
Has the Riksbank Been Reacting to Asset Prices?

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ABSTRACT

This study analyses the interest rate setting policy of the Swedish central bank, the Riksbank. In particular, the paper addresses whether or not the Riksbank reacts to deviations in asset prices from trend levels when setting interest rates. To investigate these issues a modified version of the Taylor rule is used, and is adjusted to reflect an appropriate inflation targeting horizon and augmented with terms accounting for the deviation of asset prices from their trend. Instrumental variables methods of estimation are used to determine which factors most affect interest rate setting, and it is found that forecasted inflation and interest rate smoothing are the significant explanatory variables. Meanwhile, asset price inflation is not a significant determinant of the interest rate. This indicates that the Riksbank has not reacted to asset prices and that it is highly unlikely that the Riksbank any time soon will reverse its current expansionary policies and raise interest rates substantially enough to try to deal with potential bubbles or financial imbalances. The implication for the current policy debate is therefore that policy tools other than monetary policy need to be used to handle financial imbalances, and that other institutions than the Riksbank should act to implement these.

Keywords: *Monetary policy, Taylor rule, Sveriges Riksbank, Inflation, Asset prices*

I. INTRODUCTION

In the wake of the global financial crisis, the role of central banks has been thrust into the foreground of economic debate. Once deemed solely to be the quiet stewards of inflation, monetary policy activism after the crisis has raised interesting questions about whether central banks can and should do more to support growth and employment. Equally, charges that central banks were complacent in the run up to the financial crisis have led to calls that they should take greater responsibility for preventing future crises. These debates have challenged the traditional view of the primacy of numerical inflation targeting in monetary policy. Perhaps nowhere in the world are these debates being played out as intensely and transparently as in Sweden. In an environment where potential dangers are manifold, such as negative interest rates, stock market inflation, household indebtedness among the highest in Europe, a possible real estate bubble and a housing market beset by structural problems, the Riksbank has been accused of creating the conditions for a new financial crisis by neglecting financial stability. But at the same time it has been criticised bitterly for having apparently “leaned against the wind” out of concerns for the financial system and damaged Sweden’s economic recovery. In order to understand how the Riksbank has actually behaved and gain a better understanding of how it can be expected to act in the near future, a study of whether or not the Riksbank has been reacting to asset prices is timely. Analysing the Riksbank’s behaviour is also especially appropriate since the bank is due to receive its third external evaluation by economists by the end of 2015.

We begin by recounting the Riksbank’s performance during its years as an inflation targeter. In so doing we focus on the outcomes of independent external evaluations of Riksbank monetary policy commissioned by the Swedish Parliament, while also discussing current debates among Swedish economists about whether the Riksbank has done too much or too little to react to asset prices. Next, we explain the insights provided by economic theory about how many and which goals a central bank should have. We give an overview of the arguments for and against various policy regimes. The conclusions of previous studies for other central banks are also briefly summarised. We then account for the regression model we use to examine the Riksbank’s behaviour, which is an augmented forward looking Taylor rule estimated by IV methods. Finally, we present our results and conclude that deviations in asset prices have not had a significant impact on the conduct of monetary policy in Sweden. The implications for current policy are then discussed, and it is argued that given the Riksbank’s behaviour and current situation, macroprudential tools other than traditional monetary policy should be used to address potential risk to the financial system.

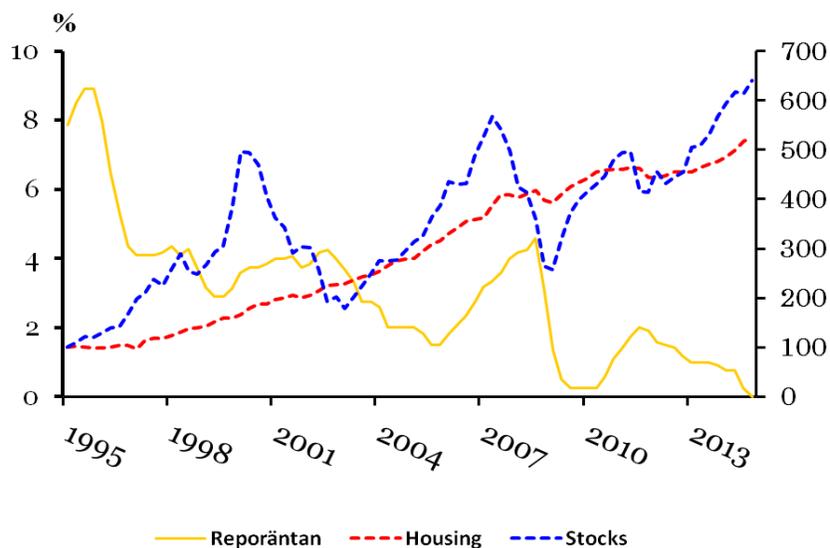
II. BACKGROUND

Today, Sweden's low inflation and recent experience of deflation have earned it the moniker of a "new Japan" from some commentators (Krugman 2014). However, Sweden's transition to a low inflation economy is relatively recent. An inflation target for the Riksbank was first announced in 1993 and put into practice in 1995. Previously, exchange rate stability had been the goal of the Riksbank, together with supporting full employment and channelling investment towards strategic sectors, such as housing (Jonung 1993). The transition to an inflation goal and a floating exchange rate was part of a battery of reforms to Swedish stabilisation policy which arose out of the severe economic crisis Sweden suffered in the early 90s, but they also came after a decade of economic turbulence in the 1980s. Sweden's economy was plagued by high inflation and the successive erosion of its competitiveness during these years, leading to cycles of devaluation where the Swedish krona was aggressively devalued against other currencies in ultimately short-lived attempts to restore competitiveness (Wetterberg 2009: 406). With the gradual establishment of formal independence for the Riksbank, enshrined in 1999, however, inflation in Sweden has followed the general trend downwards evident in other advanced economies with similar monetary policy regimes (Siklos 2002: 16).

The Riksbank has defined its inflation goal as a target of two percent for the Consumer Price Index (*Konsumentprisindex - KPI*). An interval of +/- one percent applied formally until 2010, but the goal of two percent was still primary. The inflation target is also supposed to encompass support for the goals of economic growth and full employment. In addition to this mandate, the Riksbank has been tasked with maintaining a "secure and effective payments system", which has come to take on the wider interpretation of working to help ensure financial stability in Sweden generally (Heikensten 2014: 28-9). While these goals at first glance may seem self-evident, criticism has emerged about whether the bank has neglected these goals, covertly followed others, requires more goals, or perhaps fewer, and also whether it has unduly taken on extra responsibilities or abdicated them.

In particular, the question of sustained asset price inflation in Sweden, and whether the downward movement in interest rates since the mid-90s has exacerbated this, has often been a controversial topic in discussions of Riksbank's monetary policy. As can be seen *prima facie* in figure 2.1, both stock and house prices have had a strong upward trend in Sweden for two decades while the Riksbank's *reporänta* has successively fallen. The left axis refers to the short-term interest rate, and the right to the indexes of stock and house prices.

Figure 2.1: Interest Rates & Asset Price Inflation in Sweden 1995-2014



Sources: Riksbanken, SCB, NASDAQ OMX

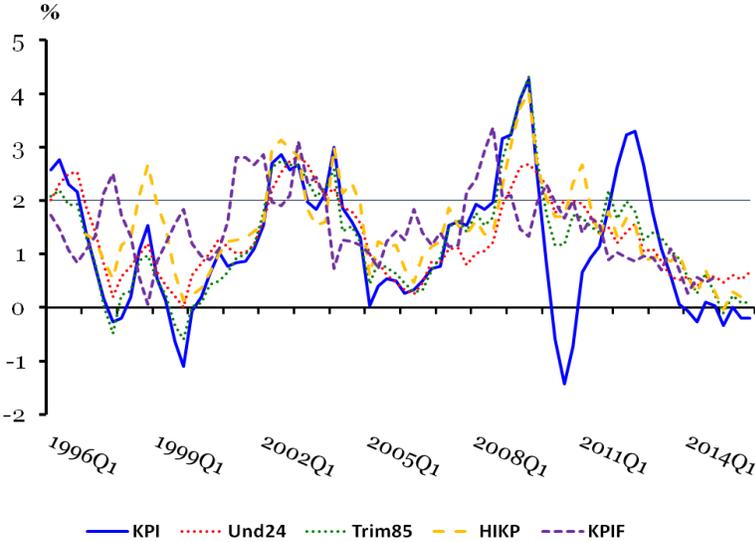
While stock prices have seen large swings and corrections, notably in the early and late 2000s, house prices have sustained a determined upward path. Galloping asset prices have been a forerunner to many financial crises, not least the latest in 2007-8 in many advanced economies. Prior to this, the relationship between the financial and real economies was less well understood, but now the potential for financial market havoc to bring deep and painful turmoil to the real economy has been thrown into sharp relief. Large asset price corrections can damage household finances and induce declines in consumption, while commercial banks are likely to react to declines in their own and their customers' financial positions by tightening credit, with deleterious effects on business and investment. In the Swedish case, high levels of household indebtedness arguably strengthen the potential dangers of these mechanisms. All this begs the question whether a central bank like the Riksbank can, should, or has in the past attempted to, conduct monetary policy in a way which reacts to deviations of asset prices from perceived normal levels in the hopes of precluding any future crisis.

