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Automatic Stabilization in Sweden

- Developments through 30 years of economic change

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Abstract

This thesis deals with the topic of effectiveness of automatic stabilization in Sweden from 1970 and onwards. A simple model of how the business cycle affects taxes (through the automatic stabilizers) is used to construct new series for disposable incomes, aggregate demand components and finally aggregate demand. The effectiveness of the automatic stabilizers is measured using the ratio of the root mean square errors of the output gaps of the original and the constructed series. The results indicate that the effectiveness of automatic stabilizers have been decreasing steadily during the examined period. The causes of this decrease in effectiveness are discussed with respect to an overview of important economic changes in the Swedish economy, such as the deregulated financial markets, introduction of the floating exchange rate and decreases in the replacement rate in the unemployment insurance system and the level of progressivity in the tax system.

Keywords: fiscal policy, automatic stabilization, Sweden

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1. Introduction

The business cycle is one of the most prominent features of capitalist economies. We see ever reoccurring patterns of booms being followed by downturns. This has caused a number of fields of related research. One such field is that trying to determine what causes the business cycle. Models have been constructed that try to mimic the behavior of actual business cycles, with respect to magnitude, length and correlations with other macroeconomic variables. A second field of research is concerned with determining the welfare costs of business cycles. Whether one believes that output fluctuations have negative welfare effects, or not has major implications for the topic of this thesis – fiscal policy. Proponents of the view that the negative effects of output fluctuations are small do not see any reason to engage in fiscal policy as a way of reducing the amplitude of business cycles. On the other hand, if one adheres to the idea that business cycles are welfare reducing, fiscal policy alongside monetary policy is an important area of research.

In this thesis I study a specific kind of fiscal policy called automatic stabilizers. An automatic stabilizer is defined as government expenditure and revenue categories that change automatically with the business cycle. As an example, we consider income taxes and unemployment insurance in the case of an economic downturn. As an effect of the lowered activity in the economy unemployment will increase. The automatic stabilizers will now work in two ways to counteract the decrease in aggregate disposable income associated with higher unemployment. First government transfers will increase through the unemployment insurance system, and secondly the total income tax will decrease as total pre-tax income decreases. Without these automatic responses the fluctuations in aggregate demand would be higher, and thus the magnitude of the business cycles would be larger.

Automatic stabilizers can have significant stabilizing effects on the business cycle. Van den Noord (2000) finds that in the OECD countries automatic stabilizers reduce the business cycle magnitude by on average 25 percent. The effectiveness of automatic stabilizers has important implications for economic policy. If a government implements economic policy changes, the effectiveness of automatic stabilizers can be significantly affected. If a change in policy results in a significant reduction of the effectiveness of automatic stabilizers the government should consider other stabilization policies, for example more active fiscal policies.

The Swedish economy has experienced a number of significant changes during the last 35 years relevant to automatic stabilization. The most noticeable is perhaps the increased openness. In the early 1970´s imports and exports as share of GDP was just above 20 percent. In 2006 imports had increased to above 40 percent and exports were approaching 50 percent of GDP. Another important change with respect to openness is that of financial deregulation. During the 1980´s a number of deregulations of international transactions were abolished. Among other things this allowed capital to move more freely, and financial assets to be traded outside of Sweden[1]. In 1990-1991 a major tax reform was implemented. One important aspect of the reform with respect to automatic stabilizers was the decrease in marginal taxes on labour income, and the increase in value added taxes introduced to counteract the lowered income tax revenues (Eklund 2001 p. 419). The result was a decrease in the degree of progressivity in the tax system. In November 1992 it was time for the next major change in the Swedish economy – the floating currency exchange rate. After major disturbances in the currency markets Sweden gave up defending the fixed exchange rate[2]. Even though this list of changes is not exhaustive it constitutes a foundation from which the development of automatic stabilizers can be examined.

With the current financial crisis, and following economic crisis, fiscal policy has once again become a topic of major interest. Also in Sweden many economists are proponents of fiscal stimulus as a way of stabilizing the business cycle. Others claim that the need for fiscal stimulus is not that large due to the fact that automatic stabilizers in Sweden (as well as the rest of Europe) are large compared to for example the US. There is not much research though on how the effectiveness of automatic stabilizers in Sweden has developed over time. The Swedish economy is usually considered to have a number of characteristics that contribute to large automatic stabilizers, among others the unemployment benefit system and a progressive tax system. During the last decades though, several of these have changed in a way such that their contribution to automatic stabilization should have decreased.

The purpose of this thesis is to study how the effectiveness of automatic stabilizers has changed during the period 1970-2006, a period during which the Swedish economy has experienced a number of significant changes.

[1] For a more detailed overview of the deregulation see Englund (1990).

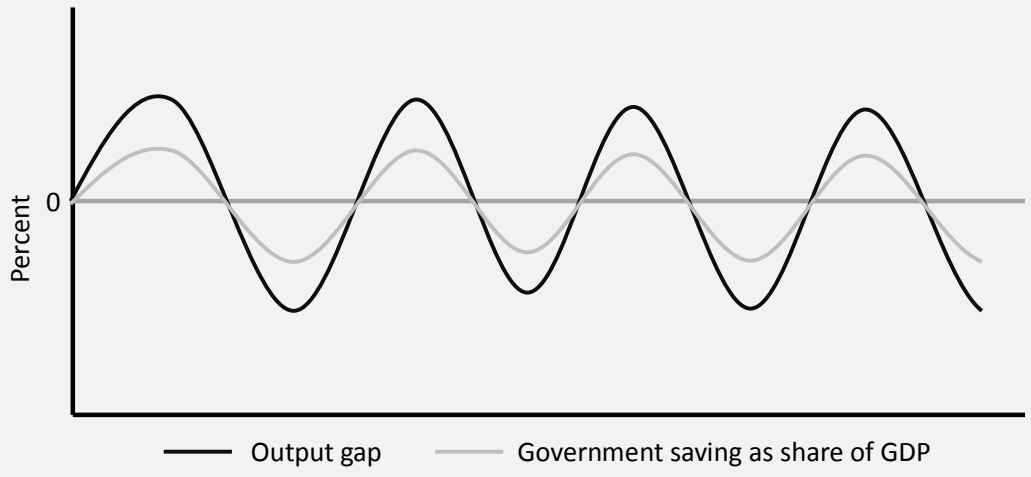
[2] For a review of the events that led to this decision see Sveriges Riksbank (1993).

The first part of section 2 of this thesis contains a review of the theory of and research on fiscal policy and automatic stabilizers. A number of topics such as Ricardian equivalence, openness and exchange rate regimes are discussed with respect to automatic stabilizers. This is followed by an explanation of the model and method used to estimate the effectiveness of automatic stabilizers. Section 3 discusses data collection, transformations and where necessary approximations to variables in the model. Section 4 contains a discussion on changes in the Swedish economy during the period of interest. Changes in GDP composition, international integration, the exchange rate regime and other relevant policy changes are discussed and their importance for automatic stabilizers is analyzed. In section 5 the model is estimated and the effectiveness of automatic stabilizers is calculated. Section 6 contains a discussion on the results and the method as well as some ideas for improvements and in the final section the results are analyzed.

2. Theory and method

2.1 Theory of automatic stabilizers

Figure 1: Output gap and fluctuations in government savings



The original theory behind automatic stabilizers can be considered a fairly simple one; certain categories of government revenue and expenditure react automatically to the business cycle and in doing so they counteract fluctuations in aggregate demand. In aggregate data this can easily be seen by the fact that government saving is pro-cyclical, i.e. it increases when the economy grows faster and decreases when growth slows down, as depicted in figure 1. One example of a type of government expenditure that causes government saving to decrease when the growth slows down

is unemployment insurance, which acts to stabilize household disposable income, in a recession (boom) by increasing (decreasing) government transfers and thus decreasing (increasing) government saving, and in doing so offsetting the decrease (increase) in aggregate household disposable income caused by increased (decreased) unemployment.

A number of critiques against this theory, and the methods used to examine the effectiveness of automatic stabilizers have been put forward during the last 30 year. Some have been directed at fiscal policy in general but have also had implications for how economists have viewed the stabilizing effects of automatic stabilizers. Christiano (1984) examines a number of these critiques and their validity.

The first is the Lucas critique which implies that it is not possible to determine the effectiveness of automatic stabilizers because we do not know what changes their removal would cause in the dynamic structure of the economy. A relevant example would be that we do not know how savings behavior will be affected by removing the unemployment insurance system, and therefore a counterfactual analysis of automatic stabilizers might not be accurate. One conclusion drawn from this is that it is not enough to determine the static effectiveness of automatic stabilizers, because in a dynamic setting the automatic stabilizers could in fact be destabilizing.

The second line of critique is based on the policy ineffectiveness proposition. The main argument is that since the government has no information advantage over individuals, and individuals form rational expectations from knowledge of the government policy rules, fiscal policy has no effect on the behavior of individuals. As Christiano points out it is not obvious that the government would not have access to more complete information with respect to automatic stabilizers. Since automatic stabilizers are assumed to react automatically to the business cycle, the government does not actually need to observe the business cycle for automatic stabilizers to work. A related line of critique is that since unemployment is lagging behind the business cycle, the automatic stabilizers might actually react too slowly. If the lag between changes in the business cycle and unemployment is too large, automatic stabilizers might not have an advantage over other kinds of fiscal policy.

