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# The Difficult Decision to Devalue a Currency

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# THE DIFFICULT DECISION TO DEVALUE A CURRENCY

BY
MENNA BIZUNEH

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree
of
Doctor of Philosophy
in the
Andrew Young School of Policy Studies
of
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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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This Dissertation is Dedicated to my Parents and my Brother

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ABSTRACT

THE DIFFICULT DECISION TO DEVALUE A CURRENCY

BY

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The switch from a fixed exchange rate regime to a flexible exchange rate regime seldom goes smoothly. It usually disrupts financial markets, and produces steep output recession and inflation. The 1997 devaluations in Indonesia, Malaysia, and Thailand; the 1994 devaluation in Mexico; and the 2001 devaluation in Argentina are only a few examples. In each of these cases output contracted by more than 10 percent and unemployment went into double digits. The economic disruption often spreads throughout the region and globally. The IMF was established to prevent and contain such crises but they seem to be a recurrent theme throughout the world.

A major reason why devaluations are so disruptive is that countries are reluctant to abandon their fixed exchange rate regimes. The longer they have been on the fixed exchange rate, the less likely they seem to become to switch to a flexible exchange rate, irrespective of what is happening to the economy. The pressure on the fixed exchange rate could mount for years, and yet countries refuse to devalue until they have no choice. Devaluation without choice, however, shows that the authorities have lost control. As a result, the financial markets panic, putting the economy into a tailspin.

This "reluctance to devalue" phenomenon is one of the puzzles in international finance. Yet, although it is observed regularly and has far reaching policy implications, it has not been systematically explored by the literature. My dissertation makes steps in that direction.

In the first chapter I investigate the factors that may influence the probability of a switch from a fixed to a flexible exchange rate regime using survival models. The use of survival models allows us to test if a switch to flexible exchange rate regime is dependent on the time spent on a fixed exchange rate regime. I use the non-parametric Kaplan-Meier estimator and a proportional hazard Cox model to show that exchange rate regimes, namely fixed exchange rate regimes, have non-monotonic duration dependence. Moreover, I find that GDP growth strongly influences the probability of abandoning a peg in favor of floating currency policy. These results are robust even when possible country intra-correlation is accounted for through marginal risk analysis. Based on the finding in chapter one, which highlights that a decrease in GDP growth, namely recessions, increase the probability of devaluation, the next two chapters provide possible explanations as to why countries may be reluctant to abandon their pegs.

The second chapter proposes that the reluctance to devalue could stem from uncertainty about the control over inflation after devaluation. In countries with long-standing currency pegs as well as in countries where the fixed exchange rate was preceded by high inflation, central banks have little credibility. The uncertainty about the consequences of monetary policy raises the threshold of economic pain that could convince policy makers to devalue. I develop this argument in a rules-vs-discretion theoretical framework. Empirical analysis based on survey data from Bulgaria supports this hypothesis.

However, abandoning a fixed exchange rate regime is one of the three options that is available to countries on a peg. To this effect the last chapter investigates whether a periphery country's decision to abandon to keep its peg or to abandon it is impacted by potential move to a currency board (a move from a peg to a peg). In particular I examine whether the European Monetary Union (EMU) is viewed by periphery countries as an insurance mechanism and how this view impacts their

willingness to pursue Eurozone membership, focusing on Bulgaria. I find that there is a perception that a member country will be bailed out by the EMU even if the problems are not caused by the EMU. Also, the country can loosen its fiscal discipline if it is in the Eurozone, expecting a bailout if it has problems paying back debts as confirmed by recent financial assistance extended to Greece by EU governments, European Central Bank (ECB), and the IMF. This is pure moral hazard and an expected but undesirable consequence of the Greek bailout. These perceptions strengthen significantly the support for pursuing EMU membership. Although a large fraction of Bulgarians expect a negative impact of the euro on the Bulgarian economy and on themselves they still support adopting the euro because of its safety mechanism.

There are three main lessons to be taken from this dissertation. First, societies prefer *status quos* $vis - \grave{a} - vis$ currency policy. This is especially true, if the *status quo* is attained after a negative experience with a different previous currency policy. Second, society's view assessment of the benefits and costs currency policy doesn't always reflect the cost and benefits calculated by economists. Furthermore, the cost-benefit analysis for currency policy options change as citizens adapt their expectations based on sustained or violated rules associated with a currency policy (i.e. the violation of *Maastich Treaty* in providing bailouts to Greece). Third, the credibility of the institutions that administer the currency policy is as equally important as the currency policy itself. Therefore, in trying to understand the "reluctance to devalue" phenomenon that is observed populations' expectations play a significant role.

# Chapter I

# ARE WE FLOATING YET? DURATION OF FIXED EXCHANGE RATE REGIMES

## I.1 Introduction

The frequency of currency crises in the past decade has brought renewed interest in the issue of optimal exchange rate policy. This interest was further fueled recently as we watch pegged economies (i.e. Estonia, Latvia, and Bulgaria) face the decision to abandon their fixed exchange rate regimes or face a severe recession during the current global financial crisis. Economists are particularly interested in the nature of these exits and their macroeconomic, financial and institutional determinants.

In this paper we argue that time is an important concept for the analysis of transition between exchange rate regimes. In particular, we argue that the probability of an exit from a particular exchange rate regime is likely to be determined by the time spent within a given regime. To this effect, we study the conditional probability of a particular exchange rate regime ending by adopting a duration model for various countries. The duration of a given exchange rate regime is important in assessing currency stability. Exchange rate credibility depends not only on the reaction to speculative attacks, but also on the time already spent in a regime for which a particular currency does not suffer from a speculative attack. Furthermore, we explicitly account for intra-correlation within countries' choice of

exchange rate regime through marginal risk analysis, using the Andersen and Gill (1982) and Wei et al. (1989) models.

The choice of exchange rate regimes is extensively explored in the international finance literature. The determinants of which types of exchange rate regimes should be implemented depending on a countrys characteristics have been theoretically predicted (see Mundell (1961), McKinnon (1963), Rizzo (1998), Frankel (1999), Fischer (2001), Poirson (2001), Juhn and Mauro (2002), VonHagen and Zhou (2007), Carmignania et al. (2008)). The determinants of the choice of currency policy are argued from several perspectives including optimal currency areas, currency crises, and policy credibility. However, the existing literature could not identify a single generalizable variable as an unquestionable determinant of exchange rate choice.

Empirical studies which aim to uncover the determinants of exits from one exchange rate regime to another seem to also be plagued with the problem of not having a single generalizable determinant of the choice of exchange rate regime, instead these studies provide varying results for the determinants of choice of exchange rate regimes depending on the definitions of an exchange rate regime classification, the definition of exit from an exchange rate regime, the time periods covered, the sample of countries used, the econometric methodology, and explanatory variables utilized.

Most of the empirical studies undertaken in the estimation of the determinants of exchange rate regime choice so far have been of the probit and logit nature (Kumar et al. (1998), Eichengreen et al. (1995), Klein and Marion (1994), Masson and Ruge-Murcia (2003)). As such, they are unable to account for the time dependence that may be present in the decision to abandon a fixed exchange rate regime in favor of a flexible exchange rate regime. Ideally, the empirical model to be used in the estimation of the determinants of exchange rate regime choice should take into consideration two conditions: the possibility of non-monotonic

time-dependence and the effect of intra-correlation. First, the probability regime switch depends on economic and institutional characteristics as well as time spent in a particular exchange rate regime. Moreover, the time-dependence may be non-monotonic resulting in a probability of exit from an exchange rate regime which increases during short duration but increases for longer duration.