Monetary Policy Evaluations

The development of the Riksbank's role in the post crisis Sweden of the late 90s and 21st century has not gone without public scrutiny. As noted above, its performance has received criticism from many quarters, but interestingly, it has also been the subject of two independent evaluations. As can be seen from figure 2.2, inflation has for the most part indeed been "low and moderate" in Sweden since the 90s, however, according to various measures, it has consistently lain under the stated goal of two percent. There has at times existed uncertainty over which measure of inflation the Riksank has preferred. But in

practice, the staff and decision-makers of the Riksbank weigh together a variety of measures of inflation and underlying inflation when making decisions. For a time a measure known as KPIX drew special attention given that it removed effects of interest rate changes on subsidies, mortgage payments and indirect taxes, which may have inflationary or deflationary consequences directly associated with monetary policy adjustments. In the late 2000s KPIX was phased out, having been found to consistently lie under KPI levels, and instead a measure known as KPIF where mortgage rates are held constant has recently received more attention (Hansson et al 2008: 24). Other methods include reducing the weighting of goods in branches where prices have displayed high volatility (Und24 and Trim85), or to harmonise measures with those used in other EU countries (HIKP). Notwithstanding the merits of the various measures, it is KPI for which the target of two percent exists and which receives the Riksbank’s primary attention (Wickman-Parak 2008: 1), and against which the Riksbank’s performance has most often been judged.

Figure 2.2: Inflation in Sweden, various measures 1995-2014



Several explanations have been put forward for the consistent outcome of inflation below the target, such as preference on the part of the Riksbank for inflation lower than two percent, poor forecasting, or the undue targeting of other variables such as asset prices (Svensson 2014a: 58). Elsewhere it has been explained that the Riksbank actually has no obligation to compensate for previous periods of “undershooting” and that the perceptions of failure on the part of the Riksbank because inflation has deviated from two percent are incorrect (Andersson & Jonung 2014: 38). It has also been stated that because interest rates have fallen and that these enter the KPI measure, inflation has tended to appear lower

than underlying measures would indicate (Ibid.: 39). Meanwhile, others have argued that the Riksbank has systematically overestimated inflation (Konjunkturinstitutet 2013a).

In their independent evaluation of the Riksbank's monetary policy for the period 1995-2005, Giavazzi & Mishkin call attention to what they regard as problems with the Riksbank's communication in its increasingly flexible inflation targeting policy (Giavazzi & Mishkin 2006: 69-70, 71). In particular, asset prices, specifically real estate, are singled out as areas where the Riksbank has not been clear in its communication. The authors cite the bank's own motivations for interest rate decisions in 2006, concluding that these could "easily" be interpreted as having been based primarily on a reaction to movements in house prices, especially given that actual inflation was forecasted to be below two percent (Giavazzi & Mishkin 2006: 71-3). This, they point out, could give rise to confusion amongst the public regarding whether the Riksbank implicitly has given itself an additional target for asset prices over and above the inflation goal, and that this may have been interfering with its primary responsibilities (Ibid. 72). In their recommendations for improving the Riksbank's conduct of monetary policy, they emphasise pointedly that the Riksbank's mandate to ensure financial stability should not enter its flexible inflation targeting system through an independent concern for house prices. Instead, they argue that asset prices should only be reacted to if they are judged to be potentially contributing to overheating in the economy and to too high inflation (Ibid. 73, 77-8).

A follow-up evaluation was conducted in 2011, focusing on the period 2005-10. This time the Riksbank was praised for its general transparency and for the quantity of information it produces. Nevertheless, concerns were expressed about the division of responsibility for the management of the financial system in Sweden and the lack of policy instruments available to the Riksbank other than "moral suasion" to carry out a broader interpretation of its financial stability mandate (Goodheart & Rochet 2011: 44-45). In addition, inflation was again concluded to have been lower than in comparable countries according to various measures, and it was suggested that the Riksbank's policies could have been even more aggressive and expansionary than ultimately was the case (Ibid.: 60).

How well the recommendations of the evaluations have been followed in subsequent years is debatable, however. Although full responsibility for macroprudential policy was finally given to the Swedish financial supervisory authority (*Finansinspektionen*) in 2013, it has continued to be argued that monetary policy has an important role to play as a tool of macroprudential regulation (Jansson 2014a: 57-8). Also, in practice, coordination between the Riksbank, the government and *Finansinspektionen* has at times been judged to be as poor.

Regarding Giavazzi and Mishkin's critique, while there are admissions that the connection between monetary policy, asset prices and the real economy are not well enough understood to substantially inform policy decisions (Ingves 2006: 8), the Riksbank has still expressed itself mercurially regarding how it treats asset prices in its deliberations. For example, when commenting on Giavazzi and Mishkin's recommendations, Ingves (2006) has

suggested that decisions to increase interest rates could be hurried along to correct expectations of developments in house prices judged to be “unrealistic” (Ingves 2006: 4-5). Hence, whether the Riksbank’s flexible inflation targeting regime has broadened its focus and allowed asset prices an undue role alongside the primary goal of targeting KPI, and secondary concerns about output and employment, has remained an open question.

Contemporary Criticism of the Riksbank

In addition to the two official evaluations of its policies outlined above, the Riksbank’s performance has also become a subject of intense debate among Swedish economists. The consistent outcome of inflation levels lower than the stated goal of two percent has fuelled accusations that the Riksbank has deliberately pursued a strategy which has kept inflation from reaching the target, and undermined the wider goals of economic policy such as full employment (Svensson 2014a: 54).

Probably the most vocal critic of this persuasion is Lars E.O. Svensson, a former vice-director and member of the bank’s executive board. In a multitude of articles, speeches and columns, he has ignited debate about whether the Riksbank has caused damage to the Swedish economy by failing to pursue an appropriate monetary policy and by worrying too much about housing and indebtedness and raising interest rates too quickly as a result (Svensson 2014b: 104-5). Svensson has argued that nearly 40,000 jobs may have been lost because of this policy (Svensson 2013: 2), while contending that the Riksbank has historically interpreted its task of contributing to financial stability too broadly and has thereby wrongly taken it upon itself to pre-emptively combat financial imbalances better left to other institutions to handle (Svensson 2014a: 59). Svensson has, however, received criticism for these standpoints. On the one hand, it has been pointed out that his calculations regarding unemployment higher than the “necessary” level of equilibrium unemployment in Sweden rely on the assumption that inflation expectations are constant, when these in fact vary (Andersson & Jonung 2014: 40-1). On the other, his claim that the Riksbank has set interest rates with household indebtedness and house prices in mind has been described as presenting a history of Riksbank decision-making which is not in accordance with reality (Jansson 2014b: 2-3).

At the other end of the spectrum has been the judgement that the Riksbank is abdicating responsibility to contain the threat of financial crisis in the future by lowering interest rates during a period of persistent asset price inflation. In doing so, it has been argued that the Riksbank is contributing to blowing a bubble economy of the very same sort which led to financial trouble in other countries (e.g. Jonung 2014). This discourse has recently gained traction, especially given that the planned introduction of mandatory mortgage repayment by Finansinspektionen has been postponed and that politicians and government have ruled out abolition of interest rate deductions (*ränteavdrag*) which are widely regarded as exacerbating fervent housing market activity.

In sum, the criticisms it faces make clear that the Riksbank has recently found itself caught between a rock and a hard place. Faced with an economy either experiencing outright deflation, or flirting with it, adherence to its inflation target would seemingly dictate further expansionary measures. However, in doing so the Riksbank leaves potential imbalances in the housing and financial sector unaddressed while as yet receiving little help from other institutions in dealing with these issues. This is a monetary policy dilemma if ever there was one. To analyse what the Riksbank, and central banks more generally, can reasonably be expected to do, or have done, we must turn to the prescriptions of economic theory.