The third critique considered is that of the Ricardian equivalence theorem. For this thesis the relevant implication is that a change in tax revenues not associated with a present or future

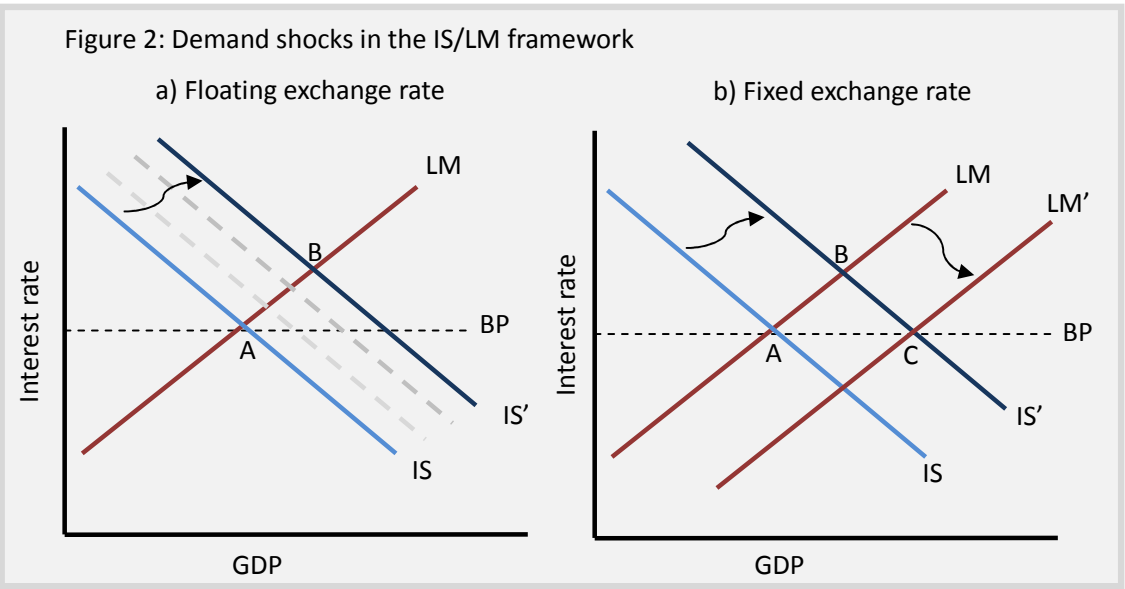
reduction of government expenditure will not have any effects on individuals' life-time wealth, and thus consumption smoothing individuals will not change their consumption as a result of a temporary change in taxes, since any change in government spending is fully internalized by the individuals in the economy (Sorensen and Whitta-Jacobsen 2005 p. 484). If the Ricardian equivalence theorem holds, then the changes in tax revenues – in the form of automatic stabilizers – would therefore be assumed to be followed by a future change in the opposite direction, and therefore not affect the consumption pattern of individuals. Christiano shows, using a two-period model that if it is not possible for individuals to distinguish between common (affects the whole economy) and idiosyncratic (only affects the individual) shocks this proposition does not hold. If an individual believes that a negative shock is idiosyncratic, even when it is common, he will not assume that the current decrease in tax liabilities will be offset by a future increase, and therefore will not decrease consumption in order to be able to pay for future tax increases. Christiano thus shows that income tax in fact has a stabilizing effect on aggregate consumption, in the case when it is not possible to perfectly distinguish between common and idiosyncratic shocks.

Unemployment insurance is often assumed to be an important part of automatic stabilizers. In an economic downturn the reduction in aggregate disposable income due to increased unemployment is partially counteracted by the benefits unemployed individuals receive from the unemployment insurance system, thus reducing their fall in total disposable income. A counter argument though, is that in the absence of an unemployment insurance system individuals would save money to be able to smooth their consumption, thus achieving the same result as the unemployment insurance. This argument is examined by Hamermesh (1982) in a study of unemployment insurance in the US. Cerda and Vergara (2007) use a dynamic general equilibrium model where a fraction of the population is liquidity constrained to study the stabilizing effects of the unemployment insurance system in Chile. They conclude that it does indeed have a stabilizing effect, though they are not of the opinion that it is large enough to justify an unemployment insurance scheme exclusively from its stabilizing effects.

Another relevant discussion is that of the effectiveness of fiscal policy with respect to different exchange rate regimes. Figure 2 shows the reactions to a fiscal policy expansion in the IS/LM framework, in the case of both fixed and floating exchange rate regimes. First consider a fiscal

expansion (which is what the automatic stabilizers are equivalent to in an economic downturn) in the case of a floating exchange rate regime. This would shift the IS curve in panel a) to the right, thus moving the intersection between the IS and the LM curves from point A to B, pushing the interest rate above the world interest rate. As the interest rate increases, capital will flow into the country and the currency exchange rate will appreciate. The effect will be to make exports more expensive and imports cheaper and therefore the trade balance will worsen. The increased interest rate will also decrease the level of investment through the higher cost of financing. As a consequence the IS curve will start shifting back along the dashed lines in the figure, a process that will keep on until the IS curve is back at the original position and the interest rate is back at the world interest rate. Therefore the initial fiscal expansion will have been fully offset by the worsening of the trade balance and decreased investment levels. This analysis suggests that automatic stabilizers, and other forms of fiscal policy, are not effective in a small open economy with a floating exchange rate regime, like Sweden.

Figure 2: Demand shocks in the IS/LM framework



Since Sweden changed from a fixed to a floating exchange rate during the period examined in this thesis, it is also relevant to examine the results of a fiscal expansion in the case of a fixed exchange rate; this is done in panel b) of figure 2. As in the floating exchange rate case the initial response to a fiscal expansion is a rightward shift of the IS curve, and thus the intersection between IS and LM curves move to point B. As a response to the increased money demand the interest rate increases to maintain equilibrium in the money market. The increased interest rate

will in turn attract foreign investment, thus increasing demand for the domestic currency. To defend the fixed exchange rate the central bank will sell domestic currency and buy foreign currency, thus increasing the money supply. This shifts the LM curve to the right until it reaches LM', and the interest rate is back at the world interest rate. The fiscal expansion has thus caused an increase in GDP, and a new equilibrium at point C[3].

From the discussion on fiscal policy with respect to different exchange rate regimes we can draw the conclusion that fiscal policy, and therefore automatic stabilizers, were potentially effective before Sweden abandoned the fixed exchange rate in late 1992. Within the IS/LM framework fiscal policy in a small open economy with a floating exchange rate is not effective at all. A fiscal expansion is fully offset by the negative effect on the trade balance. Several studies have found that this result is not robust to the introduction of different kinds of market rigidities and imperfections[4]. Short-run aggregate demand effects from fiscal policy are also derived in a number of macroeconomic models, for example those developed by Konjunkturinstitutet and the Bank of England (Konjunkturinstitutet 2008 p. 29).

2.2 Prior research

Empirical research on automatic stabilizers can generally be divided into two categories: 1) research trying to determine the determinants of automatic stabilization effectiveness and 2) research trying to determine the effectiveness of automatic stabilizers.

2.2.1 Determinants of the effectiveness of automatic stabilizers

As the automatic stabilizers are assumed to work mainly through taxes an obvious determinant of the effectiveness of automatic stabilization is the income tax system, and more specifically the level of progressivity. Kniesner and Ziliak (2000) study the effects on automatic stabilization of the Economic Recovery Tax Act of 1981 and the Tax Reform Act of 1986 in the US. They make the point that the progressive income tax system stabilizes private consumption by acting as a form of insurance. If the tax rate is dependent on the level of income, a sudden decrease in

[3] For a more detailed discussion on fiscal policy within the IS/LM framework see Burda and Wyplosz 2005.

[4] For example short-run price and wage rigidities in many models cause temporary fiscal policy to have short-run effects on aggregate demand. See Hemming et al (2002) for a literature review.

income will cause the individual to move down to a lower tax bracket. Compared to a system with a single tax rate the loss of disposable income can be significantly lower in the progressive case, thus stabilizing the consumption of individuals. The same applies in the case of an individual experiencing an increase in income; since a higher tax bracket will be reached the increase in disposable income will be smaller than the increase in pre-tax income. Kniesner and Ziliak find that the tax reforms in the US reduced the progressivity of the tax system, by lowering marginal tax rates and reducing the number of tax brackets, and thus decreased the tax system's contribution to consumption stabilization significantly. This is not a general conclusion though. Rodseth (1984) uses a simple open economy macroeconomic model with fixed exchange rate to derive the result that even though an increase in the progressivity of the tax system is likely to contribute to reducing the impact of a demand shock, it can magnify the impact of wage shocks as well as contribute to destabilizing the wage formation process, and thus the overall result can be destabilizing.

Another determinant of the effectiveness of automatic stabilizers is the size of government, measured as government spending or taxes as share of total output. Even though there does not seem to be any consensus on the theoretical reasons for a negative relationship between output volatility and size of government, several studies have found significant empirical results supporting this relationship (see for example Fatás & Mihov 2000 and Debrun et al 2008). One explanation for this empirical result is that government consumption is often less volatile than private consumption, and therefore a high share of government consumption to GDP decreases aggregate demand volatility. But Fatás & Mihov also examine if there is a positive relationship between government size and the size of automatic stabilizers. They conclude that there is such a relationship, but do not propose a specific theoretical foundation for this relationship. What they do find is that there is also a positive relationship between government size and the size of tax and transfer elasticities with respect to output fluctuations. The positive relationship between the effectiveness of automatic stabilizers and government size might therefore be explained by the fact that government size is a proxy for other determinants of the effectiveness of automatic stabilizers.

From the previous discussion on the exchange rate regimes and their consequences for fiscal policy we know that in the case of an open economy fiscal policy is thought to be effective with a

fixed exchange rate and non-effective with a floating exchange rate. It would seem reasonable though that in the case of a floating exchange rate, the degree of openness would be correlated with the speed of adjustment to the world interest rate, and thus the effectiveness of fiscal policy should also depend on the degree of openness in the economy.