A possible source of correlated failure times of the same event type are familial studies, in which each family member is at risk of developing a disease of interest. Failure times of family members are correlated because they share genetic and perhaps environmental factors.

Another source of correlated failure times of the same type are studies where the same event can occur on the same individual multiple times.

Second when analyzing multiple exit (failure) times of the same time there is a potential for a lack of independence of the failure times. These correlated exits times from a particular exchange rate regime could set the platform for contagious effect regional or through closely linked economies (i.e. industrial economies). There have been several studies that argue that currency crises can be transmitted between countries, especially through the mechanism of trade (Eichengreen et al. 1995). The empirical studies that tried to address the duration dependence that could affect the choice of exchange rate regimes are limited (Setzer 2004), (Tudela 2004), (Walti 2005). None of the empirical studies provide a comprehensive analysis for different types of economies (i.e. industrial, emerging, developing) using *de facto* exchange rate regimes.

This paper contributes to the literature by expanding on the works of Tudela (2004) and Walti (2005) in four ways. First, the paper analyzes the duration dependence of exits from a fixed exchange rate regime and whether there exits are non-monotonically dependent on time. Second, the paper utilizes Reinhart and Rogoff (2004)'s *de facto* classification of exchange rate regime following Walti

(2005). Third, Tudela (2004) and Walti (2005) both focus on a subset of countries and monthly or quarterly data. Using high frequency data creates more exchange rate regime switches (observations), however does not correspond with the long-run behavior of exchange rate choice. In the same token, having a larger sample of countries provides broad evidence base about how countries choose their exchange rate systems. Therefore we use a data set that has a more comprehensive list of countries and a longer period (annual) of observation. And finally, the paper addresses the possibility of the decision to abandon a peg being intra-correlated through the use of marginal analysis. To our knowledge, no such empirical work has been carried out.

Our results reveal that the probability of an exit from a fixed exchange rate regime is non-monotonically time-dependent. To control for country-specific heterogeneity, we include time-varying covariates in the Cox proportional hazard model. The findings from the semi-parametric approach suggest that some factors, such as GDP growth, could affect the probability of a switch from fixed to flexible exchange rate regimes. These findings are confirmed through the marginal risk analysis.

The remainder of the paper is organized as follows: Section 2 discusses the empirical model, while section 3 presents the data. Then section 4 presents empirical results and in section 5 we provide concluding remarks.

## I.2 Econometric Methodology

Let $T$ be a nonnegative variable which represents the length of time a country spends in a certain type of exchange rate regime, or the duration (spell) of that exchange rate regime. In our study $T$ represents the time during which a country is in a fixed exchange rate regime until the exit to a floating exchange rate regime.

The random variable $T$ can be described through its cumulative distribution function given by

$$F(s) = \int f(s)ds = Pr(T \leq t), \tag{1}$$

where the probability density function, $f(t)$, represents the probability that an exchange rate regime will survive less than some given value $t$.

The survival function, which describes the probability that the regime will last $t$ periods or longer, is given by

$$S(t) = 1 - F(t) = Pr(T > t) \tag{2}$$

$$\text{for } t = 0, S(t) = 1 \text{ and for } t = \infty, S(t) = 0.$$

Duration analysis focuses on conditional probabilities. To this effect the hazard function becomes a central concept. The hazard function determines the instantaneous probability that an exit from a particular exchange rate regime will occur in $t + \Delta t$, given the exchange rate regime has survived up to time $t$. Thus the hazard function [1] is defined as

$$\lambda(t) = \lim_{\Delta t \to 0} \frac{Pr(t \leq T \leq t + \Delta t)}{\Delta t} = \frac{f(t)}{S(t)}. \tag{3}$$

The estimation of the hazard function requires some assumptions about the duration pattern. If such assumptions cannot be made the non-parametric approach of Kaplan-Meier estimation allows for a preliminary analysis of duration dependence. The graphed hazard function by the Kaplan-Meier estimator affords us the opportunity to test whether time already spent in a fixed exchange rate regime has an independent effect on the likelihood of an exit into a flexible exchange rate

[1] The hazard function, sometimes known as the hazard rate, contains the same information as the probability density function but duration dependence is easily interpreted based on the shape of the hazard function.

regime beyond the control of time-varying variables. However, the non-parametric Kaplan-Meier estimator does not allow the inclusion of constant or time-varying explanatory variables.

To incorporate time-varying covariates, the Cox (1972) approach of proportional hazard is used to specify the duration model. This semi-parametric method requires less than complete distributional specification of the base-line hazard. Given the lack of theory regarding the duration of fixed exchange rate regimes, the proportional hazard model seems a reasonable compromise between the non-parametric approach of Kaplan-Meier estimator, which does not allow for various explanatory factors, and the possibly wrongly specified parametric approach.

The Cox proportional hazard model assumes that covariates shift the baseline hazard multiplicatively. As such in a continuous time and with time-varying covariates it is introduced in the following functional form:

$$\lambda(t, x(t), \beta) = \lambda_0(t)\phi(x(t), \beta), \tag{4}$$

where $\lambda_0(t)$ is the baseline hazard, $\phi(x(t), \beta)$ is a function of $x(t)$, which are time-varying regressors, and a vector of unknown coefficients $\beta$. In a semi-parametric model the baseline hazard $\lambda_0(t)$ has an unspecified functional form and represents the case where $x(t) = 0$. In other words, the baseline hazard provides the hazard function for a mean country and information about duration dependence. The explanatory variables found in $x(t)$ shift the hazard function for different countries with given length of time spent in a given exchange rate regime by multiplying the baseline hazard.

The most common choice of $\phi(x(t), \beta)$ is the exponential form

$$\phi(x(t), \beta) = \exp(x'(t)\beta), \tag{5}$$

ensuring that $\phi(x(t), \beta) > 0$ and allowing coefficient to be easily interpreted.

In this paper, the duration of countries on fixed exchange rate regimes is measured in terms of years. But the exact time in the year is not given. In such a case the transitions from a fixed exchange rate regime to a non-fixed exchange rate regime is said to be grouped. Discrete-time proportional hazard models handle this type of data better than continuous-time proportional hazard models. In discrete-time proportional hazard model the regressors are constant within the interval but can vary across intervals, while the baseline hazard,$\lambda_0(t)$, can vary within the interval. In implementation the complementary log-log model is utilized. The complementary log-log hazard function after some algebra becomes [2]

$$h(t) = 1 - \exp(-\exp(x'(t)\beta + \gamma(t))), \tag{6}$$

where $\gamma(t) = \ln \int_t^{t+1} \lambda_0(s)ds$.