III. THEORY & LITERATURE

From the mid 1980s, the conduct of monetary policy by central banks gradually crystallised around the supremacy of numerical inflation targeting as the primary policy goal. The desire to press down and control inflation arose out of the economic turbulence of the 1970s when high inflation was seen as a culprit for the unsatisfactory performance of Western economies in these years. High and volatile inflation makes it difficult to plan economic activity, leads to higher borrowing costs, and distorts patterns of investment and consumption as well as having distributional effects on borrowers and savers (Freedman & Laxton 2009: 4-5). The implementation of inflation targeting has widely been regarded as a success by economists (Svensson 2010: 1242), with inflation expectations having become well anchored in most cases (e.g. Mishkin & Posen 1997: 89-90).

Simply, inflation targeting involves the setting of a numerical goal for some measure of inflation, most often a two percent level for the consumer price index, as is the case for the Riksbank. In practice, because monetary policy affects the economy with considerable lag, forecasts of inflation are used when making interest rate decisions to (hopefully) steer inflation towards its target. The transparency of the two percent goal has come to be regarded as one of the merits of inflation targeting, as central bank decisions and objectives were often shrouded in secrecy during prior regimes. Furthermore, in tandem with enhanced central bank independence, inflation targeting has depoliticised monetary policy and increased the longer-term stability of its objectives. Finally, because inflation has a tight relationship with real economic variables such as output, this allows inflation-targeting central banks to be “flexible targeters” and carry out short-term stabilisation policy which gives some weight to the output of the economy (Svensson 2010: 1239). This is something which has been succinctly and famously described by the Taylor rule which will be discussed later. Though just how flexible this flexible inflation targeting should be has long been controversial.

How Many Goals?

While the merits of inflation targeting are regarded as clear among most mainstream macroeconomists, there has been lively discussion about whether central banks ought to do more, or less. This is especially the case in light of the recent financial crisis which thrust monetary policymakers more into the limelight than before. Commonly advocated “third” goals include conducting macroprudential policy by using the interest rate or other instruments, or explicitly trying to ensure full employment. Advocates of extra goals meet resistance from those who maintain that monetary policy’s sole task should remain the objective of price stability and that adding extra objectives increases the risk of repoliticising monetary policy (Orphanides 2013: 2).

A popular argument for defending the idea that a central bank should only target inflation as a primary goal is to refer to Tinbergen's rule. This rule states that if a policy maker wishes to achieve n goals, he or she must have n instruments at his or her disposal. The implication is that central banks in fact only have one true policy tool, the short-term interest rate, and that it is therefore foolish to try to do too many things at the one time. Indeed, central banks which have not been legally responsible for other goals have appeared to perform better in attaining their inflation targets (Siklos 2002: 13).

This is not to suggest that central banks should completely neglect other concerns, but rather that these should enter into a "hierarchical" monetary policy as subordinate to, but linked with, the goals of inflation or price stability. Even as monetary policy is carried out with one main goal and one instrument, it does so in a manner of "constrained discretion" and with flexibility rather than rigidity (Bernanke & Mishkin 1997: 10). This means that while the central bank can respond to e.g. short-run traumas, the extent to which it does so is constrained by its adherence to the ultimate goal of price stability. Former Fed chairman Alan Greenspan tactfully expressed this idea by claiming that only growth associated with, and occurring in the context of, price stability should be maximised (Greenspan 2004: 37). This kind of hierarchy can be said to exist for the Riksbank, given that the task of supporting general economic policy goals ("*den allmänna ekonomiska politiken*") is a function of its inflation goal and not a separate objective in and of itself.

Reacting to Asset Prices

Once thought to have little influence on the real economy, asset prices, and especially real estate prices, have shown themselves to have significant implications for the business cycle, not least in the wake of the 2007-8 financial crisis. This has prompted calls for central banks to better predict, manage and take action against asset price bubbles or anomalies which may imply risks for the real economy.

An early sketch of how monetary policy affects asset prices, and in turn the real economy, is provided by Friedman and Schwarz (1963). With its purchases of securities the central bank increases the balance sheets of commercial banks and others, who then purchase their own securities, diversifying into equities and other instruments as prices increase (Friedman and Schwarz 1963: 60). The "diffusion" of the monetary stimulus from the financial to the real economy occurs as the price of financial assets rises so as to encourage the further diversification of portfolios into non-financial assets (Ibid.: 61-62). In the same way, monetary tightening encourages asset prices to fall, increasing the real rate of interest and leading to a switch from investment to saving (Alchian and Klein 1973: p. 179). The conditions through which asset price changes in the housing market influence the real economy have to do with the large role played by housing in the expenditure of much of the working population in advanced economies (Goodhart 2002: p. 350). Indeed, facilities through which households can borrow against the increased value of their homes to finance

higher consumption are widespread. As such, a significant correlation between the development of house prices and real output in the economy has been discernable (Ibid.: 342).

In spite of this, monetary policy doctrine for most of the inflation targeting period prescribed that central banks should not respond to asset prices or try to prick bubbles. The most influential view was presented by Bernanke & Gertler (1999), and it would go on to become orthodoxy. These authors wrote that asset prices should enter into monetary policy deliberations only in so far as they may contain information about actual future inflation and output. The central bank should not try to stabilise them at an equilibrium level, since this cannot be defined. Nor can a central bank with any degree of certainty predict if a movement in an asset price is reflective of economic fundamentals or not (Bernanke & Gertler 1999: 79). Elsewhere, the idea of reactive policy designed to control asset prices having a decisive role to play has been described as an “illusion”, and it has instead been argued that central banks should confine their actions to mopping up after the fallout of bubbles by implementing rate cuts (Greenspan 2004: 36).

More recently, it has been proposed that central banks should have an explicit goal of reacting “systematically” to asset price developments over and above just adjusting interest rates to minimise deviations from target inflation (Cecchetti et al 2000). It is claimed that when asset prices can be observed to be deviating from “warranted levels”, monetary policy action should be taken through modest interest rate adjustments to try to pilot asset prices back to normal levels and hence offset any potential over spills from financial turbulence into output and inflation. It is also argued that such measures could perhaps even preclude the formation of bubbles entirely (Cecchetti et al 2002: 3). The case for “leaning against the wind” rests on a situation where disturbances in asset prices can be traced to underlying factors affecting the demand or supply of the asset, and on the perception that potentially volatile asset market developments which may have a sizeable effect on future inflation will be absent in traditional inflation forecasts (Ibid.: 4-5). Both of these scenarios would seem to apply to Sweden where, for example, the housing market remains regulated and highly inefficient, especially regarding housing supply, but also because increases in house prices have led to rises in household indebtedness. This potentially exposes home owners’ finances (and thus possibly their spending and saving decisions etc.) to distress should property prices fall (Konjunkturinstitutet 2013b: 38-9).

The ideas put forth by Cecchetti et al. have gained more traction in recent years, and have been echoed in other studies. As an example, it has been argued that had central banks paid more attention to real estate market misalignments and given them greater weight in their decision-making, the recent financial crisis may have been avoided or mitigated substantially (Cobham 2012: 26-7). Studies like these form part of a wider international critique of central bank policy more generally during the period known as the Great Moderation from the mid-1980s until the late 2000s. This period has commonly been regarded as one of unprecedented macroeconomic stability, presided over by deft monetary

policy conducted by adroit and increasingly independent central banks (Bernanke 2004). This interpretation is now being challenged because of the arguable role of central banks' "complacent" monetary policy in failing to curb mounting imbalances, effectively supervise the financial system, or respond pre-emptively to developments which would later result in disaster. Examples of the complacent policies which have regularly been criticised include the "puts" of Fed chairs Greenspan and Bernanke whereby interest rates were cut in response to financial market turbulence. These actions have been derided as having fomented speculation and moral hazard (Miller et al. 2002). The verdicts reached by this literature are generally similar to the ideas earlier put forward by Checchetti et al.

On the flip side, however, these events have also been interpreted as an example of why monetary policy is a poor instrument for pre-emptively or retroactively responding to financial imbalances. Looser monetary policy as an answer to stock market difficulties may risk causing overheating in the real economy, while interest rate hikes designed to stop speculation may worsen a prevailing downturn (a famous folly committed by the Federal Reserve in 1928-29), or constrict a fragile economic recovery as is now the case in several Western countries. The conclusion reached here is that to control the financial market, instruments other than traditional monetary policy must be used and developed and possibly be handled elsewhere than at the central bank, which should focus on the real economy and on its inflation or price stability mandate (e.g. Eichengreen 2015: 62).