2.2.2 Effectiveness of automatic stabilizers

As discussed before, a necessary condition for automatic stabilizers to be effective is that fiscal policy is effective. The previous section dealt with the theoretical arguments, but without empirical results we cannot make an informed judgment as to whether fiscal policy is actually effective in Sweden. The most common method for assessing this is studying the size of fiscal policy multipliers. The multiplier is a measure of how much GDP changes from a fiscal expansion or contraction of one unit. A multiplier of 1 would thus mean that an increase in government spending by one SEK causes GDP to increase by one SEK. Unfortunately the research regarding fiscal policy multipliers for the Swedish economy is very limited. When it comes to the applied use of multipliers one example is the macroeconomic model for Sweden developed by Konjunkturinstitutet where the government spending multiplier has been calibrated to 1.0 and the tax multiplier to 0.5 (Konjunkturinstitutet 2008 p. ???).

When it comes to assessing the effectiveness of automatic stabilizers van den Noord (2000) does so using a method adopted by the OECD. Using estimates of the elasticites of government expenditures and revenues with respect to output, and estimates of the output gap he calculates the cyclical components of different government expenditure and revenue categories. Through a simulation using the OECD´s macroeconomic model INTERLINK he comes to the conclusion that during the 1990´s automatic stabilizers decreased cyclical output fluctuations among the OECD member countries with an average of approximately 25 percent. For Sweden the study finds that the automatic stabilizers have dampened output fluctuations with between 25 and 30 percent during the 1990's.

In a recent study Darby and Melitz (2008) argue that most research on the effectiveness of automatic stabilizers is exclusively concerned with government tax revenues and transfers in the form of unemployment insurance. They argue that a number of other government expenditure categories also have a stabilizing effect on the economy, more specifically health care spending,

retirement benefits, and incapacity and sickness related benefits. Even if they point out that their results are not directly comparable to other studies they conclude that for thirteen member states of the European Union, government spending seems to be stabilizing to a larger extent than what is normally thought, and that therefore it is likely that automatic stabilization is underestimated in most studies.

2.3 Method applied in this thesis

2.3.1 Model of automatic stabilizers

The method applied in this thesis to assess the effectiveness of automatic stabilizers is based on one proposed by Gabriel Di Bella (2002) in an IMF working thesis titled *Automatic Stabilizers in France*. The basics of the model are fully described by the set of equations below. One important assumption is that all time series-variables can be decomposed into permanent and temporary components. The assessment of the effectiveness of the automatic stabilizers is performed using a model of how temporary changes in GDP components are affected by temporary changes in government taxes and transfers. Government taxes and transfers work as stabilizers through their effect on *household disposable income (yd)* and *entrepreneurial disposable income (ye),* which in turn are important determinants of the GDP components; *private consumption, investment* and *imports.* The structure of the method will allow the construction of new series for the cyclical fluctuations in net taxes and transfers on households and entrepreneurs, which will be approximations of what the real series would have developed like if the automatic stabilizers were not allowed to function. Using these series allows the construction of a new series for aggregate demand, through their effects on GDP components. Comparing this aggregate demand series to the actual economy then allows assessing the effectiveness of automatic stabilizers.

First of all the decomposition of a time series variable into permanent and temporary parts needs to be discussed. To be able to perfectly separate permanent from temporary changes we would need perfect information about all the relevant changes in the structure of the economy. A permanent change to a time series variable is one caused by a permanent change in structure of the economy, for example permanent policy changes. While a temporary change is one assumed to be one caused by temporary changes such as business cycle fluctuations. One example is government tax revenues that will be affected both by the business cycle (temporary changes) but

also for example by permanent changes in the tax system and the efficiency with which the government collect taxes. The decomposition of time series data can be described by the following set of equations. Eq. (1) states that any time series variable $\bar{\bar{z}}$ can be decomposed into a permanent part $\bar{z}$ and a temporary part z. Eq. (2) follows from this and states that the total relative change in a variable $\widehat{\widehat{\Delta z}}$ can be decomposed into a permanent relative change $\widehat{\Delta z}$ and a temporary relative change $\widehat{\Delta z}$.

$$\bar{\bar{z}} = \bar{z} + z \qquad (1)$$

$$\hat{\bar{z}} = \hat{\bar{z}} + \hat{z}, \qquad (2)$$

where $\hat{z} = \Delta z / \overline{\overline{z_{-1}}}$

Eq. (3) is a form of the standard GDP accounting identity, i.e. aggregate demand (y) is the sum of private consumption (c), investment (i), government consumption (g) and exports (x) minus imports (m). In this model though, we are interested in temporary relative changes. Therefore eq. 3 says that the temporary relative change in output equals the weighted sum of the temporary relative changes in the GDP components. The weights are by definition each components share of GDP in the previous period.

$$\hat{y} = a_c \cdot \hat{c} + a_i \cdot \hat{\imath} + a_g \cdot \hat{g} + a_x \cdot \hat{x} - a_m \cdot \hat{m} \qquad (3)$$

The rest of the equations follow a structure that will allow the study of automatic stabilizers. Therefore the only determinants of GDP components included are the ones that are necessary for assessment of the effectiveness of automatic stabilizers. As a consequence the equations below should not be thought of as complete models of different categories of consumption, but as a limited model suitable for the specific task of studying automatic stabilizers. This is what justifies the inclusion of the residual terms that capture the effects of factors not related to the business cycle.

Eq. (4) describes private consumption. It says that the changes in private consumption are determined by changes in household disposable income (yd) in the current, and the previous period, all other effects are captured by the residual term oc.

$$\hat{c} = \beta_1 \cdot \widehat{yd} + \beta_2 \cdot \widehat{yd_{-1}} + oc \qquad (4)$$

Investment is modeled in such a way as to allow us to study the effects of automatic stabilizers through entrepreneurial disposable income. Again the residual term captures changes caused by other factors.

$$\hat{\imath} = \beta_3 \cdot \widehat{ye} + oi \qquad (5)$$

The last GDP component to be affected by automatic stabilizers is imports. This is because imports are correlated with private consumption and investment. Contrary to the effects from private consumption and investment the effect from imports are not likely to contribute to stabilizing aggregate demand. The reasoning is that in the case of a decrease in aggregate demand, the automatic stabilizers will counteract the decrease in private consumption and investment. But some of this relative increase in private consumption and investment will be in the form of imports of consumption and investment goods; therefore some of the stabilizing effect will be lost due to import leakage. Including eq. 6 allows taking this effect into account.

$$\widehat{m} = \beta_4 \cdot \hat{c} + \beta_5 \cdot \hat{\imath} + om \qquad (6)$$

Eq. (7) and (8) describe the temporary changes in household disposable income and entrepreneurial disposable income. They share the same basic definition: a change in disposable income equals the weighted sum of temporary changes in gross income (or more specifically each factors income as share of GDP multiplied with GDP) and the net taxes/transfers. The weights are each components share of disposable income in the previous period.

$$\widehat{yd} = \gamma_y\left(\widehat{\alpha^l \cdot y}\right) - \gamma_t \cdot \widehat{t^l} \qquad (7)$$

$$\widehat{ye} = \delta_y(\widehat{\alpha^e \cdot y}) - \delta_t \cdot \widehat{t^e} \qquad (8)$$

The next two equations are the ones that will allow us to study the effects of automatic stabilizers through taxes/transfers. According to eq. (9) the temporary changes in net taxes /transfers on households can be decomposed into one part that is dependent on the changes in the business cycle and a part caused by other factors which is captured by the residual term ot^l. Since the equations are expressed in relative change terms the interpretation of the coefficient Θ^l is the elasticity of net taxes/transfers on households with respect to output. The magnitude of this elasticity determines the effectiveness of automatic stabilizers; a high elasticity will imply a

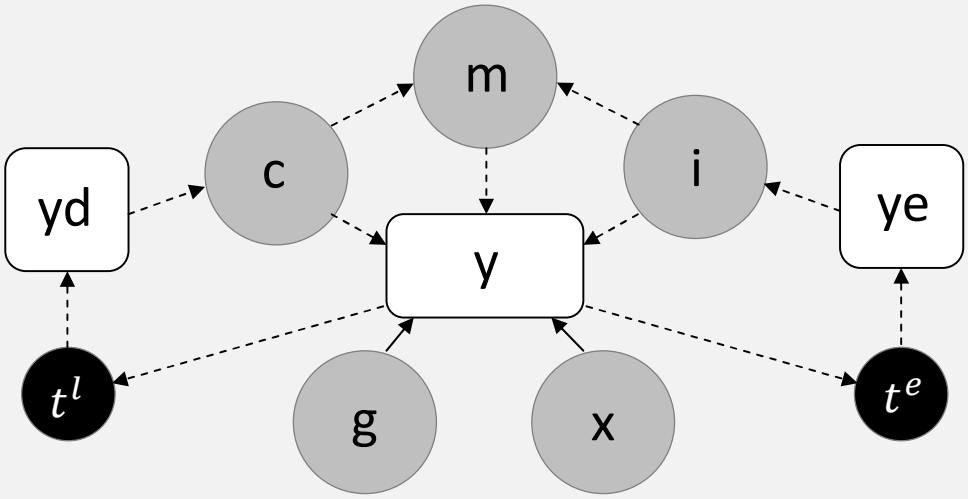
lower multiplier and therefore more efficient automatic stabilizers. This elasticity can also be studied at a less aggregated level by estimating the separate elasticities for different tax categories, and the elasticity used here would then be a weighted average of these different elasticities. Eq. (10) follows the same principle for net taxes/transfers on entrepreneurial income.

$$\widehat{t^l} = \Theta^{\mathrm{l}} \cdot \hat{\mathrm{y}} + \mathrm{ot}^{\mathrm{l}} \qquad (9)$$

$$\widehat{t^e} = \Theta^{\mathrm{e}} \cdot \hat{\mathrm{y}} + \mathrm{ot}^{\mathrm{e}} \qquad (10)$$

Fig. 3 is a representation of this model. The automatic stabilizers are represented by the dotted arrow between y and the two tax variables t^l and t^e. Studying the effects of automatic stabilizers involves removing this link and constructing a new series for all the variables determining aggregate demand. The dotted arrows represent the channels through which the automatic stabilizers work.