In order to estimate the unknown parameters $\beta$ and $\gamma(t)$, we have to express the probabilities presented in the hazard function in terms of a likelihood function. The log-likelihood for the contribution made by the $i^{th}$ country observation in the interval $t_j$ is then given by

$$L_i(\theta) = d_i \ln(h_i(t)) + \sum_{t=1}^{t_{j-1}} \ln(1 - h_i(t)), \tag{7}$$

$$L_i(\theta) = d_i \ln(1 - \exp(\exp(x'(t)\beta + \gamma(t)))) - \sum_{t=1}^{t_{j-1}} \exp[x'(t)\beta + \gamma(t)], \tag{8}$$

[2]

$$\begin{aligned} h(t) &= 1 - \exp(-\exp(x'(t)\beta)) * \int_t^{t+1} \lambda_0(s)ds = 1 - \exp(-\int_t^{t+1} \lambda_0(s)ds[\exp(x'(t)\beta)]) \\ &= 1 - \exp(-\exp(\ln(\int_t^{t+1} \lambda_0(s)ds) + x'(t)\beta))) \end{aligned}$$

where $\theta$ is the set of parameters to be estimated and $d_i$ indicates whether the $i^{th}$ spell is censored or not[3]. If $d_i = 1$ the spell is uncensored- the transition from a fixed exchange rate regime to a flexible exchange rate regime is observed- and if $d_i = 0$ the $i^{th}$ observation is censored, implying the transition is not observed.

Furthermore, we need to consider that our data consists of $N$ countries each of which has multiple-cycle data, where countries experience multiple transitions. Hence, the a hazard function may depend upon the number of previous spells of fixed exchange rate regime (*occurrence dependence*) as well as the lengths of previous time spent in the fixed-exchange rate regime state (*lagged duration dependence*). As such conducting an analysis of multiple transition data by just examining time to first event, ignoring additional failures, is inadequate because it wastes possibly relevant information. Thus, in order to incorporate multiple spells, the partial likelihood framework needs to be utilized where the log-likelihood function or a given country incorporates different transition intensities[4]. Let us define $d_c = 1$ if a fixed exchange rate regime is abandoned at the end of the $c^{th}$ cycle and 0 otherwise. Then, a country observed over $C_i$ cycles will have the following log-likelihood function:

$$\begin{aligned} L_i(\theta) &= \sum_{c=1}^{C_{i-1}} [\ln[h_i^c(t_c^i, s_c^i, t_j)] + \sum_{c=1}^{t_{j-1}} \ln[1 - h_i^c(t_c^i, s_c^i, t)] \\ &\quad + d_i \ln[h^{C_i}(t_{C_i}, s_{C_i})] + \sum_{t=1}^{t_{j-1}} \ln[1 - h^{C_i}(t_{C_i}, s_{C_i}, t)], \end{aligned} \tag{9}$$

where the last cycle of each country may be right censored or result in an exit and $h(.)$ is given by Equation (6). Furthermore, the baseline rate in this estimation has been defined through a set of dummy variables. This function, known as the

[3]A spell is censored when we do not observe the duration of the spell until its conclusion.

[4]Multiple spells occur when a country can fix the exchange rate for some time, then float, then fix again according to our definition of fixed exchange rate regimes.

piecewise constant(PWC) hazard model, is a proportional hazard model, which lets the baseline hazard be a step function with $k$ intervals, where the hazard is constant in each interval, but may vary from one interval to the other.

While PWC model is one proportional hazard approach to conducting duration analysis for multiple-cycle data, a major issue in extending the proportional hazard models to multiple events per country is the intra-subject correlation(Therneau and Grambsch 2000) . As previously stated, this problem can be sidestepped by only taking time until first exit from a peg; however important information on the exit process will be lost. When a given country may contribute multiple events, the assumption of independent observations in the standard Cox model does not hold. Marginal models offer flexibility in the formation of strata and risk sets, definition of the time scale, and have a well-developed estimator of the variance.Lipsitz et al. (1990) showed that marginal models can overcome this assumption for the estimation of the variance of $\beta$ by an appropriate correction based on a grouped jackknife estimate[5].

Another important issue in multiple events data is to distinguish between data sets where the multiple events have a distinct ordering and those where they do not. In the particular case of this study, the outcome of leaving a fixed exchange rate regime is ordered. A country cannot have its second exit from a peg before its first. To account for such ordered events with possibility of being correlated we utilize two common approaches: the independent increments model (Andersen and Gill 1982), and marginal (Wei et al. 1989) model. Both are marginal regression models in that the estimated $\hat{\beta}$ is determined from a fit that ignores the correlation between the events followed by a correction of the variance, but differ considerably in their creation of the risk set.

[5]Although unbiased, this grouped-jackknife estimate is typically more variable than the ordinary variance of the Cox model, but it is a robust variance that adequately addresses repeated event correlation.

The Andersen and Gill (1982) (AG)model is the simplest method, but it makes the strongest assumptions. Each country is represented as a series of observations with non-overlapping time intervals, where the end of time for each interval is determined by an occurrence of an exit or change in any time-varying covariates. The AG model makes the assumption that events are equal and thus treats them independently. This allows the exit to be measured as time to first exit, time from first exit to second exit and so on (Cleves 2002). Each country contributes to the risk set for a specific time as long as they are under observations, as defined by inclusion of the specified time in the country's interval set[6].

The AG model is a counting process approach. The difference between the AG model and the standard Cox model can be seen through the definition of the hazard function. The intensity process for subject $i$ in the AG model is given by

$$h(t) = Y_i(t)\lambda_0(t)\exp(X_i(t)\beta), \tag{10}$$

where $Y_i(t)$ is the indicator function that country $i$ is still under observation at time $t$, $\lambda_0(t)$ is the baseline hazard, $X_i$ denotes the covariate vector for country $i$, and $\beta$ is a vector of coefficients. In the standard Cox model, the individual country ceases to be at risk when the event exit from a peg occurs and $Y_i(t)$ takes value zero, but for AG model for recurrent events, $Y_i(t)$ remains one as exits occur until the last time the exit is observed.

In the Wei et al. (1989) (WLW) model, the ordered outcome data set is treated as if it were an unordered competing risk case. The number of strata in the analysis will be equal to the maximum number of exits a country experiences in the time period. Unlike the AG model, the WLW model allows for a separate underlying

[6]While the Andersen-Gill formulation has a number of advantages, including the ability to accommodate left-censored data, time-varying covariates, multiple events, and discontinuous intervals of risk, a major limitation of this approach is it doesn't allow more than one event to occur at a given time. Some of these practical advantages are discussed in an applied framework by Johnson et al. (2004).

hazard for each exit[7]. In the WLW model a country is at risk until the country exits a peg or there is censoring. Hence, the hazard function for the $j^{th}$ event for country $i$ becomes

$$h(t) = Y_{ij}(t)\lambda_{0j}(t)\exp(X_i(t)\beta_j). \tag{11}$$

$Y_{ij}(t)$, the at-risk indicator for the $i^{th}$ country, is one until the occurrence of the $j^{th}$ exit. If the $j^{th}$ exit occurs or if there is censoring then $Y_{ij}(t)$ becomes zero, indicating that the country is no longer at risk after the last given exit[8].

We proceed in this paper in three steps. First, we estimate the hazard function utilizing the non-parametric estimator which can illustrate the duration dependence in graphical form. Second, we conduct semi-parametric analysis with time-varying covariates to see if the patterns in duration dependence could be explained by time-varying factors. In particular, using the Piecewise Constant (PWC) proportional hazard framework allows us to estimate the unknown parameters without specifying the form of the base-line hazard. Moreover, we can address the possibility of occurrence dependence and duration dependence through time dummies. And finally, we introduce marginal analysis to treat multiple events from a country without violating the assumption that events per subject are independent. Marginal models, namely the AG and WLW models, will be able to explicitly account for intra-subject correlation by replacing the standard variance estimate with one which is corrected for possible correlations.