Other Objectives

In addition to inflation and asset prices, other variables have also been proposed as targets for central banks. These include employment, nominal output, and exchange rates. Regarding the inevitable conflict between two or more of these goals with inflation targeting, it has been said that central banks should accept the existence of multiple objectives and the trade-offs associated with these and simply pursue the outcomes at the time regarded as most important (Cobham 2015: 2).

Some economists have called for the replacement of inflation targeting with an explicit target for nominal GDP, or for employment, though these ideas have not broken through into mainstream monetary economics. Regarding GDP targeting, advocates contend that this would lead to a smoother business cycle and the avoidance of a classic dilemma where a positive supply shock, higher inflation and low output tend to produce contractionary monetary policies which worsen recessions. It has also been argued that communicating about monetary policy in a way that focuses on GDP instead of inflation will lead to less confusion among members of the public who react negatively to calls for "higher inflation" when increased aggregate demand is the intended consequence of stimulus (Sumner 2011: 15). Meanwhile, the case for an employment target is made chiefly on the grounds that by targeting inflation, central banks have neglected growth and employment creation. In response, a more "socially conscious" monetary policy is favoured, similar to the

developmental role it is surmised central banks played in, for example, Europe during the Golden Age of Economic Growth after the Second World War (Epstein 2007: 14-15).

However, when it comes to the business cycle it has been found that the presence of explicit quantitative targets for variables like inflation and money growth are significantly associated with smoother business cycles (Fatás et al 2006: 30-1). Moreover, when turning to the role of monetary policy and employment, it is a widely held viewpoint that labour market institutions and structural variables are by far the most important determinants of unemployment, and that while e.g. expansionary monetary policies can mitigate the employment costs of downturns, they cannot be expected to create higher employment for extended periods by themselves (Orphanides 2013: 5). Furthermore, by instead focusing primarily on inflation and creating a climate of stable expectations, it is arguable that monetary policy contributes to an environment more conducive to higher employment already, without the need to vigorously react to labour market developments as an independent policy goal.

A final proposition is that the central banks of small open economies may wish to engage in some form of exchange rate targeting (Ball 1999: 142). The reasons why a central bank might wish to target exchange rates are many. These may include assisting economic expansion through depreciating a currency to support exports and competitiveness in the short-term (even though this is frowned upon), or equally to strengthen the exchange rate against another currency. An exchange rate target may also complement inflation targeting if it, for example, implies that a central bank should aim for below target inflation if depreciation is forecasted to occur (Ibid.). On the other hand, however, exchange rate targeting has been claimed to lead to sub-optimal outcomes by increasing the volatility of inflation and by also failing to reduce exchange rate volatility in a meaningful way (Batini & Nielson 2000: 36).

Interest Rate Smoothing, Credibility & Financial Stability

Beyond the actual targeting of various economic variables, detection of the behaviour of interest rate smoothing has also become a standard outcome when macroeconomists have modelled monetary policy. With interest rate smoothing is meant the gradual adjustment of short term interest rates in incremental steps with infrequent changes in direction and the eschewing of large and volatile increases or decreases (Sack & Wieland 1999: 2). Interest rate smoothing is a phenomenon present in most advanced countries (Goodhart 1998: 13). This has led to some arguments that central banks have it as an unspoken goal to smooth interest rates (Woodford 2002: 1), and even criticisms that smoothing essentially inhibits central banks from responding to macroeconomic developments in a timely fashion (Rudebusch 2006: 86-7). This is particularly because smoothing parameters sometimes return very high and significant values in Taylor rule regressions, and can imply very

sluggish adjustments by central banks towards their targeted interest rate (Welz & Österholm 2005: 2).

The notion that interest rate smoothing and the slow adjustment it implies leads to suboptimal outcomes for inflation and output has, however, been rejected in favour of the argument that smoothing is in fact an optimal policy choice. Given that forward-looking central banks inevitably make errors in their forecasts, it is arguable that slighter adjustments based on these predictions are preferable, since a large forecast error may end up implying a highly unsuitable policy rate if non-smooth adjustments had been made (Sack & Wieland 1999: 31). It has also been argued that because the economic impulses and uncertainty originating from monetary policy decisions are greatest when rates *do* move in another direction, avoiding frequent reversals is sensible (BIS 1998: 68-9). The argument is further strengthened when one considers that modern inflation-targeting regimes and independent central banks owe much of their success to their establishment of credibility. In this context, an environment where small adjustments in interest rates are expected to persist is likely to be viewed as more credible by forward-looking private actors, who, if confronted with fickle monetary policy characterised by large swings, would lose confidence in the central bank (Crow 2001: 2). Indeed, this latter point about the importance of credibility is especially pertinent for the Swedish experience, where the Riksbank's inflation targeting regime has led to stable expectations and long-duration contracts among employers and employees (Fregert & Jonung 2008: 19). This is a fact which would arguably have been less the case had monetary policy moved in large steps or jumped in different directions in a volatile manner if interest rates had not moved smoothly.

A final and important explanation put forward for interest rate smoothing is that it contributes to financial stability. Short-term interest rates set by central banks affect a variety of other interest rates of importance to commercial banks and other financial institutions. Large swings in monetary policy would therefore have a disorderly impact on financial markets and cause "undue stress" (Ruebusch 1995: 272). Additionally, volatile short-term interest rates could lead to sizable swings in flows of payments between corporations and financial intermediaries (Crow 2001: 2).

Interestingly, however, although the objectives of financial stability are generally agreed to lie at the heart of interest rate smoothing, it may have the unintended consequence of actually promoting other forms of *instability*. This might occur if smooth interest rates are interpreted as a "buffer" by banks, who may then choose to engage in higher lending in riskier assets (Smith & Van Egeren 2004: 164, 167) and dilute their abilities to absorb interest rate fluctuations (Driffill et al 2006: 106). In circumstances where a smoothing policy is in place, it may therefore be incumbent upon other institutions than the central bank to account for macroprudential regulations, and to make these tighter (Smith & Van Egeren 2004: 20-1).

Previous Studies of Central Banks and Asset Prices

There have been several prior empirical studies of whether central banks have reacted to asset prices or not. Most of these papers have involved adding terms for asset prices to Taylor rule regressions. This forms part of the wider Taylor rule literature where monetary policy equations are estimated with instrumental variable (IV) methods such as the Generalised Method of Moments, Two Stage Least Squares, and Limited Information Maximum Likelihood. The focus of asset price studies has most often been limited to the larger central banks: the Federal Reserve, the ECB and the Bank of England. The results of these studies have been inconclusive, even when the same central bank has been analysed. For example, the ECB has been found *not* to directly react to asset prices but rather use these in inflation forecasting in a fashion akin to that proposed by Bernanke & Gertler (Siklos et al 2004), while another study finds that stock price movements influenced the ECB's policies even before the recent financial crisis (Botzen & Marey: 2010). Elsewhere, a study of the behaviour of the Bank of England has found the bank to account for asset price inflation, and the property market in particular (Kantonikas & Montagnoli 2004), and an IMF staff paper has also argued that US, UK and Japanese central banks set interest rates to offset deviations in asset prices and exchange rates from equilibrium levels (Chadha et al. 2004). However, this was only for a later study to conclude that similar regressions produce disperse and bias results for both the Bank of England, the Federal Reserve and the Bank of Japan (Finocchiaro & Von Heideken 2012).

So, it is clear there is no generally agreed upon answer as to how central banks have actually behaved and how they have reacted to asset prices. Studies of the above type have not been carried out for the Riksbank, but given the current debate about the Riksbank's apparent neglect of its policy goals and prioritisation of asset prices, it appears that it is timely to do so. We must first, however, set out an appropriate method.

IV. DATA & METHOD

The foremost method used for analysing the monetary policy of inflation-targeting regimes in the standard macroeconomics literature is the Taylor rule, set out by Taylor (1993). The Taylor rule proposes that the interest rate set by the central bank will be a function of the deviation of the actual inflation rate from its target rate, i.e. the target which the central bank has either set or is mandated to achieve, and the output gap, measuring the deviation of GDP from its potential level. A standard Taylor rule is thus given by:

$$i_t = \alpha + \beta_\pi(\pi_t - \pi^*) + \beta_y y_t^{gap} + \varepsilon_t \quad (4.1)$$

Where i is the short term interest rate set by the central bank, α is the intercept, π is actual inflation and π^* the inflation target, and y the output gap. Finally, ε is an error term, which as we will see cannot yet be assumed to be i.i.d..

