volatility affects trade. Not surprisingly, the conclusion has been, only modestly. It could be expected however that such short term volatility influences hot money flows, and on this there is indirect evidence – ultra volatile exchange rates, as was New Zealand’s under a “clean” float policy, became the sixth most traded currency in the world. However, there is to say the least division amongst economists on whether such massive hot money flows are equilibrating speculation or destabilising speculation. Efforts to judge the trade costs of exchange rate uncertainty by comparing trade within and without currency unions are suggestive of high trade costs, eg Rose (2000, 2004), But again there are data difficulties of too few sizable countries joined in currency unions (instead mainly couplings of big with ultra tiny countries). Further there were suggestions that cause-effect chain from exchange rate uncertainty to trade reduction is not solely what the regressions capture, but rather also some reverse causation, eg Kenen (2002a). Further in all the studies, whether theoretical or empirical, of which the authors are aware, there is a rather limited spectrum of goals of a country’s official sector investigated.

2 Our Laboratory Design

To get a fresh handle on exchange rate uncertainties, and to gauge their impact on a more representative gamut of the goals of a country, without the shortcomings of a time series with both too many extraneous developments, or too few observations of reasonably similarly sized countries. In designing it, we differed from earlier theoretical and experimental frames for a number of reasons in addition to having an array of goals of the official sector. One was to model centralized wage fixing as occurs in principal EURO countries, as this had been a prime concern of economists in Europe opposed to the EURO’s introduction. Another concern was to model the role of central banks in setting exchange rates. A prime reason for the failure of efforts to model exchange rate changes as equilibrating and thus out of sample predictable values, is the crucial role of central bank behaviour, behaviour not reducible to simple formulae. We the public hear only the fights between central banks that reach the press – that between the central banks of

Japan and the US during the nineties, and more recently that between China and both the US and Europe. If central banks agree, there can be no overwhelming private speculation dislodging and exchange rate. To get private speculation “dislodging” an exchange rate is rather a case of one central bank wishing to hold its rate, and the other central banks not deeming the country is following or can be guaranteed to continue to follow, appropriate measures. After each currency crisis, the governments of the major countries and monetary advisers gather, pondering how to avoid the next one, and propose “good conduct rules for a country to avoid a speculative attack by having the other central banks assist. But the terms are onerous, rather as with IMF loans for other matters, and controversial, when as yet we cannot model exchange rate changes out of sample better than a random walk. Conflicts thus have arisen, and will continue to arise, between central bank. We wished to model this, the relative strength of the two central banks, and the limited role of private hedging, speculation and trade flows, able only to set the exchange in the range between the conflicting aims of rival central banks. This too, to our knowledge, constitutes a considerable deviation from other theoretical and empirical investigations of the effects of exchange rate uncertainty.

Our design is a compromise between realism, and other constraints, including the number of seats in our laboratory, and the maximum time for which we keep participants in a session (one day). To our knowledge it is the most complex experiment performed in an economics laboratory other than those on the Sinto market, Becker and Selten (1970), Becker, Hofer, Leopold and Selten forthcoming. More complex experiments have however been conducted in psychology laboratories on economic decision making, eg those of Dieter Doerner, Bamberg University and Alex Wearing of Monash University. To grapple with real world uncertainty costs, we sought as complex a design as was teachable to advanced economics students for them to play it within a day, and also theoretically analyzability with a game theoretic benchmark.

Despite simplifications, the set-up is sufficiently complex that we are unable to determine if it has a standard game theoretic solution. Accordingly Reinhard Selten has devised a new concept of an incomplete equilibrium. This is more realistic than the normal concept in that it does not require a player to investigate branches of the tree (courses of action) that would be unambiguously unprofitable for him. The new incomplete equilibrium concept, being more plausible than the standard concept under which the player investigates all these irrelevant ones, has potentially widespread applications in situations other than exchange rate uncertainty investigations. It is however beyond the scope of this paper to articulate the new concept in detail.

Our set-up has two countries, symmetric in every respect, and thus suggestive of the EURO’s two leading countries, France and Germany that are of approximately equal economic size. In each

country there is in the two currency case: 1 government, 1 central bank, 1 union representative, 1 employer representative, 5 firms who buy local and imported materials produced under competitive conditions that are used in fixed proportions to produce a homogenous final good sold in a Cournot market, with nominal demand set by the government. Firms buy their imports on credit, and must pay for them only next period. They face fixed costs, must produce at least a minimum amount, and face a capacity constraint on the maximum that they can produce. They can hedge or speculate in the current period, and thus face uncertainty concerning both the current and the future exchange rate. Their importing and hedging / speculative activity helps determine the exchange rate whenever the two central banks conflict on their exchange rate goals, which also depends on that government's nominal expenditure. In addition to setting nominal expenditure, the official sector, in the form of its central bank, sets its interest rate and announces its price and exchange rate goals. Thus between its government and central bank, a country's official sector has four instruments of macromanagement. In this it is under-instrumented for meeting goals, of which it has six: 1, its ideal interest rate; 2, its ideal employment range; 3, its ideal level of competitiveness in its cost structure relative to the other country; 4, meeting its price target; 5 meeting its exchange rate target; and 6 keeping prices steady.