[7]The AG and WLW models are the same in that we get a single set of covariates that are constant across the event ranks.

[8]Metcalfe and Thompson (2007) have shown that the WLW model infringes on the proportional hazards assumption when applied to multiple spells, maybe causing a bias. However, they have also shown that such a a bias is not behind the distinctive effect estimates and also that the infringement of the proportional hazards assumption is not necessarily greater than the experienced with other applications of proportional hazards regression. As such we do not see a prohibition to the application of the WLW method to the multiple spells data.

## I.3 Data

### I.3.1 Classification of Exchange Rate Regime

The classification of exchange rate regimes has some variation in different studies. The predominant number of the studies focuses on the official *de jure* exchange rate regime classification retrieved from the IMFs *Annual Report on Exchange Arrangements and Exchange Restrictions*, which is based on official declarations made by national governments once a year (Klein and Marion 1994). The obvious problem with this form of classification is that many countries which declare having floating exchange rates are characterized by pegs and many announced pegged regimes turn out to be a more flexible regime (Obstfeld and Rogoff (1995),Calvo and Reinhart (2002)). On the other hand some studies have constructed their own indicators to define exchange rate regime (Tudela 2004) , while other research uses pure or hybrid *de facto* classification ( Reinhart and Rogoff (2004),Setzer (2004),Levy-Yeyati and Struzenegger (2002),Duttagupta and Otker-Robe (2003)).

We use Reinhart and Rogoff (2004)'s annual *de facto* classification of exchange rate regime and group exchange rate regimes into two categories: fixed regimes and floating regimes. The constructed *de facto* classification is chosen for three main reasons. First it avoids identifying short spells of exchange rate stability as regimes. Unlike other *de facto* classifications which identify short-term spells of exchange rate stability within a regime, Reinhart and Rogoff (2004) identify longer-term regimes by considering a five-year horizon.

Second, it takes into account the fact that countries may have dual or multiple exchange rates and/or parallel markets. Failing to look at market-determined rates can lead to misleading perceptions about the underlying monetary policy and the ability of the economy to adjust to shocks. This can results in an underlying

inflationary monetary policy which may not be captured by the official exchange rate.

Finally, the Reinhart and Rogoff (2004) *de facto* classification is not based on official declaration but rather on the action of monetary authorities, avoiding a possible discrepancy between officially reported exchange rate regimes and the actual characterization of the exchange rate regimes in the countries. Previous empirical studies on exchange rate regimes that relied on the classification available from the *Annual Report on Exchange Arrangements and Exchange Restrictions* published by the IMF were missing important information[9].

### I.3.2 Definition of Exits

Duration of a spell in this study is defined as the time that a currency is pegged. We define an exit from a fixed to a flexible exchange rate regime as the shift from a strict fixed category to announced pegs, crawling pegs, managed float or free floating exchange rate regime[10]. The sample period extends from 1970 to 2007. Each duration period corresponds to the number of years from the time of origin until an exit. If a regime is still in place by the 2007 we register the observation as being censored.

The Kaplan-Meier calculation of the hazard function makes use of the number of regimes that are eligible to exit, and this number will capture the fact that these regimes are not at risk of exiting a fixed exchange rate regime (since they all survived) until they come under observations. The semi-parametric approach uses only observation at times of exit. The simple fact that a regime is observed in 1970 means that it did not exit a fixed exchange rate regime before. This is true for all regimes observe in 1970, so none of these regimes could have abandoned a peg

[9]For other de jure and *de facto* classifications see (Shambaugh 2004), (Bubula and Otker-Robe 2002), (Ghosh et al. 2002),and (Levy-Yeyati and Struzenegger 2002)

[10]We define an exit from a fixed exchange rate regime as a shift from categories 1 or 2 to categories 3 or 4 using Reinhart and Rogoff (2004)'s coarse grid.

before that date. Hence, we would not have any observation to contribute to the partial likelihood.

### I.3.3 Time-Varying Variables

As determinants of the likelihood of exit from a peg, country-specific time-varying variables are selected on the basis of empirical studies dealing with the determinants of the optimal choice of exchange rate regimes. Macroeconomic variables include inflation, economic growth, openness, current account balance, real exchange rate, unemployment, and claims on government. Financial variables consist of net foreign assets as ratio of GDP, international reserves and domestic credit. Finally, the quality of institutions, proxied by an index of political rights, is added[11]. Table 1 presents the explanatory variables and their expected signs. The expected signs are based on the findings of previous empirical studies using duration analysis. The data assembled is annual data from 1970 through 2007 for 144 countries. The database for most of the variable is the *World Development Indicators* published by the World Bank, *Polity IV* data set, and *External Wealth of Nations provided* by Philip Lane.

## I.4 Empirical Results

Before explaining the result of our estimates, we have to report some of the characteristics of the duration of the spells. Recall that a spell is defined as the time that a particular country is in a fixed exchange rate regime. Information about the duration of the pegs is provided in Table 2. We see that we have 4,942 years of pegs (among all countries). Also we see that the number of years on a fixed exchange

[11]In order to avoid feed back effects of the occurrence of a switch from a peg into macroeconomic variables,variables from year $t$ are used to determine the probability of exit from the peg in year $t+1$.

rate regime is the highest in year 38 (23.07%), which reflects the right censoring of the data.

Table 3 provides information on the exit rate from a fixed exchange rate regime to a floating exchange rate regime. It is worth noting that about one third of the spells in our sample end in the first 10 years of the peg. It should also be noted that both Table 2 and Table 3 account for duration and exits where countries could have multiple exits. In fact, Table 4 presents how many observations have multiple exits. About 49 percent of our observations are right censored (meaning there is no exit from the peg), while about 33 percent our observation experience only one exit from a peg. The remaining 19 percent of our observation experience multiple exits from a peg. These multiple exits reaffirm the existence of *multiple-cycle* in the data. In this case, the hazard function may depend upon the number of previous entries to the pegged state (*occurrence dependence*) or it may depend upon the lengths of previous visits to the pegged state (*lagged duration dependence*).

### I.4.1 Baseline Hazard Rate

Probability of exit from a fixed exchange rate regime to a floating exchange rate regime can be graphically illustrated with the non-parametric Kaplan-Meier estimator. Figure 1 presents the smoothed hazard estimate and the estimated hazard function obtained with the Kaplan-Meier estimator. A clear non-monotonic pattern of duration dependence appears. More precisely, it starts out increasing, reaches a peak then starts decreasing. Duration dependence can not therefore be qualified as positive nor negative, it depends upon survival time. What can explain this non-monotonic shape? It could be that at the very beginning of the peg that agents are not very confident in the peg. Then, as the peg goes on, conditional on survival upto a certain threshold, the probability of an exit from the peg starts to decline. Although, the duration dependence is not clearly linear, negative duration

dependence exists after approximately 12 years on a fixed exchange rate regime, showing that the probability of leaving the peg decreases with duration. The integrated hazard function in Figure 2 confirms the evidence in favor of a non-monotonic pattern of duration dependence. Moreover, the non-monotonic relationship between time spent within a fixed exchange rate regime and the probability of exit from a peg is illustrated through the estimated base-line hazard in Figure 3.