Although Taylor's initial work fitted the data for the United States, for the rule to achieve explanatory power for other cases its specification usually has to be modified, and augmented with additional terms (Fernandez & Nikolsko-Rzhevskyy 2006: 3). Most commonly, Taylor rules have been augmented with a lagged value of the interest rate. As we have seen, the literature argues that this is supposed to account for the phenomenon of interest rate smoothing whereby central banks refrain from large increases or decreases in the interest rate, preferring to make small adjustments to the previous rate out of concerns for financial stability (DiGiorgio & Rotondi 2011: 6). This allows for the previous period's interest rates to play a role in the determination of the current rate. The Taylor rule now becomes:

$$i_t = \alpha + \beta_\pi(\pi_t - \pi^*) + \beta_y y_t^{gap} + \rho i_{t-1} + \varepsilon_t \quad (4.2)$$

With i_{t-1} as the lagged interest rate and ρ is the smoothing parameter, while the β coefficients indicate the short-run effects of the output gap and the deviation from target inflation on the interest rate.

Estimating equation 4.2 for the Riksbank reveals that the error terms are serially correlated. The presence of a lagged dependent variable and serial autocorrelation means that OLS is inconsistent, but surprisingly this has been ignored by a number of Taylor rule studies (Welz & Österholm 2005: 5). We do not ignore this issue here and instead, we attempt to remove the serial correlation by following the practice of using additional lags of the dependent variable until the autocorrelation is removed (Kennedy 2003: 144). Adding

one additional lag of the interest rate is found to be sufficient to eliminate the autocorrelation of the residuals at all lags, according to a Breusch-Godfrey LM test.

A further problem with running regression 4.2 is the suspicion that the series for the Rikbank's short-term interest rate contains a unit root. As suspected, unit root tests on this series fail to reject the presence of a unit root. To address this issue, we replace the short term interest rate with its change from the previous period. Hence, we arrive at:

$$\Delta i_t = \alpha + \beta_\pi(\pi_t - \pi^*) + \beta_y y_t^{gap} + \rho_1 \Delta i_{t-1} + \rho_2 \Delta i_{t-2} + \varepsilon_t \quad (4.3)$$

A Forward-looking Inflation-targeting Taylor Rule

Although equation 4.3 can be estimated, it would not be a good model of how central banks behave when they set the interest rate. Monetary policy does not instantaneously affect the economy and a change in the current interest rate will not automatically restore inflation towards its target level. Rather, just as with other economic policy tools, monetary policy operates within the context of significant “outside lags” where the full impact of a policy change will not be felt on the economy until several periods later (Svensson 1997: 1113). This would suggest that the deviation of inflation from the target in the current period, π_t , would not be a suitable variable to be included in the policy rule, and that it would instead be more realistic to include expectations of inflation π_{t+n} for some n future period (Batini & Haldane 1999: 158). The Riksbank policy is based on targeting inflation occurring in one or two years in the future (Berg et al 2004: 4), and we therefore choose to set period for the expected inflation four quarters ahead as the variable of most interest to the Riksbank, and as the horizon most feasible to include. Taking the route proposed by Clarida et al (1998) in an influential article on forward looking Taylor rules, we can write a forward looking rule in the following way:

$$\Delta i_t = \alpha + \beta_\pi E[(\pi_{t+4} - \pi^*) | \Omega_t] + \beta_y E[y_t^{gap} | \Omega_t] + \rho_1 \Delta i_{t-1} + \rho_2 \Delta i_{t-2} + \varepsilon_t \quad (4.4)$$

Where Ω_t is the information set available to the central bank at time t , and where the expectation expressions $E[(\pi_{t+4} - \pi^*) | \Omega_t]$ and $E[y_t^{gap} | \Omega_t]$ denote the expected deviation of inflation from its target four periods ahead and the expected deviation of GDP from its potential level. Both of these are conditional on the information available to the central bank in the information set and this reflects the resources available to the Riksbank when it carries out forecasting. The current output gap is conditional on the information set because the output gap is a variable which is not contemporaneously observed by

policymakers and which has to be estimated. It is also the case that GDP statistics are published with a sizeable lag. We have here followed the specification often recommended in the literature (e.g. McCallum 1993, Berg et al 2004: 8, Clarida et al 1998: 1037).

In order to transform 4.4 into an estimable equation, we express inflation and output as their realised values and thus remove the expectation/forecast terms...

$$\Delta i_t = \alpha + \beta_\pi(\pi_{t+4} - \pi^*) + \beta_y y_t^{gap} + \rho_1 \Delta i_{t-1} + \rho_2 \Delta i_{t-2} + \varepsilon_t \quad (4.5)$$

... and define the error term as a linear combination of the errors in forecasting the inflation and output gaps, together with an i.i.d. disturbance term, v_t . This yields:

$$\varepsilon_t = \alpha + \beta_\pi\{(\pi_{t+4} - \pi^*) - E[(\pi_{t+4} - \pi^*) | \Omega_t]\} + \beta_y\{y_t^{gap} - E[y_t^{gap} | \Omega_t]\} + v_t \quad (4.6)$$

Having arrived at the specification detailed in 4.5, we can quickly surmise that this regression will likely suffer from simultaneity and endogeneity problems which would render OLS estimation inconsistent. This is because of the outside lag of monetary policy which we have previously identified, so adjustments in the short term interest rate today will affect the level of inflation in the future, and thus its deviation from its target. The estimated output gap for the current period will of course also depend on the interest rate.

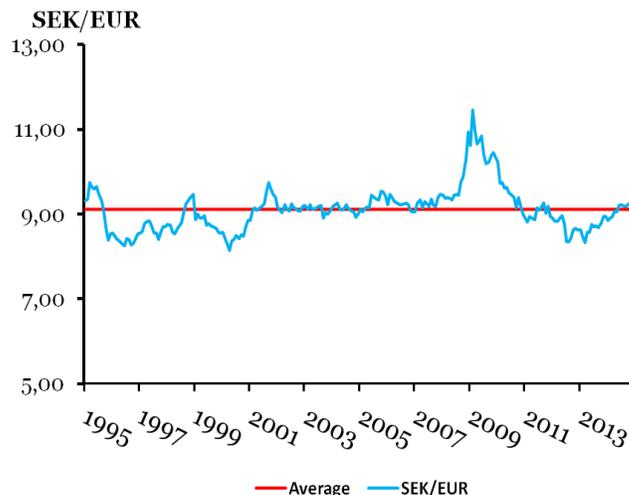
In order to amend these problems, estimation with instrumental variables (IV) should be attempted. For this we need instruments which are not correlated with the error term and which are correlated with the endogenous regressors. Most commonly, the literature proposes using lags of the inflation and output gaps (Clarida et al 2000: 156-7) and we also do so here, while additionally using an index for commodity prices also suggested by Clarida et al (1998, 2000). In our case this data is taken from the World Bank. We use four lags of the inflation and output gaps and the current value of the commodity prices in addition to four lags. Our reasoning is that past values for inflation and GDP gaps will be indicators of future and current movements in these variables while not being correlated with the error term of an expression explaining changes in the current interest rate. This is given that the previous values belong to the past and are already realised. Similarly, commodity prices can be expected to be correlated with inflation given that e.g. oil is an essential input, but they are certainly independent of the interest rate set by the Riksbank.

Accounting for Asset Prices

We follow the implications of Bernanke & Gertler (1999) and Cecchetti et al (2002: 3) and model the central bank's behaviour towards asset prices as a reaction to changes in asset prices in the previous period. This is because responses to asset prices should either be determined by whether or not these variables give an indication about coming levels of output and inflation (Bernanke & Gertler 1999: 115), or as an explicit monetary policy response to prices moving away from the "warranted levels" (Cecchetti et al 2002: 3). This is a reasonable specification as central bankers possess no outright forward-looking target for asset prices, while they are legally obligated to set interest rates in a manner which should aim for the target rate of inflation to be achieved. However, this does not, of course, mean that asset price developments are ignored entirely despite the lack of an explicit target, and as Ingves (2007: 5) explains for the case of the Riksbank, "... we do not target house prices, but we do not ignore the risks associated with them." Additionally, it is generally regarded as extremely difficult to predict future asset price movements or discern the presence of financial bubbles, and what information is available can seldom confirm whether changes in asset prices reflect movements in fundamental factors or not. By specifying in this way we are also able to account for the ideas advanced by Cecchetti et al where previously observed deviations in the prices of assets should induce changes in interest rates, while their future values remain untargeted.