Figure 3: Temporary changes in GDP, its components and their relationship to automatic stabilizers



The following equations describe how the removal of the automatic stabilizers is achieved. Since it is assumed that automatic stabilization work through changes in net taxes and transfers caused by changes in the business cycle, removing $\Theta^{\mathrm{l}} \cdot \hat{\mathrm{y}}$ and $\Theta^{\mathrm{e}} \cdot \hat{\mathrm{y}}$ from eq. (9) and (10) gives the new set of eq. (9') and (10'), which is an approximation of what the temporary changes would have developed like if there had not been any automatic stabilizers in the economy.

$$\widehat{t^{l}_{new}} = \text{ot}^{\text{l}} \qquad (9')$$

$$\widehat{t^{e}_{new}} = \text{ot}^{\text{e}} \qquad (10')$$

Inserting (9') into (7) and (10') into (8) gives

$$\widehat{yd_{new}} = \gamma_y\left(\widehat{\alpha^{l} \cdot y}\right) - \gamma_t \cdot \widehat{t^{l}_{new}} \qquad (7')$$

$$\widehat{ye_{new}} = \delta_y(\widehat{\alpha^{e} \cdot y}) - \delta_t \cdot \widehat{t^{e}_{new}} \qquad (8')$$

Using $\widehat{yd_{new}}$ in eq. (4) and $\widehat{ye_{new}}$ in eq. (5) gives the new series for private consumption and investment

$$\widehat{c_{new}} = \beta_1 \cdot \widehat{yd_{new}} + \beta_2 \cdot \widehat{yd_{new_{-1}}} + oc \qquad (4')$$

$$\widehat{\imath_{new}} = \beta_3 \cdot \widehat{ye_{new}} + oi \qquad (5')$$

These new series for private consumption and investment are then used to construct the new series for imports

$$\widehat{m_{new}} = \beta_4 \cdot \widehat{c_{new}} + \beta_5 \cdot \widehat{\imath_{new}} + om \qquad (6')$$

And finally (4') , (5') and (6') can then be substituted for $\hat{c}, \hat{\imath}\ and\ \widehat{m}$ in eq. (3) to get

$$\widehat{y_{new}} = a_c \cdot \widehat{c_{new}} + a_i \cdot \widehat{\imath_{new}} + a_g \cdot \hat{g} + a_x \cdot \hat{x} - a_m \cdot \widehat{m_{new}} \qquad (3')$$

2.3.2 Measuring effectiveness

After this new series has been constructed the effectiveness of automatic stabilizers can be assessed by comparing the output gaps with and without automatic stabilizers. A common method used to do this is to calculate the ratio of the root mean square errors of the two series[5]. The root mean square error is defined as

$$RMS = \sqrt{\frac{1}{j}\sum_{t=0}^{j}\left(\frac{(\bar{\bar{z}}_t - \bar{z}_t)}{\bar{z}_t}\right)^2} = \sqrt{\frac{1}{j}\sum_{t=0}^{j}\left(\frac{gap_t}{trend_t}\right)^2}$$

[5] This approach is adopted by both Gabriel Di Bella(2002) and van Den Noord (2000).

where $\bar{\bar{z}}_t$ is the original series and $\bar{z}_t$ is the trend series. The root mean square is thus the average square root of the gap as share of trend. It should be noted that the gap and trends used in this definition of the root mean square error are expressed in levels, and therefore the new cyclical growth rates obtained using the method above cannot be directly used to measure the effectiveness of automatic stabilizers. Before calculating the RMS ratio we must instead calculate a new level series using the cyclical growth rates.

$$RMS\ ratio = \sqrt{\frac{1}{j}\sum_{t=0}^{j}\left(\frac{gap_t^{No\ AS}}{trend_t}\right)^2} \Bigg/ \sqrt{\frac{1}{j}\sum_{t=0}^{j}\left(\frac{gap_t^{AS}}{trend_t}\right)^2}$$

If the RMS ratio is written as above we can interpret it as how much the automatic stabilizers have reduced the average deviation from trend in a specific period. A RMS ratio of for example 1.25 would mean that the automatic stabilizers have reduced the deviations from trend by 25 percent.

2.3.3 Decomposition of time series data

Decomposition of time series data into permanent and temporary components can be performed using a number of different methods. Gabriel Di Bella uses the fitted values of an ARIMA estimation as the permanent component and the residuals as the temporary component. However he does not present any justification for using this method instead of for example the Hodrick-Prescott filter. One such justification could be that by using an econometric method it is possible to include dummy variables to take into account relevant changes in policy and major economic shocks. Identifying the relevant shocks for the Swedish economy is beyond the scope of this thesis, and thus the main justification for the use of econometric methods for decomposition is not relevant. Therefore I have decided to use the Hodrick-Prescott filter for decomposition of the data. The method allows us to calculate a trend by minimizing a weighted sum of the squared temporary (cyclical) fluctuations and the squared changes in the growth rate of the trend,according to the following equation[6]. Using a notation similar to that used above, $\bar{\bar{z}}_t$ denotes

[6] Technically a number of observations should be deleted at the start and end of the series because the HP-filter is known to not give accurate results for endpoints. Due to the limited data available this will not be done in this paper.

the natural logarithm of the series to be smoothed and $\bar{z}_t$ the chosen logarithmic trend for t=1,2…,T.

$$\min \sum_{t=1}^{T}(\overline{\overline{z}_t} - \bar{z}_t)^2 + \lambda \sum_{t=2}^{T-1}[(\bar{z}_{t+1} - \bar{z}_t) - (\bar{z}_t - \bar{z}_{t-1})]^2$$

The method thus involves numerically choosing the trend series $\bar{y}$ such that the above expression is minimized for a given λ. Choosing a higher λ means giving a higher weight to the trend growth rate, and thus making the trend smoother. For annual data it is common to use λ = 100 (Sorensen and Whitta-Jacobsen 2005 p. 422).

3. Data

A list of the collected data, measures and sources can be found in table 1. Before any of the data was used it was transformed into 2000 prices using a consumer price index.

Table: 1 Data, measures and sources

Variable/s	Measure	Source
GDP and components 1970 - 2006	**Mil. SEK current prices**	**National Accounts, OECD.Stat**
Household income, taxes and transfers data 1970 - 2006	**Mil. SEK current prices**	**Economic outlook No 83, SourceOECD**
Entrepreneurial income, gross income and net taxes		
Gross operating surplus/mixed income	**Mil. SEK current prices**	**National Accounts, OECD.Stat**
Tax revenues	**Mil. SEK current prices**	**Revenue Statistics, SourceOECD**
Other		
Consumer price index	**Index, 2000 = 100**	**Price indices, OECD.Stat**
Interest rate data	**Percent per annum**	**Financial indicators, OECD.Stat**
Marginal tax rates	**Percent**	**Johansson 2004**
Value added tax	**Percent**	**Skatteverket 2008b**

3.1 Household disposable income

The data for *household disposable income* has been collected from the statistics database supplementing the OECD publication Economic Outlook No. 83. From eq. (7) we have $\widehat{yd} = \gamma_y\left(\widehat{\alpha^l \cdot y}\right) - \gamma_t \cdot \hat{t}^l$. The relevant variables are labour share of income (α^l), aggregate demand (y) and net taxes and transfers paid by households (t^l). To simplify I have chosen to use the OECD definitions of household disposable income and its components, as approximations of the variables in eq. (7). A detailed description of this can be found in table 2.

Table: 2 Household disposable income[7]	
Variable	**OECD Economics outlook code**
+ *Compensation of employees*	*WSSS*
+ *Self-employment and property income received by households*	*YOTH*
- *Interest on consumer debt*	*INTDBT*
- *Net compensation of employees received, rest of the world*	*YRH_ADJ*
= Household income pre-tax and pre-transfers $\boldsymbol{\alpha^l \cdot y}$	
+ *Direct taxes on households*	*TYH*
+ *Total transfers paid by households*	*TRPH*
- *Current transfers received by households*	*TRRH*
= *Net taxes and transfers* $\boldsymbol{t^l}$	
+ Household income pre-tax and pre-transfers $\boldsymbol{\alpha^l \cdot y}$	
- *Net taxes and transfers* $\boldsymbol{t^l}$	
= *Household disposable income*	*YDH*

3.2 Entrepreneurial disposable income

The data available for entrepreneurial disposable income is very limited, only from 1993 and onwards has it been constructed. The main reason is probably that the definition includes quite a large number of variables related to the income and expenses of corporations. Entrepreneurial income can be calculated for different sectors of the economy and is basically gross operating surplus plus net dividends, interest and rent payments[8]. Disposable entrepreneurial income is then given by subtracting taxes on income and wealth. Since this data is not available I have constructed a new variable called disposable income of corporations. This is defined in table 3. The main difference compared to disposable entrepreneurial income is that gross mixed income is included in pre-tax income (which due to data availability issues covers the whole economy and not just corporations). Another difference is that net dividends, interest payments etc are not included due to the data not being available.

Table 3: Disposable income of corporations
Variable
+ *Gross operating surplus and gross mixed income* $(\boldsymbol{\alpha^e \cdot y})$
- *Taxes on income, profits and capital gains, paid by corporations* $\boldsymbol{(t^e)}$**.**
= *Disposable income of corporations*

[7] Details of OECD Economic Outlook data definitions can be found in Economic Outlook Database Inventory.

[8] For a detailed definition of entrepreneurial income see Statistiska Centralbyrån 2004.

There are of course a number of problems with proceeding with this method. The first is that the weights used to calculate disposable income of corporations will not be correct. Gross operating surplus and gross mixed income for the total economy is significantly larger than entrepreneurial income for corporations and thus the effects of automatic stabilizers on disposable income of corporations will probably be underestimated when constructing the series with the automatic stabilizers disabled. A second problem is that the correlation between gross operating surplus/mixed income for the whole economy and for corporations might be low.