However, hazard functions are affected by a variety of country-specific factors, potentially varying over time. Consequently, it is desirable to control for such factors directly. As such in the next section we conduct the estimation of the proportional hazard model by means of partial likelihood.

### I.4.2 Duration Dependence and Time-varying Covariates

The piecewise constant proportional hazard (PWC) model is constant at each interval, but varies from one interval to the other. This method allows the estimation of fully non-parametric specifications for the baseline hazard, analogously to the Cox model. All intervals are assumed to be of unit length so the recorded duration for each country $i$ corresponds to the interval $[t_i - 1, t_i)$ and countries are recorded as either having left the pegged state during the interval, or as still remaining in the pegged state. This methodology will allows us to observe if the hazard function depends upon previous length of time spent in the pegged state, duration dependence.

The interval-specific baseline hazard in PWC model can only be identified for those intervals during which events occur. If there are duration intervals for which this is not true, then the duration dimension needs to be grouped more or the relevant country-year combinations must be dropped from the estimation. To this effect we look at the number exits from a peg for each year under observation.

Table 5 shows that there are no exits from a fixed exchange rate regime during years 1, 11, 25, 27, 32, 36, and 37. As such, a year-specific hazard rate cannot be estimated for these intervals. We also observe that the exit rate from a fixed exchange rate regime is the highest in the early years of the peg. About 27 percent of the exits in our sample occur in the first four years of of the peg, and about 43 percent of the exits occur within the first 10 years. The non-parametric baseline model is then estimated by including all the relevant duration dummies. Due to these proportions we focus our estimates in the behavior of the base-line hazard for the first 10 years since the beginning of the peg.

The results of the PWC model are reported in Table 6. The dependent variable is the probability of leaving a fixed exchange rate regime for a non-fixed exchange rate regime. The baseline hazard rate has been defined through a set of dummy variables, one for each year until the fourth[12]. From the fifth until the tenth year it has been defined with a dummy for every two years. Three more dummies are introduced for the remaining years with bigger intervals[13].

If the sign on the estimated parameters is negative we interpret it as a decline in the probability of exit from a peg based on that variable. On the other hand if the sign on the estimated parameter is positive then that implies that the probability of exit from a peg increases with that variable. So the negative signs and the statistic significance on the time dummy variables associated with year 4, the interval for years 5 and 6, the interval for year 11 to 16, the interval for years 17 to 26, and the interval for year 27 to 38 indicate that a decrease in the probability of exit from a fixed exchange rate regime during those periods. Furthermore we plot the base-line hazard for our estimated semi-parametric function in Figure 3. The base-line hazard function shows a general downward slope. That is, the likelihood of exit into a a

[12]The first interval, $yr1$, is used as the reference level.

[13]The number of exits per year for years that there is an exit is relatively small. Some additional grouping of duration intervals might therefore be considered desirable. Hence, we redefine the baseline hazard through a more aggregate set of dummy variables, one for each 6 year period.

floating exchange rate regime declines with the length of time spent under a peg. Therefore, we can clearly state a negative duration dependence.

We also find that *GDP Growth* has a negative effect on the probability of abandoning a peg and it is robustly significant. The negative sign of the estimated parameter indicates that a decline in GDP growth leads to an increase in the probability of ending the spell of fixed exchange rate regime. That is if growth is declining there would be pressure to ease financial policies through currency devaluation to stimulate activity, especially exports. This will increase the probability of exit from a fixed exchange rate regime.

*Inflation*, measured as an annual percent change in CPI, is expected to have a positive sign implying that high inflation increases the likelihood of exit from a fixed exchange rate regime. In a country with a peg, higher inflation than partner countries results in significant overvaluation of the real exchange rate. This in turn can impact resources allocation, competitiveness, and macroeconomic stability (Kumar et al. 1998), increasing the probability that a peg is abandoned. The estimated coefficients for *Inflation* from the PWC proportional hazard model are positive and non-significant.

As indicators of the health of the foreign sector we have included the variables *Current Account Balance* and *Openness*. Both of these variables are expected to have negative signs. A greater degree of openness to the rest of the world and a stronger current account should correspond to a reduced probability of an exit. We find that *Current Account Balance* has a surprising positive sign on its estimated value. Notwithstanding, our estimated coefficient is not significant.

*Openness* reflects how connected the economy is to the rest of the world and reflects trade liberalization. The parameter estimation on the variable *Openness* is negative or positive depending on the model specification. However, it is not

significant. Hence we do not have support for Milesi-Ferreti and Razin (1998)'s finding that more open economies are less likely to suffer an exchange rate crash.

*Claims on Government* is included in the model to capture the effect of domestic credit expansion on the likelihood to abandon a fixed exchange rate regime. The variable *Claims on Government* is expected to have a positive estimated parameter because credit expansion due to the monetarization of the government budget deficit increases the likelihood of a speculative attack resulting in the abandonment of a peg. Yet, we find that the estimated coefficient is negative, albeit it non significant. We also directly test for the effect of domestic credit on the probability of abandoning a peg by estimating the model using domestic credit (*Credit*). The estimated parameter has no effect on the probability of abandoning a peg.

The variable *Political Rights* is included as a proxy for the quality of institutions. It is likely that countries with a stronger institutional framework will be able to sustain a fixed exchange rate regime for a longer period of time. We find that the estimate on *Political Rights* is positive and highly significant in model specification (3) indicating that the more democratic institutions a country has the more likely it will maintain a peg. A stronger democratic country means a better quality of institutions. The fact that better quality of institutions tend to reduce the probability of an exit from a peg is not surprising, given that these institutions, including the central banks, have more credibility.

*Unemployment* is expected to increase the probability of exit from a fixed exchange rate regime. An increase in unemployment reflects the fall in economic activity which increases the vulnerability to currency crisis. Our results indicate that *Unemployment* is not a significant determinant of a switch from a fixed to a flexible exchange rate regime[14].

[14]The insignificance of the *Unemployment* variable could be attributed to the fact that the lack of competitiveness is already captured through the variable *GDP Growth*.

*Real Effective Exchange Rate (REER)* is expected to have a positive sign. *REER* can be used as a proxy for the loss of international price competitiveness as well as for exchange rate misalignment. When a country devalues its currency, the trading partners' position deteriorates with regards to that country's economy. A higher value of the exchange rate index implies a more appreciated domestic real exchange rate leading to a less likelihood of abandoning a fixed exchange rate regime in that country Kumar et al. (1998). Our results show that the conditional probability of an exit is not significantly affected by *REER*.

The variable *Reserves*, which measures the level of international reserves (minus gold) held by a country, remains negative and insignificant except in model specification (6). However, this significance is not robust. The negative sign on *Reserves* is expected for a country that has a high level of foreign reserves which can maintain its peg easily. Similar reasoning can be applied for expecting the negative sign associated with *Net Foreign Assets*. In our estimations we find that the direction of the coefficient on *Net Foreign Asset* varies but remains insignificant.

### I.4.3 Intra-country Correlation

As we have shown in Table 4, countries could have multiple exits from a fixed exchange rate regime to a floating exchange rate regime during the period of observation. A major issue in extending proportional hazard regression models to multiple events per subject is the intra-subject correlation which violates the assumption of independent observation in the standard Cox model (Therneau and Grambsch 2000).