Sweden is a small open economy, and it has regularly been argued that for such economies an exchange rate term should also be added to the Taylor rule specification (e.g. Bask 2006, Chadha et al 2003). An example would be the deviation of the real exchange rate from its equilibrium level, however, there are significant problems with calculating equilibrium levels for the real exchange rate (Baffes et al 1997), a variable which is furthermore not observed and where changes are difficult to distinguish from nominal exchange rate movements (Sawyer & Sprinkle 2015: 337). Other studies have instead included a term for the exchange rate between the national currency and another, more dominant currency (e.g. Claida et al 1998: 1055). For Sweden, the obvious choice here would be the Euro, and prior to its inception the D-mark. This is due to the tight integration of the Swedish business cycle with the German and European ones (Bergman 2008: 57-8), and Sweden's dependence on exports to the European market. Given that successive bouts of inflation and erosions of competitiveness plagued Sweden prior to the establishment of an inflation-targeting regime for the Riksbank, it is conceivable that the Riksbank pays special attention to the SEK/EUR exchange rate. Indeed, perhaps because of this the SEK/EUR exchange rate has been largely stable since the mid-90s, as can be seen in figure 4.1. In light of this stability, we can expect that the Riksbank may wish to keep the SEK within a certain "band" in its relationship to the euro, even although this is not an explicit target. As such, we use the percentage deviations of the SEK/EUR exchange rate from its average level for the period as an exchange rate term.

Figure 4.1: SEK/EUR Nominal Exchange Rate 1995-2014



By adding these three terms to the specification in 4.5, we obtain an augmented version of the modified Taylor rule:

$$\Delta i_t = \alpha + \beta_\pi(\pi_{t+4} - \pi^*) + \beta_y y_t^{gap} + \beta_a(a_{t-1} - \hat{a}) + \beta_h(h_{t-1} - \hat{h}) + \beta_s(s_{t-1} - \bar{s}) + \rho_1 \Delta i_{t-1} + \rho_2 \Delta i_{t-2} + \varepsilon_t \quad (4.7)$$

Here, $a_{t-1} - \hat{a}$ and $h_{t-1} - \hat{h}$ denote the lagged percentage deviations of asset prices and house prices from their trend levels respectively, while $s_{t-1} - \bar{s}$ is the lagged percentage deviation of the SEK/EUR exchange rate from its average value for the period. Regarding instruments for these variables, these are not required since the observed deviations of the asset prices from their trend levels in the previous period and the deviation of the SEK/EUR exchange rate from its average from the previous period will not be correlated with the error term for the change in the interest rate in the current period, ε_t .¹ Hence, these variables will function as their own instruments. The same applies to the two lagged values for the change in the interest rate.

The data used for the variables is obtained from quarterly data for Sweden from 1995Q1 to 2014Q4. The measure used for the short-term interest rate is the Riksbank's *reporänta*, which is the interest rate commercial banks face when borrowing from the Riksbank for a period of seven days and the short-term rate which the Riksbank uses to adjust monetary policy. The inflation target is two percent, while the deviations of inflation are calculated from the consumer price index minus the target rate. GDP data for the output gap are taken from the OECD and the output gap is approximated by an HP filter. Data for house

¹ i.e. $Cov([a_{t-1} - \hat{a}], \varepsilon_t) = 0$, $Cov([h_{t-1} - \hat{h}], \varepsilon_t) = 0$, $Cov([s_{t-1} - \bar{s}], \varepsilon_t) = 0$

prices come from *Statistiska Centralbyråns Fastighetsprisindex* while asset prices are from the OMX Stockholm All-share index. The trend levels of these series are also calculated from HP filtering as suggested by Siklos et al. (2004: 12) and the percentage deviations from these trend levels are obtained. The SEK/EUR exchange rate data is from the Riksbank. Regarding the HP filters, the value of λ is set at 4800 for quarterly data, and we also drop the first and last observations in the series to reduce the risk of imprecise trend estimates at the start and end of the sample in accordance with standard practice (Sørensen et al 2005: 425) (the dropped observations are from 2015 and 1994). The data for the interest rate, inflation, asset prices and the SEK/EUR exchange rate were aggregated from monthly to quarterly using 3 month averages. The regression in 4.7 is initially estimated using Two Stage Least Squares (2SLS) with HAC standard errors and the aforementioned instruments.

V. RESULTS & ANALYSIS

Table 5.1 reports the results from the initial 2SLS regressions using the modified Taylor rule set out above. From these results we can deduce that the deviations of stock and house prices from their trend values do not have a meaningful impact on changes in the interest rate, as none of the asset price variables are significant. On the other hand, the Riksbank

Table 5.1: 2SLS Regression Results

Explanatory Variable	2SLS Estimates	S.E.s
β_π <i>inflation gap</i>	0.22** [0.005]	0.06
β_y <i>output gap</i>	0.04 [0.568]	0.07
β_a <i>asset prices</i>	0.001 [0.840]	0.003
β_h <i>house prices</i>	-0.05 [0.068]	0.03
β_s <i>SEK/EUR</i>	0.002 [0.850]	0.19
$\rho_1 \Delta i_{t-1}$	0.72** [0.000]	0.15
$\rho_2 \Delta i_{t-2}$	-0.26* [0.033]	0.12
T	77	
R^2	0.59	

- (i) p-values are given in parentheses
- (ii) * Indicates significance at the 5 percent level
- (iii) ** Indicates significance at the 1% level
- (iv) Instruments: $\pi_{t-1...4} - \pi^*$, $y_{t-1...4}^{gap}$, $com_{t,t-1...4}$, $a_{t-1} - \hat{a}$, $h_{t-1} - \hat{h}$, $s_{t-1} - \bar{s}$, Δi_{t-1} , Δi_{t-2}

does react to inflation and a one percentage point increase in the expected deviation of inflation from its target rate is associated with a short-run change in the interest rate of +0.22 percentage points. Additionally, we receive no significant result for the measure of the output gap, and this is similar to results from some other studies of inflation-targeting central banks (e.g. for the Riksbank: Berg et al 2004: 28). This is also the case when we look at the first coefficient for interest rate smoothing, which is indicative of the presence of smoothing and of policy “gradualism”, something which is commonly found in other studies (e.g. Castelnuovo 2003: 8-9), and confirms the likely preference of central banks like the Riksbank to only make incremental changes to their policy rates.

Instrument Diagnostics

Having estimated the 2SLS equation, we can now determine if this was indeed the right choice of estimator by running a series of tests. The first test we run is to determine whether or not the regressors of the inflation gap and the output gap are in fact endogenous. To do this, we conduct a Durbin-Wu-Hausman test with the null hypothesis that the suspect regressors are exogenous to the model. As can be seen in table 5.2, we clearly reject this null and confirm that the inflation and output gaps are endogenous. The next important test to be carried out is the Sargan test of overidentifying restrictions where the null hypothesis is that the instruments chosen are uncorrelated with the error term. For this test we are unable to reject the null hypothesis and conclude therefore that the instruments are valid and that the 2SLS estimation is thereby consistent.

Table 5.2: Instrument Diagnostics 1

	Regressor endogeneity test		Sargan Test
	$H_0 =$ Regressors are exogenous		$H_0 =$ Instruments uncorrelated with ε_t
Durbin score	11.66	Sargan score	4.032
p-value	0.003	p-value	0.402

However, when we check for the weakness of our instruments, we unfortunately detect considerable weakness. The 2SLS estimator is therefore not unbiased, with Stock-Yogo

tests in table 5.3 indicating that we are unable to reject null hypotheses of “size distortions” where the true significance level of hypotheses tested may be much lower than five percent. We have thus run into a weak instruments problem where despite instrument validity and the inconsistency of OLS having been confirmed, our results may still suffer from large bias. This means that we cannot trust only the 2SLS estimates. This is a recurring problem in the estimation of macroeconomic and time series models where there are few observations, and it is common for the 2SLS estimators to perform poorly in small samples (Woolridge 2013: 521-2). The problem is amplified when there are many instruments relative to the number of endogenous regressors (Bun & Windmeijer 2010: 2).

In order to deal with these problems we rerun the regression using Limited Information Maximum Likelihood (LIML) estimation, which is a linear combination of OLS and 2SLS estimators and has better small sample properties than 2SLS (Hausman 1983, Imbens 2010: 2). Additionally, we drop later lags of the instrumental variables which are less likely to be correlated with the endogenous variables. We can thus see how the results are affected and compare how well the estimates now perform to judge if there is any improvement.