After the official sector has set its four targets and made these public knowledge, the union and employer representative bargain over nominal wages. In this bargaining the union representative's payoff is real wages measured as nominal wages divided by the announced official sector target price, while that of the employer representative, is the average profit of the firms. If after set time allowed of 8 minutes, an agreement had not been reached, there was strike, with both negotiators receiving zero pay, a government set wage, and firms subject to a lower maximum production level and a cut in nominal demand relative to that announced by the government.

Once the wage rate (from bargaining or a strike) was announced for both countries, firms decided on output and on the amounts of a currency (home or foreign) to borrow in order to offer on the foreign exchange market in order to either hedge, speculate. The currency market then operated, and set the period's exchange rate, followed by the consumer market, determining the consumer price, followed by firms paying for last period's imported materials, and profits flowing to the firm's owners.

This round (sequence of decisions and their outcomes) was played by the same participants 20 times, with a lunch break, typically after the 8th period. The first round was preceded by an hour's instruction by Sebastian Kube on details of the game giving participants practice on acts. Sebastian Kube also programmed the experiment and the monitor viewed by two of the authors during the experiments, and made the statistical computations requested of the other authors for

analyzing afterwards the experiments. The participants were economics students at Bonn University who had passed two or more years of economics, ranging in skill from those in their third year undergraduate of economics up to doctoral candidates. There were twelve such sessions run on 12 different days in 2003. Each of the 12 sessions contained different participants. Six of the sessions had two currencies. Six had only one currency, only one central bank. This allowed us a comparison of the situation with and without a currency union. Since we had only 12 independent observations, given the cost in time and payments for each session of 20 rounds, only strong effects were detectable. The sessions were typically on Saturdays, since few participants were available for an entire Monday to Friday weekday. Participants were paid in proportion to their task achievement.

3 Results

We started play in the initial round in equilibrium, though not announcing this to participants. There were no random shocks in our set-up. As is largely the case in reality, any change, any shock of the system would arise from a human decision. The set-up allowed for aggregate demand shocks (by the foreign government), expenditure switching shocks (by the foreign central bank) and supply shocks (by the wage setters and the home and foreign firms.

Despite starting off in equilibrium, there was no session in which at least one central bank did not choose to alter its exchange rate aim. Thus in every session, contrary to standard theory, exchange rate changes were not equilibrating, rather destabilizing. This accord with other experimental findings that axiomatised expected utility theory, and game theory which uses that axiomatic base also, is descriptively invalid, Selten (1997), and that assuming expecting utility theory yields biased estimates, Pope (2004). The degree of exchange rate instability varied markedly from session to session indicating the importance of individual players and the infeasibility of predicting exchange rate changes. Treating each round as a year plus, in one session the instability of the exchange rate mirrored that of the inter-war period and the post-Bretton Woods era, as these are computed in Eichengreen (1995). In other sessions the instability was less, down to 1/100th of this level.

The lesser instability may relate to having only two countries, only two central banks to agree on their exchange rate policy. In the early gold standard era, there were only two players, England and France, who helped each other out, France helping out Britain in the earlier 19th century, then vice versa in the 1830s. In the later 19th and early 20th century there were essentially only four players, these two and the Prussians and the Hapsburgs. In such a small gentleman's club, co-operation would have been easier than in the inter-war and post Bretton Woods eras of vast

numbers of central banks. The lesser instability may also pertain to the central bank goals being so transparent in our set-up – more transparent than is the norm. It may also pertain to how the official sector's competitiveness goal was modeled (and thus the official sector paid). This was with symmetric penalties for being too cheap as too dear relative to the other country. Apart from Singapore, no country to the author's knowledge has pushed up wages at home declaring it wishes to be a high labour cost country. Instead, many German economists bewail the EURO, feeling that German labour is too expensive, and the cause of its slow-down, and that a German currency depreciation would do the trick. In a similar spirit some see the EURO as bad for Italy – that it should depreciate against Germany to alleviate southern Italian unemployment. Again the US and Europe ask China to depreciate as they feel that their labour is too expensive relatively causing unemployment, while China is loathe to appreciate, considering its hidden unemployment too high.

Despite the exchange rate changes being on average small compared to those actually experienced under floating rates, the instability damaged governments and central banks in their goal achievement. For the central banks, this was significant at the 10% level, and the more variable their exchange rate was, the worse their goal achievement, significant at the 5% level. The results thus suggest that even when the official sector is short of instruments, having two less than its number of goals, it is better for it to lose its exchange rate instrument – even when as in most sessions, the exchange rate instability is minor. In a complex environment, adding the additional uncertainty of exchange rate changes reduces attainment of the government's set of price and employment goals.

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