The first step to analyzing multiple failure data is deciding whether the failure events are *ordered* or *unordered*. Then we need to decide if the failure events are the same type or of different type. In our case we have ordered failure events, because a country can't experience its second exit from a peg before its first. Moreover, the

hazard function is not allowed to vary by failure type because we only have one definition of an exit from a peg.

The two common approaches that are utilized to analyze correlated ordered events are the (Andersen and Gill 1982) model (AG) and the (Wei et al. 1989) model (WLW). Both of these approaches are marginal regression models in that$\hat{\beta}$ is determined from a fit that ignores the correlation between the events followed by a correction of the variance. The results of the AG estimations are presented in Table 7, while the estimated results for the WLW model are found in Table 8.

The results of the AG estimation match those of the piecewise constant (PWC) model with regards to signs, even though magnitudes vary. *GDP Growth* appears to be the only robust significant variable that affects the conditional probability of an exit from a fixed exchange rate regime. Surprisingly, however, we find that *Current Account Balance* carries a significant positive sign. We expect that when the *Current Account Balance* is positive that exports are greater than imports, in which case a country on a peg should continue its peg for currency stability as opposed to abandoning the peg. Hence, this unexpected result could possibly be explained by the limitation of the Andersen-Gill model, where the fact that there are multiple events occurring at a given time is not allowed.

The negative and significant results associated with *GDP Growth* and the positive and significant results found for *Political Rights* are reiterated in the WLW estimations. *Current Account Balance* is also positive and significant in the third specification of the WLW model which is surprising, but the result is not robust. Furthermore, *Reserves*, *Openness*, and *Unemployment* have the expected sign, albeit the coefficients are not significant. The signs on the parameter estimates on *Inflation*, *Current Account Balance*, and *Claims on Government* are not consistent with the predictions of economic theory. Notwithstanding, the coefficients are not significant.

## I.5 Final Remarks

In this paper we employ a duration model approach towards the determination of the choice of exchange rate regime, in particular the conditional probability of exit from a fixed exchange rate regime. To this effect, we use both non-parametric and semi-parametric techniques to estimate hazard functions. The main objective of this study was to test if time spent on a fixed exchange rate regime was a determinant of the probability of exit into a flexible exchange rate regime. The results both from the non-parametric Kaplan-Meier estimator and the semi-parametric piecewise constant proportional hazard model uncover significant duration dependence (with a small but not significant positive dependence at the beginning). It appears that time spent within a regime is itself significant determinant of the probability of exit from a fixed exchange rate regime. This fact may suggest that as the credibility of the peg increases over time the need to abandon a peg decreases.

Furthermore, to the extent that duration dependence may be driven by time-varying covariates, we also estimated a semi-parametric proportional hazard model as well as marginal models. GDP growth appears to be the only variable that robustly affects the conditional probability to abandon a peg. A decrease in GDP growth is associated with an increase in the likelihood of an exit from a fixed exchange rate regime. This result is consistent with the predictions of economic theory in that countries facing a recession would be more likely to abandon a peg in order to stimulate exports and boost output. Other time-varying macroeconomic, financial, and institutional variables don't appear to have a significant effect on the probability of abandoning a peg.

However, the issue of duration dependence deserves further investigation. It is especially imperative to understand the different paths that countries take to move from a fixed exchange rate regimes to non-fixed exchange rate regimes. Some exits

have been orderly while other exits have been very disruptive due to the fact that authorities are devaluing without a choice signaling that they have lost control. Moreover, even though a negative GDP growth is a highly significant determinant of the probability to abandon a peg, the recent global financial crisis has shown that some emerging economies are still holding on to their peg despite economic hardship. Therefore, in the next two chapters we provide hypothesis as to why countries would be reluctant to abandon a peg.