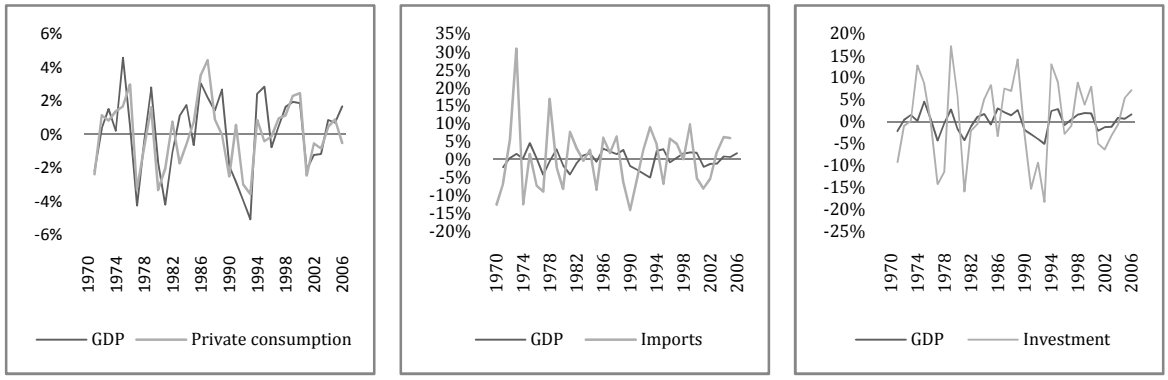
4. The Swedish Economy

In the introduction some of the major changes to the Swedish economy were discussed. What follows is a more detailed discussion on some of these as well as a look at the development of some variables mentioned in the theory section. The implications of these changes for automatic stabilizers are also discussed. No actual predictions for the effectiveness of automatic stabilizers can be made from this, but most things point in the direction of decreasing effectiveness over time.

4.1 Cyclical fluctuations in GDP and its components

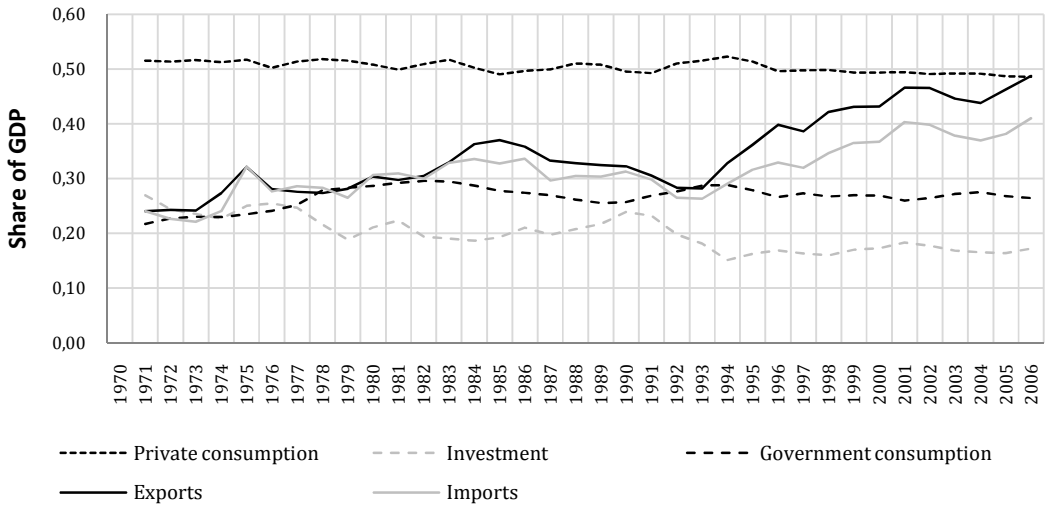
Since automatic stabilizers work through the reduction of fluctuations in several GDP components, this section discusses the co-movement of GDP and these components. First we have a look at the cyclical relative change of private consumption compared to that of GDP, calculated using eq. (2) and the HP-filter with $\lambda = 100$. In the left panel of fig. 4 we can see that during the 1970's private consumption fluctuated less than gross domestic product, while during the 1980's we cannot determine whether one series fluctuates more than the other. The most striking result though is that after the economic crisis of the early 1990's the elasticity of private consumption with respect to gross domestic product is very close to unity. This indicates that the automatic stabilizers have become less effective in stabilizing private consumption during the period examined. Imports and investment on the other hand, do not show any obvious pattern over time. Both series move with the business cycle to some degree and both are significantly more volatile than the business cycle.

Figure 4: Cyclical fluctuations in GDP components affected by automatic stabilizers



4.2 GDP composition

Figure 5: GDP composition, Sweden 1971 – 2006 (Source: OECD, own calculations)

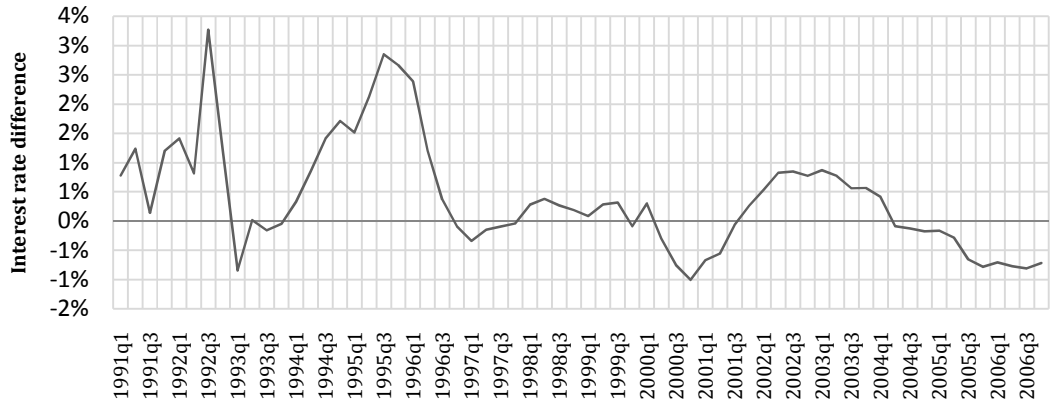


Since automatic stabilizers are assumed to only affect some of the components of GDP; changes in the shares of the components will have consequences for the effectiveness of automatic stabilizers. In fig. 5 calculations of the composition of GDP are presented. The most noticeable change is the large increase in imports and exports over the period, i.e. the Swedish economy has become more open over time. Since the effect of automatic stabilizers is assumed to leak out through imports this could be a sign of decreasing effectiveness of the automatic stabilizers. The other two components that are thought to be affected by automatic stabilizers – private consumption and investment – have both decreased since the early 1970´s; private consumption slightly and investment significantly. All in all the conclusion from the changes in GDP composition can only be that the effectiveness of automatic stabilizers should have decreased over the period examined.

4.3 Openness and financial integration

As discussed previously the degree of integration into the world market has important implications for the effectiveness of automatic stabilizers. In the previous section we saw that imports and exports have increased significantly as shares of GDP during the period examined. Using a traditional openness measure such as the sum of imports and exports as a share of GDP would thus give the result that the degree of openness in the Swedish economy has increased for most of the period, except for a few years in the second half of the 1980´s and early 1990´s. We concluded earlier though that imports is only one channel through which fiscal policy looses effectiveness in the case of a floating exchange rate regime – the other being the speed with which the interest rate converges with the international interest rates after a fiscal policy shock. Fig. 6 shows the difference between the long-term interest rates in Sweden and the European OECD member states. Even if a graphical examination of the spread cannot give any conclusive results the difference shows a clearly decreasing pattern over time. As expected from the previous discussion Sweden thus seems to be more closely integrated with international interest rates and as a consequence fiscal policy should have become less effective over time.

Figure 6: The spread between Swedish and Euro OECD long-term interest rates.



Source: Own calculations from OECD data

4.4 Replacement rate

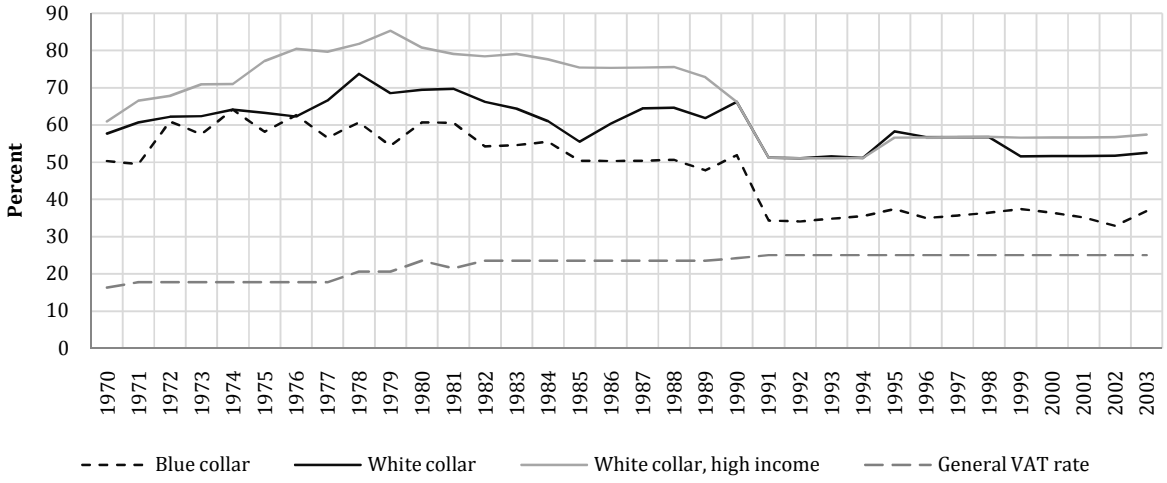
The replacement rate in the unemployment benefit system is an important determinant of how the business cycle affects aggregate disposable income, especially in the presence of liquidity constrained individuals. The actual replacement rate will be dependent on two major characteristics of the unemployment insurance system – the replacement rate and a ceiling. The

replacement rate only applies to individuals with income below the ceiling, everyone else will receive less than the replacement rate. For Sweden the actual replacement rate has been decreasing over time. Data available since 1980 shows that the average for 1981-1990 was 0.84, for 1991-2000 it had decreased to 0.77 and for the shorter period 2001-2004 the average has been 0.69 (Fregert and Pekhonen 2008). Without data for the 1970's it is not possible to predict the effect on the automatic stabilizers for the whole period but the available data clearly indicates that the contribution to stabilization from the unemployment benefit systems should have decreased over time.