Table 5.3: Instrument Diagnostics 2: Instrument quality in 2SLS & LILM

	2SLS			LILM		
	Cragg-Donald F-Stat = 4.71			Cragg-Donald F-Stat = 3.98		
Size significance ⁽ⁱ⁾	10%	21.68		Size significance	10%	3.90
	15%	12.33			15%	2.83
	20%	9.10			20%	2.52
	25%	7.42			25%	2.35

(i) H_0 = True significance level of hypothesis tests is below x% when the estimate level is 5%

As can be seen from table 5.3 above, the use of LILM improves the performance of the instrumental variables estimation and performs considerably better regarding size distortions of the significance of tests conducted on the regression coefficients. Indeed, from the Cragg-Donald statistics we can even reject the null hypothesis that the true level of significance in hypothesis testing is below ten percent when nominally five percent. As

such, it appears the small sample bias of the 2SLS estimator has been eliminated. The results of the re-estimation of equation 4.7 using LIML are given below:

Table 5.4: LIML Regression Results

Explanatory Variable	LIML Estimates	S.E.s
β_{π} <i>inflation gap</i>	0.36** [0.000]	0.09
β_y <i>output gap</i>	-0.03 [0.660]	0.07
β_a <i>asset prices</i>	0.001 [0.810]	0.004
β_h <i>house prices</i>	-0.07* [0.020]	0.03
β_s <i>SEK/EUR</i>	-0.01 [0.411]	0.19
$\rho_1 \Delta i_{t-1}$	0.74** [0.000]	0.14
$\rho_2 \Delta i_{t-2}$	-0.15 [0.338]	0.15
T	77	
R^2	0.43	

- (i) p-values are given in parentheses
- (ii) * Indicates significance at the 5 percent level
- (iii) ** Indicates significance at the 1% level
- (iv) Instruments: $\pi_{t-1...2} - \pi^*$, $y_{t-1...2}^{gap}$, $com_{t,t-1...2}$, $a_{t-1} - \hat{a}$, $h_{t-1} - \hat{h}$, $s_{t-1} - \bar{s}$, Δi_{t-1} , Δi_{t-2}

The results of the LILM estimates largely confirm those attained from 2SLS estimation, though this time without the possible considerable bias. The short-run response to

deviations of expected inflation from the target rate induce a stronger short-run response on the interest rate this time around, with a one percentage point deviation producing a change in the interest rate of 0.36 percentage points. Importantly, we obtain a small negative, yet statistically significant value for the deviation of house prices from trend levels. This manifestly rejects any notion that the Riksbank has reacted to an increased gap between actual house prices and trend levels (i.e. accelerating increases in house prices) by increasing the interest rate in attempt to cool the housing market. Rather, we can deduce that the reverse is likely to be true and that reductions in the interest rate have probably helped fuel house price inflation. We once again find no significant relationship between interest rate setting and stock prices or the SEK/EUR exchange rate, while the degree of “policy inertia” or preference for interest rate smoothing as denoted by the lagged changes in the interest rate is of similar size to our 2SLS estimations. We can finally add, that the similarity of the results of the LIML and 2SLS methods, and the better performance of largely the same instruments used in both estimations, suggests that the 2SLS weak instrument diagnostics may have performed poorly. Indeed, it is puzzling why the instruments were found not to be sufficiently correlated with the endogenous variables in the first instance given that they comprise lagged values of these same variables, and that these are the standard instruments used routinely elsewhere in the literature.

Different Directors

We now complement our estimates for the whole period with two separate estimates for the tenures of different directors of the Riksbank. The current director Stefan Ingves has held the post since 2006 and he was preceded for a brief period by Lars Heikensten from 2003-5 and by Urban Bäckström who presided from 1994 to 2002. We can therefore receive an indication of if, or how, concern for each of the variables in our equation has changed under the leadership of the different directors. We of course lose statistical power and instrument problems will be amplified because of the reduction in observations for each period, but the exercise is nevertheless interesting, and its results are displayed in table 5.5.

As we can see, we do not to obtain a strong or significant coefficient for asset prices for any of the directors. For the Bäckström and Heikensten years we fail to attain a strongly positive or significant coefficient for inflation, which contradicts the Taylor rule. These results appear to fit with the empirical story, however, as from 1994 to 2005, inflation remained under target for the greater part of the period even when monetary policy was consistently expansionary and interest rates fell from previous highs (figures 5.1 and 5.2). Additionally, in the earlier part of the period the Riksbank was still engaged in a policy of disinflation, where high interest rates were prolonged even as inflation fell, in order to build credibility for the recently agreed upon inflation target GDP performed steadily as Sweden emerged from the 1990s crisis, and the Riksbank appears to have supported this expansion in the style of central banks generally during the Great Moderation years.

Indeed, the early 2000s have been characterised as a period when central banks in advanced economies did not follow the Taylor rule (e.g. Hofmann & Bogdanova 2012: 38, Taylor 2009: 2), and the Riksbank may fit this pattern, and this would also serve as an explanation as to why asset prices once again are not found to be significant.

Meanwhile, Ingves's directorship is characterised by a statistically meaningful response to forecasted inflation and a significant coefficient of similar size to out other estimates is obtained. This is again borne out by the empirical evidence as Ingves has faced inflationary

Table 5.5: Estimates for Different Directorships of the Riksbank

Explanatory Variable	Bäckström, Heikensten (1994-2005)	Ingves (2006- present)
β_π <i>inflation gap</i>	0.05 [0.541]	0.20* [0.024]
β_y <i>output gap</i>	-0.27 [0.136]	0.03 [0.758]
β_a <i>asset prices</i>	0.013 [0.101]	-0.001 [0.885]
β_h <i>house prices</i>	0.002 [0.958]	-0.06 [0.289]
β_s <i>SEK/EUR</i>	-0.01 [0.461]	-0.003 [0.833]
$\rho_1 \Delta i_{t-1}$	0.74** [0.001]	0.51** [0.008]
T	44	33
R^2	0.50	0.67

(i) p-values are given in parentheses

(ii) * Indicates significance at the 5 percent level

(iii) ** Indicates significance at the 1% level

(iv) Instruments: $\pi_{t-1...2} - \pi^*$, $y_{t-1...2}^{gap}$, $com_{t,t-1...2}$, $a_{t-1} - \hat{a}$, $h_{t-1} - \hat{h}$, $s_{t-1} - \bar{s}$, Δi_{t-1}

headwinds twice during his tenure, once before the late 2000s financial crisis and again during Sweden’s seemingly swift recovery from the ensuing recession (figure 5.3). Hence, the response to inflation is attributable to the countercyclical policy which was intended to ward off inflationary pressures which were judged to be arising out of Sweden’s initially rapid recovery. Importantly, however, the asset price coefficients remain insignificant. This implies that the interest rate increases taking place during this period, for example in 2010, which have been criticised as leaning too heavily “against the wind” with apparent concerns about asset prices as the primary reason, instead have been motivated by forecasts about inflation. This is something which is again supported by statements by members of the Riksbank’s executive board who have said that rate hikes in the early 2010s were motivated by traditional monetary policy concerns about forecasted inflation, forecasts whose content was widely echoed by prognoses from other private and public institutions (Jansson 2014b: 3, 5-6). A final additional comment is that monetary policy under the Ingves directorship is found to be less inertial and a lower value for the smoothing parameter is obtained. This likely has to do with the relatively quick reversals in the direction of interest rate policy which have taken place during his tenure.