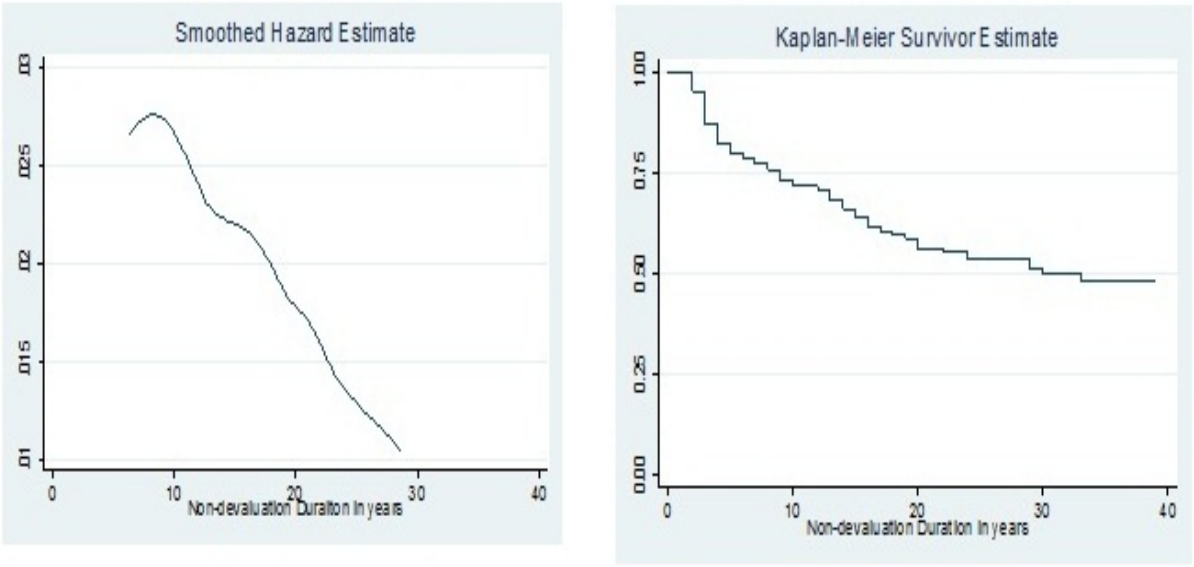



Figure 1: Smoothed Hazard Estimate and Kaplan-Meier Survivor Estimate

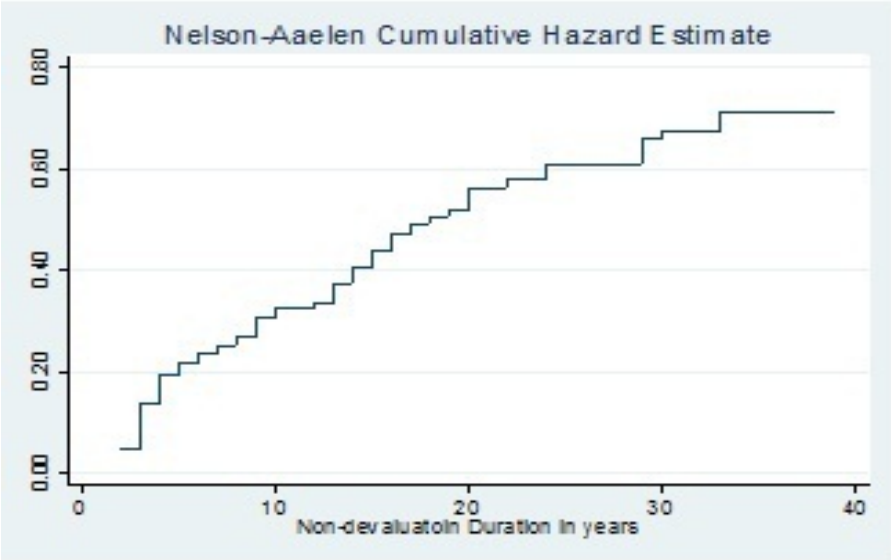



Figure 2: Nelson-Aalen Cumulative Hazard Estimate

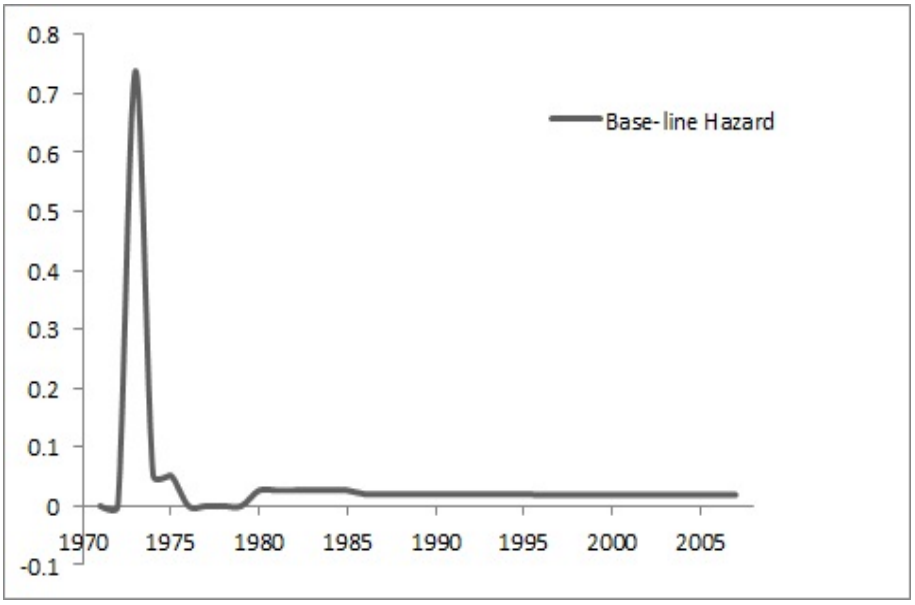



Figure 3: Estimated base-line hazard

Table 1: Expected Signs for Explanatory Variables

| Explanatory Variables | Expected Sign |
|---|---|
| GDP Growth | - |
| Inflation | + |
| Openness | - |
| Current Account Balance | - |
| REER | + |
| Unemployment | + |
| Claims on Government | + |
| Net Foreign Assets | - |
| International Reserves | - |
| Political Rights | - |

Table 2: Distribution of Total Peg Spells

| T | Frequency | Percent | Cum. |
|---|---|---|---|
| 1 | 76 | 1.54 | 1.54 |
| 2 | 192 | 3.89 | 5.42 |
| 3 | 149 | 3.01 | 8.44 |
| 4 | 152 | 3.08 | 11.51 |
| 5 | 93 | 1.88 | 13.4 |
| 6 | 197 | 3.99 | 17.38 |
| 7 | 114 | 2.31 | 19.69 |
| 8 | 164 | 3.32 | 23.01 |
| 9 | 104 | 2.1 | 25.11 |
| 10 | 76 | 1.54 | 26.65 |
| 11 | 110 | 2.23 | 28.87 |
| 12 | 110 | 2.23 | 31.1 |
| 13 | 198 | 4.01 | 35.11 |
| 14 | 145 | 2.93 | 38.04 |
| 15 | 148 | 2.99 | 41.04 |
| 16 | 38 | 0.77 | 41.8 |
| 18 | 295 | 5.97 | 47.77 |
| 19 | 115 | 2.33 | 50.1 |
| 20 | 190 | 3.84 | 53.95 |
| 21 | 76 | 1.54 | 55.48 |
| 22 | 152 | 3.08 | 58.56 |
| 23 | 76 | 1.54 | 60.1 |
| 24 | 76 | 1.54 | 61.63 |
| 26 | 114 | 2.31 | 63.94 |
| 28 | 38 | 0.77 | 64.71 |
| 29 | 38 | 0.77 | 65.48 |
| 30 | 110 | 2.23 | 67.71 |
| 31 | 76 | 1.54 | 69.24 |
| 32 | 114 | 2.31 | 71.55 |
| 33 | 38 | 0.77 | 72.32 |
| 34 | 76 | 1.54 | 73.86 |
| 35 | 76 | 1.54 | 75.39 |
| 36 | 38 | 0.77 | 76.16 |
| 37 | 38 | 0.77 | 76.93 |
| 38 | 1,140 | 23.07 | 100 |
| Total | 4,942 | | |
| Mean | 141 | | |
| Median | 110 | | |
| Stadard Deviation | 183 | | |
| Range | [1,38] | | |

Table 3: Distribution of Completed Spells

| T | Frequency | Percent | Cum. |
|---|---|---|---|
| 1 | 76 | 2.98 | 2.98 |
| 2 | 154 | 6.04 | 9.02 |
| 3 | 76 | 2.98 | 12 |
| 4 | 76 | 2.98 | 14.99 |
| 5 | 76 | 2.98 | 17.97 |
| 6 | 55 | 2.16 | 20.13 |
| 7 | 114 | 4.47 | 24.6 |
| 8 | 114 | 4.47 | 29.07 |
| 9 | 53 | 2.08 | 31.15 |
| 10 | 38 | 1.49 | 32.64 |
| 11 | 72 | 2.82 | 35.46 |
| 12 | 76 | 2.98 | 38.45 |
| 13 | 76 | 2.98 | 41.43 |
| 14 | 53 | 2.08 | 43.51 |
| 15 | 76 | 2.98 | 46.49 |
| 18 | 76 | 2.98 | 49.47 |
| 19 | 76 | 2.98 | 52.45 |
| 20 | 190 | 7.45 | 59.91 |
| 21 | 76 | 2.98 | 62.89 |
| 22 | 152 | 5.96 | 68.85 |
| 23 | 76 | 2.98 | 71.83 |
| 24 | 76 | 2.98 | 74.81 |
| 26 | 114 | 4.47 | 79.29 |
| 28 | 38 | 1.49 | 80.78 |
| 29 | 38 | 1.49 | 82.27 |
| 30 | 72 | 2.82 | 85.09 |
| 31 | 76 | 2.98 | 88.07 |
| 32 | 114 | 4.47 | 92.55 |
| 33 | 38 | 1.49 | 94.04 |
| 34 | 76 | 2.98 | 97.02 |
| 35 | 38 | 1.49 | 98.51 |
| 37 | 38 | 1.49 | 100 |
| Total | 2,549 | | |
| Mean | 80 | | |
| Median | 76 | | |
| Stadard Deviation | 36 | | |
| Range | [1,37] | | |

Table 4: Number of Total Exits from a Peg

| No. of Exits | Freq. | Percent | Cum. |
|---|---|---|---|
| 0 | 2,393 | 48.42 | 48.42 |
| 1 | 1,635 | 33.08 | 81.51 |
| 2 | 724 | 14.65 | 96.16 |
| 3 | 114 | 2.31 | 98.46 |
| 4 | 76 | 1.54 | 100 |
| Total | 4,942 | 100 | |