4.5 The tax system

Since automatic stabilizers work through taxes the properties of the tax system are important determinants of the effectiveness of automatic stabilizers. A detailed analysis of the changes to the tax system since 1970 is not possible within the scope of this thesis. I will instead focus on a number of specific topics related to stabilizing household disposable income.

Figure 7: Marginal tax rates and general VAT rate



Source: Skatteverket 2008b and Johansson 2004

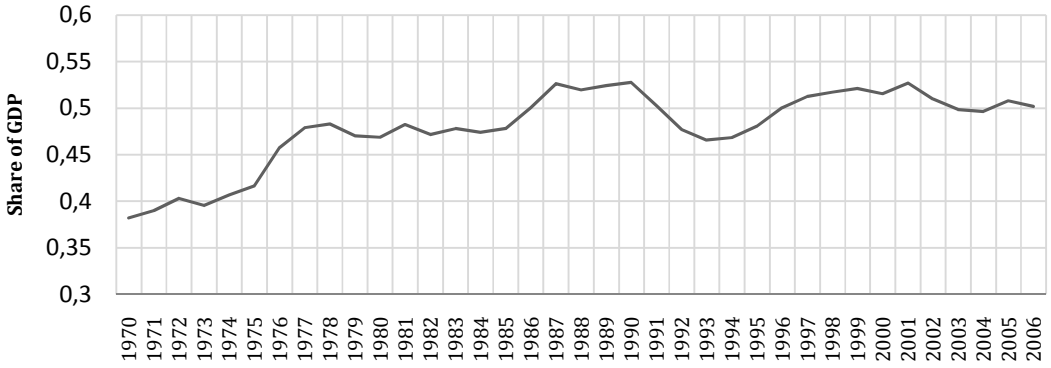
Fig. 7 shows marginal tax rates for different income groups, as well as the general value added tax (VAT) rate. First we focus on VAT. The VAT rate has been increasing during the whole period, except for a temporary decrease in the early 80´s. In itself this should not affect the effectiveness of automatic stabilizers. But if we instead choose to study it in relation to the income tax system, it will have important implications. The most noticeable changes to the income tax system were

implemented within the tax reform of the early 90´s. Before the tax reform national income tax had four different tax brackets, with the tax rates 5, 17, 31 and 42 percent. After the tax reform only one national income tax rate of 20 percent remained, and the share of people paying national income tax decreased (Palme 1994). In fig. 7 this can be seen both by the falling marginal tax rates, and the convergence between white collar and white collar high income marginal tax rates. At the same time the value added tax base was widened, so that most products are covered (Skatteverket 2008a pp. 135-136). The conclusion is therefore that the progressivity of the income tax system has decreased and a higher proportion of taxes are now collected through VAT.

4.6 Government size

The empirical result that government size is correlated with the effectiveness of automatic stabilizers (see above) justifies studying the size of the Swedish government during this period. The empirical research discussed earlier came to the conclusion that the effectiveness of automatic stabilizers increases with government size measured either as government consumption or total tax revenues as share of GDP. In fig. 5 we see that using the former the size of government increased in the first half of the 1970's and has remained relatively stable since then.

Figure 8: Total tax revenues in Sweden



Source: Revenue Statistics, OECD

The series using the latter is shown in fig. 8 above. We observe the same increase in the first half of the 1970's, followed by a stable period of 10 years. During the second half of the 1980's government size again increased, and peaked at the end of the decade. The economic crisis of the early 1990's saw a large drop in government size, but after that it recovered and returned to just below the previous levels. Assuming that government size is a proxy for effectiveness of automatic stabilizers this data indicates that the effectiveness of automatic stabilizers should have

increased between the 1970's and 1980's, but that it should not change significantly after this. We should not emphasize this result to much though, because as we have seen above at least some of the variables that government size is assumed to be a proxy for, have actually changed in a way such that they contribute less to automatic stabilization.

5 Results

5.1 Estimating the model

The first step in estimating the model is running ordinary least square regressions to find the parameters and residuals for the necessary equations of the model. The regressions are performed on the equations exactly as stated in the model description above. All the results are presented in table form in Appendix II. Four out of seven parameters are significant at the 5% level. GDP is significant at the 5% level in explaining taxes paid by corporations, but the residuals show heteroskedasticity. Using White's heteroskedasticity-consistent standard errors, the P-value of the coefficient being null is 0.1037, i.e. the regression is close to being significant at the 10 % level. I have chosen to proceed with this, but it is advised to take this into account when interpreting the results. The one-year lagged household disposable income is not significant in determining present consumption and private consumption is not at all significant in determining imports. All regressions have been tested for autocorrelation using the Breusch-Godfrey test and for heteroskedasticity using White's heteroskedasticity test.[9]

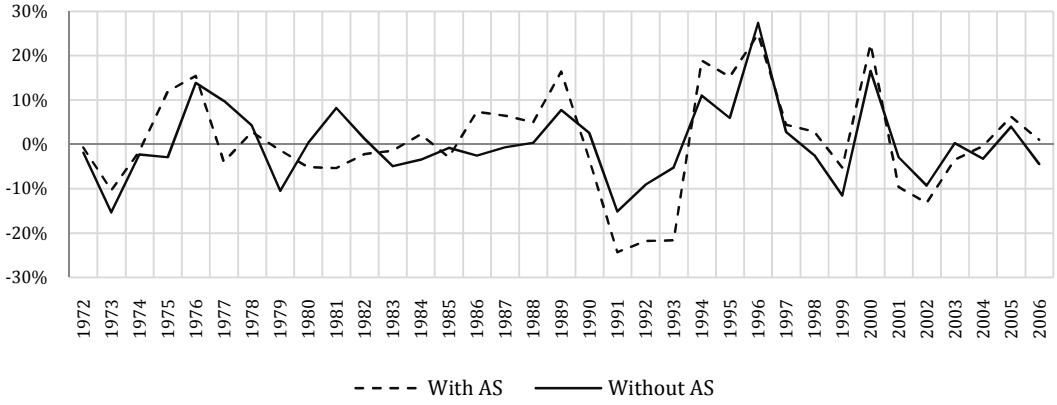
5.2 Results for Sweden

The conclusion from earlier on is that net tax revenues should fluctuate more when automatic stabilizers are allowed to work. Estimating eq. (9) gave the result that a cyclical output growth rate of one percent gives rise to a cyclical growth rate of net tax revenues of more than three percent. Fig. 9 shows the cyclical growth rates of actual net taxes paid by households and the series constructed according to eq. (9'). The two series confirm that the automatic stabilizers increase the volatility of net tax revenues. One period deserves a closer discussion, the economic crisis in the early 90´s. During these years the automatic stabilizers have large effects on the taxes paid by households, but as we shall see below this does not translate into a very large stabilizing

[9] The regressions have been performed using Eviews. Regression results can be found in Appendix II.

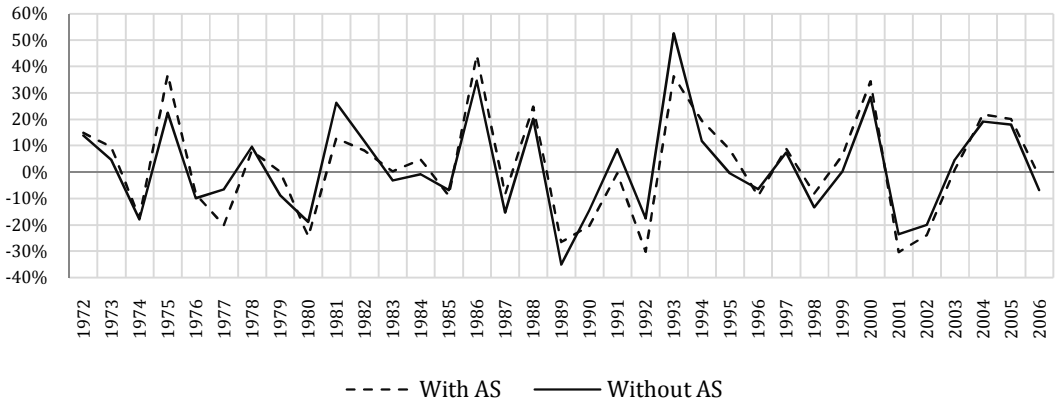
effect. One reason could be that during a crisis private savings increase, and therefore the effectiveness of automatic stabilizers are lower than during normal times.

Figure 9: Cyclical growth rates in net household taxes



The elasticity of taxes paid by corporations with respect to the business cycle is almost identical to that of the household taxes, 3.18 compared to 3.22. The automatic stabilizers affect taxes paid by corporations as expected for most years, something that was not the case for household taxes.