Figure 5.1: Reporänta for Sweden 1995-2005

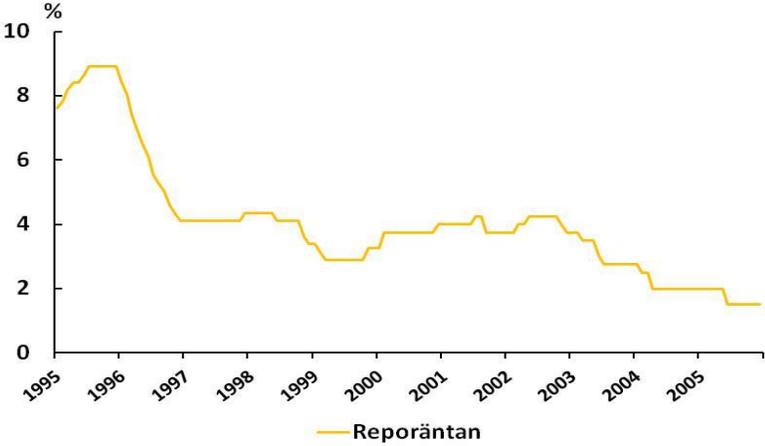


Figure 5.2: Output and Inflation Gaps for Sweden 1995-2005

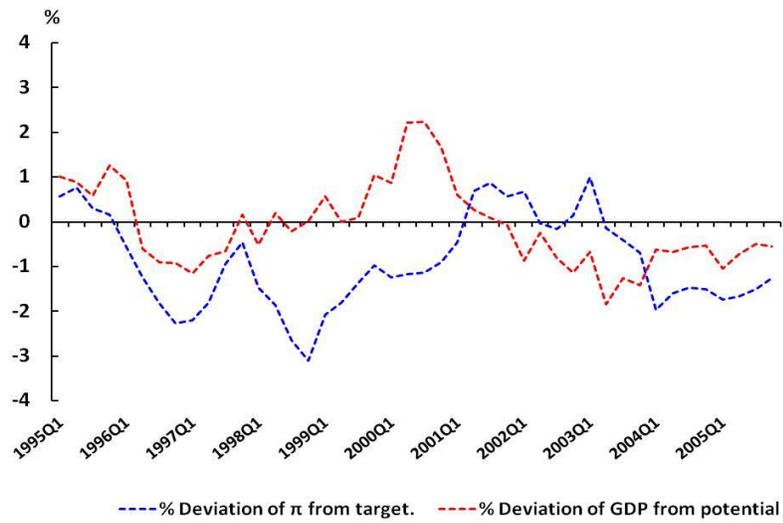


Figure 5.3: Reporänta for Sweden 2006-2014

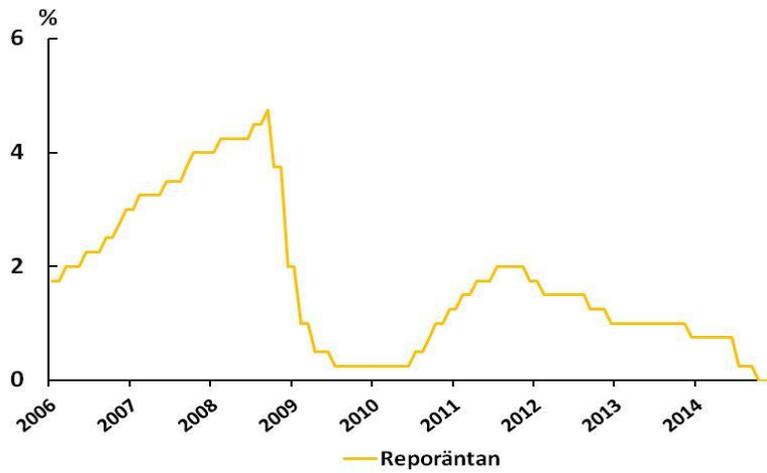
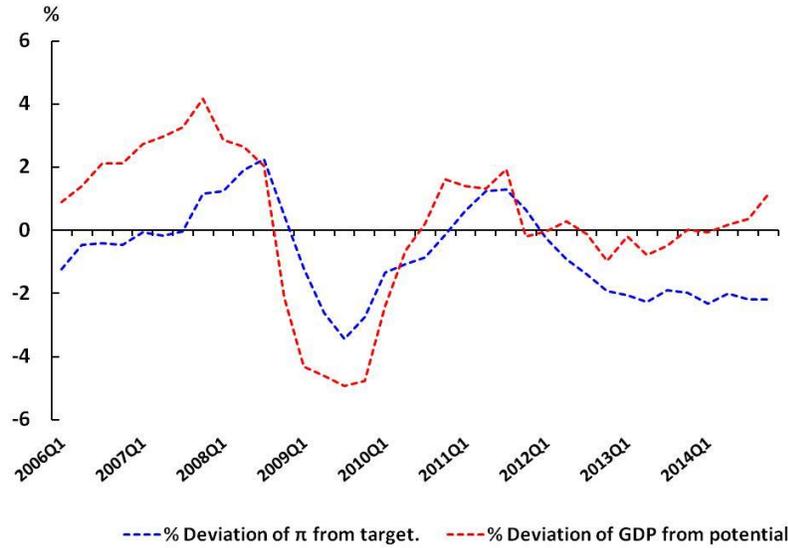


Figure 5.4: Output and Inflation Gaps for Sweden 2006-2014



Implications

We do not find evidence that the Riksbank has been reacting to the deviation of asset prices from trend levels by altering the interest rate for any of our regressions. In the only regression where house prices are significant, it is in fact in the opposite direction implying that interest rates have been cut despite real estate prices deviating positively from “normal” levels. Our results thus lead to a rejection of the notion that the Riksbank’s policies of, for example, raising interest rates in 2010-11 rest on concerns about asset prices and not forecasts about target inflation. This allows us to conclude that the Riksbank has been behaving in a manner consistent with that outlined by Bernanke & Gertler (1999), whereby asset prices may indeed play a role in the deliberations of monetary policymakers, but primarily in so far as these give suggestions about the future course of inflation. It does not appear that the Riksbank has followed the recommendations of Checchetti et al. (2002), in spite of communication by members of the Riksbank sometimes being interpreted to the contrary. This suggests that the criticisms by Giavazzi & Mishkin (2006) leveled at the bank’s communication strategies regarding how its policies relate to asset prices may still be valid.

That we draw these conclusions has important implications for financial stability in Sweden. We can see from our results that the variable of overriding significance for the setting of short term interest rates has been forecasted inflation, something which places the Riksbank’s behaviour much more in the context of the prescriptions of Tinbergen’s rule of one policy tool, one goal, as opposed to taking on too many other responsibilities at once. With inflation now at zero in Sweden, a *long* way from its target, a Riksbank behaving in

accordance with our conclusions will be very unlikely to suddenly take significant action through interest rate hikes to reduce dangers arising from potential real estate or stock market bubbles. Indeed, current communication from the Riksbank at face value confirms this, and the bank has declared itself ready to engage in further expansion to bring up the inflation rate, and sizeable rate hikes are probably not near at hand.

We note also that monetary policy in Sweden confirms the notion of interest rate smoothing and that this practice is, along with inflation, an important determinant of the interest rate. This also applies to the Ingves directorship, even if its monetary policy has been less inertial than in previous years. In light of this, it would take an unreasonably large swing in the Riksbank's behaviour for the path of interest rates to be reversed rapidly. In fact, by adhering to gradual and incremental movements in the interest rate, the Riksbank effectively rules itself out of the running to carry out adjustments in the interest rate in a large and unpredictable fashion in an attempt to dampen developments in asset markets. In addition, we know from the economic theory previously discussed that without smoothing financial stability can be undermined. So, even if smoothing were to be abandoned, this would probably conflict with the Riksbank's mandated goal of maintaining a stable and efficient payments system.

At the same time, the significant potential macroeconomic risks of inflated stock prices and house prices in Sweden remain. To make matters worse, these are being exacerbated by the structural factors earlier mentioned, particularly in real estate where housing supply is at a fraction of efficient levels while the possibility for households to benefit from interest rate deductions encourages higher borrowing. Additionally, with interest rates at record lows and likely to remain there for the foreseeable future, the room for maneuver for the Riksbank to conduct conventional monetary stimulus is minimal in the event that a housing bubble does burst and unleashes negative effects on the real economy.

Unfortunately given the circumstances, important macroprudential reforms have thus far either been delayed (the mortgage requirement), or basically ruled out by unwilling politicians (the abolition of interest rate reductions). This is far from an encouraging sign. The prevailing monetary stance and the conclusions drawn here about the Riksbank's behaviour mean that it is incumbent upon other institutions, like Finansinspektionen and the Swedish government, to make up for the macroprudential deficit Sweden currently faces.

VI. CONCLUSIONS

This study has investigated whether or not the Riksbank has been reacting to deviations of asset prices from trend levels when setting the short-term interest rate. Having surveyed debates about the Riksbank's performance, as well as the economic theory regarding how central banks should act, we then presented a modified Taylor rule incorporating forward looking central bank behavior, asset prices and interest rate smoothing. From the regression results we concluded that deviations of asset prices from trend levels have not induced a reaction by the Riksbank in the form of increases in interest rates. Instead the Riksbank has reacted to forecasts about inflation, and has set interest rates in a way characteristic of interest rate smoothing. In light of this, we do not find support for the claim that the Riksbank has disregarded its inflation targeting mandate in order to lean against the wind out of concern for asset prices. That the Riksbank has primarily focused on inflation and adjusting the *reporänta* only gradually has important policy implications. Based on its historical behaviour, and with inflation at zero and interest rates negative, the Riksbank should not be expected to undertake sizeable policy reversals in order to check asset price inflation. With this in mind, other institutions must take greater responsibility for carrying out macroprudential policy in Sweden, and instruments other than monetary policy should be used to rein in overheating in housing and asset prices, and to contain the threat posed by the potential build-up of financial imbalances.

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