Figure 10: Cyclical growth rates in corporate taxes

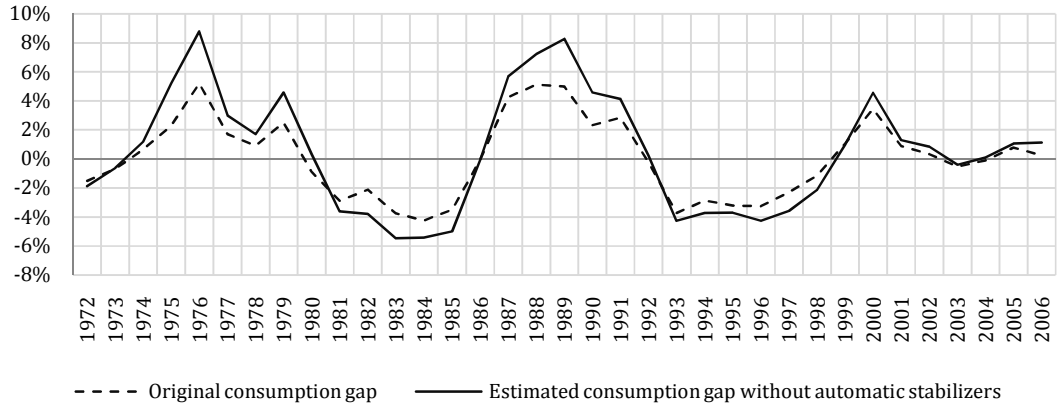


We now move on to the analysis of the effects of automatic stabilizers on components of aggregate demand. The stabilizing effect is examined by comparing the original series for the components of GDP with ones constructed by using the estimated cyclical growth rates. The procedure is to calculate new growth rates for each series, equal to the trend growth rate plus the new cyclical growth rate. The estimated series without automatic stabilizers can then be calculated by applying these new growth rate series to the initial value of each original series. From this we can then calculate relative deviations from trend, i.e. the equivalents of output gaps.

Table 4: Effectiveness of automatic stabilizers measured as ratio of Root mean square errors					
	1972-1979	**1980-1989**	**1990-1999**	**2000-2006**	**1972-2006**
Private consumption	1.77	1.44	1.37	1.36	1.48
Investment	1.03	1.05	1.04	1.08	1.04
Imports	1.01	1.07	1.01	1.06	1.03
Gross domestic product	1.36	1.22	1.14	1.08	1.21

Fig. 11 shows the consumption gap, for the original series and the one without automatic stabilizers. A graphical analysis shows that the consumption gap has been significantly reduced during the whole period. A second observation though, is that the stabilizing effect appears to be decreasing over time. This is confirmed by the ratio of root mean square errors that has decreased from 1.77 in the 1970's, to 1.44 in the 1980's and is further down to 1.37 in the 1990's (see table 4).

Figure 11: Consumption gap with and without automatic stabilizers



For investment and imports the stabilizing effect is not that significant. The RMS ratio for investment has been increasing slightly from 1.03 to 1.08, and the average for the whole period was 1.04. The average stabilization of imports has been similar, 1.03. There is however no clear trend over time. The conclusion is therefore that the results from this method is that investment stabilization is neglible and that import leakage is small.

Figure 12: Investment gap with and without automatic stabilizers

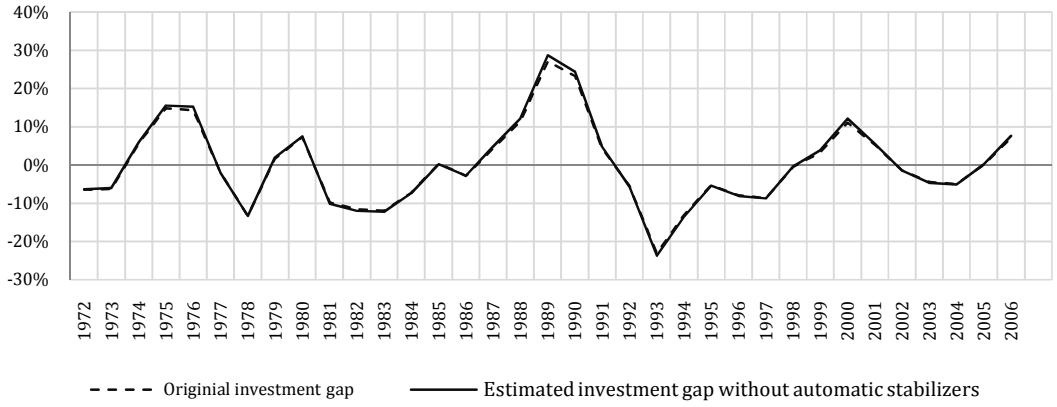
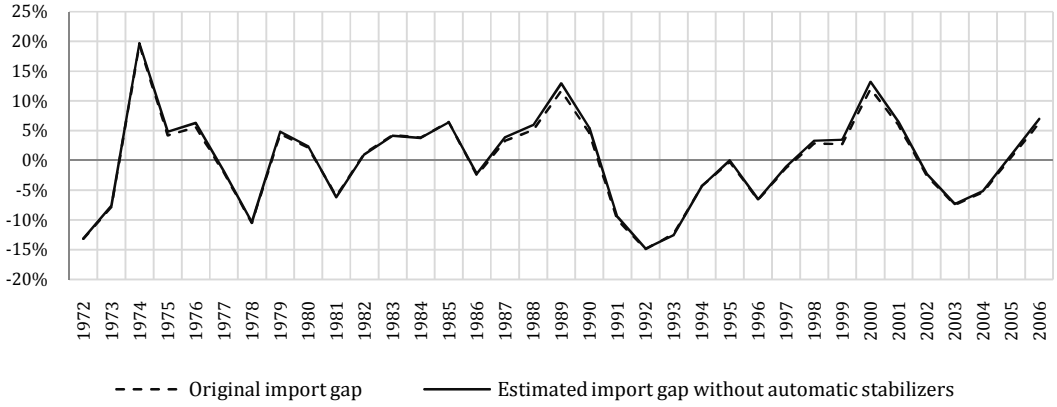
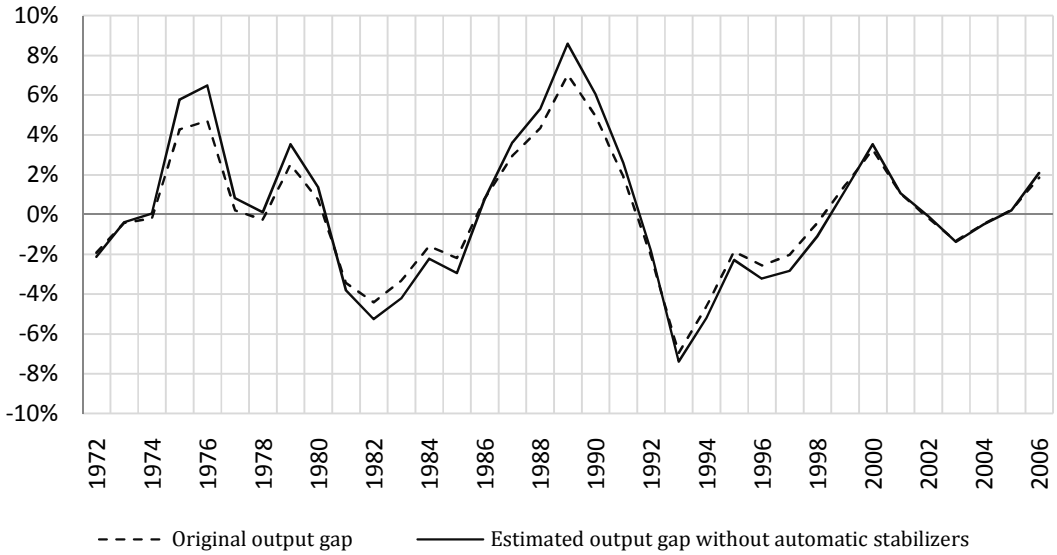


Figure 13: Imports gap with and without automatic stabilizers



Finally we examine the output gap of the economy with and without automatic stabilizers. The automatic stabilizers work to stabilize the economy for most of the period examined. Some slight destabilization can be observed between 2001 and 2005, but it is really too small to draw any conclusions. The interesting observation is instead that the effectiveness of the automatic stabilizers seems to be decreasing over time. The ratio of root mean square errors has gradually decreased from 1.36 in 1972-1979 to 1.08 in 2000-2006.

Figure 14: Output gap with and without automatic stabilizers



6. Discussion

Before drawing conclusions from the results presented above, a number of problems and difficulties need to be discussed. As with all methods there are drawbacks to the one used in this thesis. One such problem is the econometric methods used to estimate the parameters of the model. Different choices that could lead to improved results are 1) using more control variables to make sure that the estimated coefficients do not reflect effects caused by omitted variables and 2) using structural breaks in the estimation of the model (it seems likely that parameters related to the tax system would have changed after the tax reform in the early 90´s).

Another problem discussed previously it that of time series data decomposition. In this thesis the Hodrick-Prescott filter has been used. One drawback with this is that it gives non-reliable estimates for endpoints, a problem that is worse when the available data is limited. Decomposition could be more accurate if econometric methods are used, combined with data on major changes to the structure of the economy. Analyzing for example relevant policy changes is a major task though, and therefore beyond the scope of this thesis.

A third problem is that of data availability. The main problem for analyzing automatic stabilizers is the lack of data for disposable entrepreneurial income, and its components. The data I have chosen to use will most likely underestimate the effectiveness of automatic stabilizers on investment, since the component (gross operating surplus) of disposable income of corporations,

not affected by automatic stabilizers, have larger weights than the equivalent in disposable entrepreneurial income. With further research into the available data for entrepreneurial income and the related taxes, better data could be chosen that gives more accurate results.

7. Conclusion

The main question this thesis set out to examine is how the effectiveness of automatic stabilizers has changed in Sweden from the early 1970's and onwards. In previous sections we saw that a number of developments in the Swedish economy point in the direction of decreased effectiveness. The deregulation of the financial sector combined with the introduction of a floating exchange rate is a sign of decreasing effectiveness of both fiscal policy in general and automatic stabilizers. This effect is probably reinforced by the increase in the degree of trade openness. The replacement rate in the unemployment insurance system has decreased over time, thus lowering the stabilizing effect on private consumption. Also the composition of aggregate demand has changed in a way that should have slight decreasing effects on the effectiveness of automatic stabilizers due to the share of stabilized components decreasing. The only development pointing in the direction of increased effectiveness of automatic stabilizers was the increase in government size. This development might not be that significant though, because government size is relevant mostly as a proxy for other variables affecting the effectiveness of automatic stabilizers; of which at least some have changed in way such that they contribute less to automatic stabilization.

As was evident from table 4 the effectiveness of automatic stabilization has decreased during each decade. In the 1970's the automatic stabilizers contributed to stabilizing on average 36 percent of the output gap, according to the method used in this thesis. It decreased to 22 percent in the 1980's and just above 10 percent for the period 1990-2006. Since the model does not tell us exactly what has caused the changes to effectiveness of automatic stabilizers we can only come to some preliminary results. Since the change in GDP stabilization is a function of changes to the stabilization of GDP components, the first step is to determine which components that have become less affected by automatic stabilizers. The only component which shows a decrease in the RMS ratio over the entire period is private consumption. It thus seems plausible that the development of the determinants of the stabilization of private consumption are also major determinants of the automatic stabilizers effectiveness with respect to GDP. Thus the decrease in

the replacement rate and the degree of progressivity in the tax system have most likely contributed to the decrease in the effectiveness of automatic stabilizers. Even if other changes in the economy, for example the introduction of the floating exchange rate and the financial deregulations, are most likely also important explanations for the decreased effectiveness of automatic stabilizers, they most likely do not explain the whole change, since the stabilization of both imports and investment have increased slightly or remained constant during the entire period.

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Appendix I – cyclical growth rates with and without automatic stabilizers

Figure 15: Cyclical growth rates in private consumption

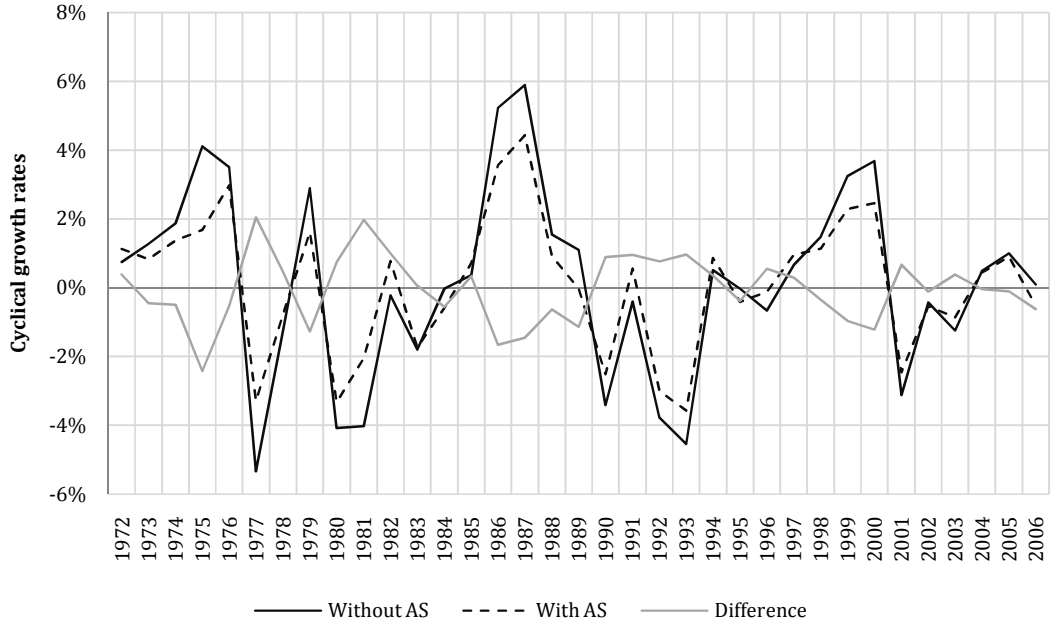

Figure 16: Cyclical growth rates in investment

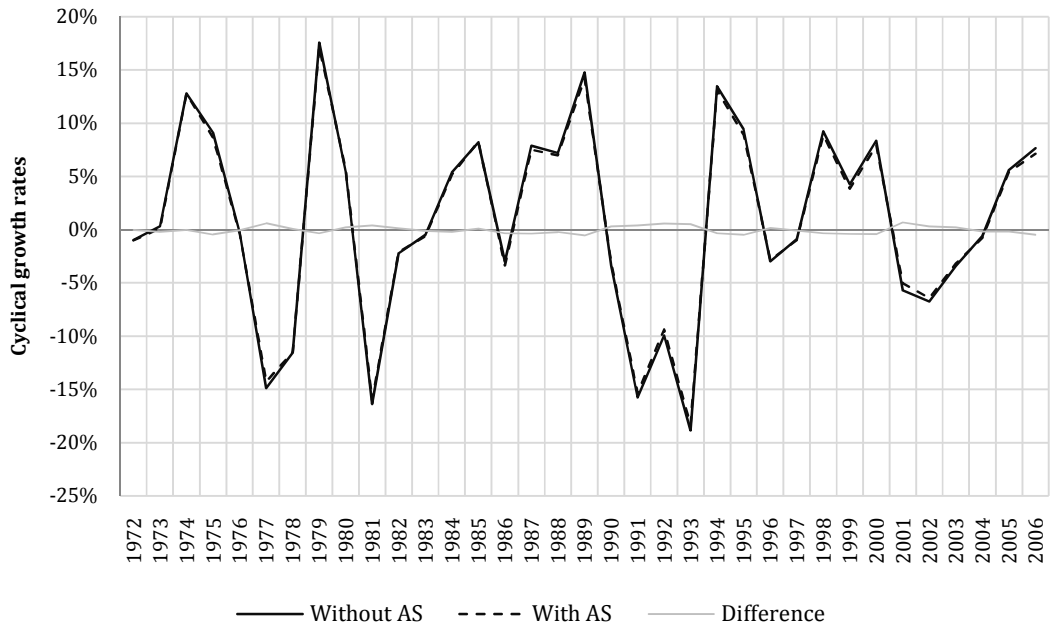

Figure 17: Cyclical growth rates in imports

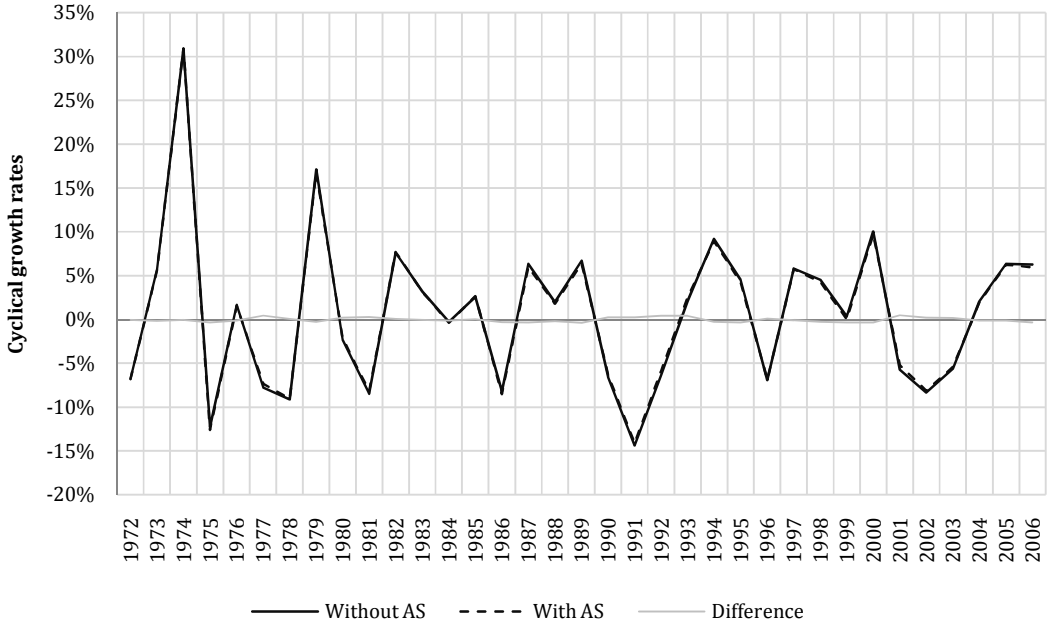

Figure 18: Cyclical growth rates in gross domestic product

Appendix IIdsw

In the tables below the coefficients are reported. The value within brackets is the probability that the null of the coefficient being equal to zero is true. The regressions have also been tested for heteroskedasticity using White's heteroskedasticity test and for autocorrelation using the Breusch-Godfrey test. The P-values for the null of no heteroskedasticity and no autocorrelation are presented at the bottom of each table.

Table 5: Consumption (eq. 4)

Household disposable income (β_1)	**0.4461 (0.0478)**
Household disposable income(-1) ($\boldsymbol{\beta_2}$)	**-0.2488 (0.2620)**
BG: 0.5639 White: 0.1664	

Table 6: Investment (eq. 5)

Disposable income of corporations (β_3)	**0.6740 (0.0160)**
BG: 0.1321 White: 0.5224	

Table 7: Imports (eq. 6)

Private consumption (β_4)	**-0.0206 (0.9762)**
Investment (β_5)	**0.6577 (0.001)**
BG: 0.0815 White: 0.5167	

Table 8: Household net taxes (eq. 9)

Gross domestic product (Θ^l)	**3.2268 (0.0003)**
BG: 0.5504 White: 0.8585	

Table 9: Corporate taxes (eq. 10)

	OLS	**OLS White**
Gross domestic product (Θ^e)	**3.1808 (0.0221)**	**3.1808 (0.1037)**
BG: 0.1791 White: 0.0011		