Table 5: Exit from a Peg Per Time Period

| Year | Period | exitpeg=0 | exitpeg=1 | Total |
|---|---|---|---|---|
| 1970 | 1 | 144 | 0 | 144 |
| 1971 | 2 | 137 | 7 | 144 |
| 1972 | 3 | 132 | 12 | 144 |
| 1973 | 4 | 135 | 9 | 144 |
| 1974 | 5 | 141 | 3 | 144 |
| 1975 | 6 | 142 | 2 | 144 |
| 1976 | 7 | 142 | 2 | 144 |
| 1977 | 8 | 142 | 2 | 144 |
| 1978 | 9 | 139 | 5 | 144 |
| 1979 | 10 | 142 | 2 | 144 |
| 1980 | 11 | 144 | 0 | 144 |
| 1981 | 12 | 141 | 3 | 144 |
| 1982 | 13 | 139 | 5 | 144 |
| 1983 | 14 | 139 | 5 | 144 |
| 1984 | 15 | 141 | 3 | 144 |
| 1985 | 16 | 139 | 3 | 142 |
| 1986 | 17 | 136 | 4 | 140 |
| 1987 | 18 | 124 | 1 | 125 |
| 1988 | 19 | 122 | 1 | 123 |
| 1989 | 20 | 120 | 3 | 123 |
| 1990 | 21 | 120 | 1 | 121 |
| 1991 | 22 | 118 | 3 | 121 |
| 1992 | 23 | 118 | 3 | 121 |
| 1993 | 24 | 117 | 3 | 120 |
| 1994 | 25 | 120 | 0 | 120 |
| 1995 | 26 | 119 | 1 | 120 |
| 1996 | 27 | 120 | 0 | 120 |
| 1997 | 28 | 119 | 1 | 120 |
| 1998 | 29 | 113 | 7 | 120 |
| 1999 | 30 | 118 | 2 | 120 |
| 2000 | 31 | 117 | 3 | 120 |
| 2001 | 32 | 120 | 0 | 120 |
| 2002 | 33 | 115 | 4 | 119 |
| 2003 | 34 | 114 | 1 | 115 |
| 2004 | 35 | 113 | 1 | 114 |
| 2005 | 36 | 114 | 0 | 114 |
| 2006 | 37 | 113 | 0 | 113 |
| 2007 | 38 | 109 | 1 | 110 |
| Total | 4,839 | 103 | 4,942 | |

Table 6: Piecewise Constant Proportional Hazard Estimations

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| yr2 | -17.17 | -16.84 | -17.66 | -16.97 | -17.17 | -17.15 |
| | (6,342) | (5,756) | (6,075) | (4,791) | (6,351) | (3,502) |
| yr3 | -18.43 | -18.08 | -18.87 | -15.94 | -18.42 | -16.10 |
| | (2,560) | (2,327) | (2,594) | (2,475) | (2,559) | (1,832) |
| yr4 | -2.405* | -2.282* | -3.085** | 0.305 | -2.398* | -0.303 |
| | (1.279) | (1.306) | (1.396) | (1.852) | (1.284) | (1.967) |
| yr5-yr6 | -3.166** | -3.070** | -3.577*** | -2.170 | -3.156** | -2.952 |
| | (1.254) | (1.273) | (1.329) | (1.717) | (1.257) | (1.952) |
| yr7-yr8 | -17.59 | -17.25 | -17.74 | -17.37 | -17.59 | -17.41 |
| | (1,539) | (1,397) | (1,485) | (1,571) | (1,541) | (1,142) |
| yr9-yr10 | -17.36 | -17.06 | -17.60 | -17.08 | -17.36 | -16.96 |
| | (1,548) | (1,408) | (1,506) | (1,564) | (1,549) | (1,152) |
| yr11-yr16 | -3.264*** | -3.225*** | -3.531*** | -2.958* | -3.264*** | -3.629** |
| | (0.641) | (0.646) | (0.707) | (1.541) | (0.643) | (1.806) |
| yr17-yr26 | -3.544*** | -3.530*** | -3.850*** | -3.335** | -3.546*** | -3.902** |
| | (0.598) | (0.605) | (0.655) | (1.445) | (0.601) | (1.718) |
| yr27-yr38 | -3.270*** | -3.258*** | -3.699*** | -3.375** | -3.275*** | -3.972** |
| | (0.595) | (0.596) | (0.692) | (1.440) | (0.600) | (1.732) |
| Inflation | -0.00172 | -0.00183 | -0.00231 | -0.0111 | -0.00173 | -0.0100 |
| | (0.00294) | (0.00304) | (0.00323) | (0.00837) | (0.00297) | (0.00808) |
| GDP Growth | -0.217*** | -0.215*** | -0.246*** | -0.218*** | -0.216*** | -0.225*** |
| | (0.0340) | (0.0345) | (0.0391) | (0.0557) | (0.0340) | (0.0583) |
| Reserves | -0 | -0 | -0 | -0 | -0 | -0* |
| | (0) | (0) | (0) | (0) | (0) | (0) |
| Openness | -0.00374 | -0.00420 | -0.00334 | 0.00264 | -0.00369 | 0.00327 |
| | (0.00555) | (0.00570) | (0.00579) | (0.00598) | (0.00559) | (0.00624) |
| Current Account Balance | 0.0352 | 0.0426 | 0.0487 | 0.0637 | 0.0355 | 0.0517 |
| | (0.0295) | (0.0331) | (0.0319) | (0.0414) | (0.0296) | (0.0455) |
| Claims on Government | -0.00510 | -0.00570 | -0.00526 | -0.00676 | -0.00543 | -0.00533 |
| | (0.0121) | (0.0123) | (0.0121) | (0.0172) | (0.0122) | (0.0169) |
| Unemployment | 0.0259 | 0.0228 | 0.0152 | 0.0299 | 0.0266 | 0.0360 |
| | (0.0300) | (0.0310) | (0.0316) | (0.0352) | (0.0300) | (0.0346) |
| Net Foreign Asset | | -0.00148 | | | | 0.00651 |
| | | (0.00319) | | | | (0.00695) |
| Political Rights | | | 0.0748* | | | 0.0545 |
| | | | (0.0404) | | | (0.0566) |
| REER | | | | -0.00136 | | 0.00190 |
| | | | | (0.00949) | | (0.0102) |
| Credit | | | | | 0 | |
| | | | | | (0) | |
| Number of Obs. | 1,617 | 1,617 | 1,615 | 1,091 | 1,617 | 1,091 |

Standard errors in parenthesis. ***(**,*) indicates statistical significance at the 1 (5,10) percent level.

We also implemented a PWC proportional hazard model that accounted for unobserved heterogeneity but didn't get any convergence.

Table 7: Andersen-Gill Estimations (Ordered Multiple Exit Data

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Inflation | -0.000544 | -0.000490 | -0.000554 | -0.00809 | -0.000524 | -0.00631 |
| | (0.00148) | (0.00144) | (0.00146) | (0.00723) | (0.00146) | (0.00656) |
| GDP Growth | -0.192*** | -0.194*** | -0.211*** | -0.181*** | -0.194*** | -0.205** |
| | (0.0313) | (0.0329) | (0.0390) | (0.0644) | (0.0326) | (0.0811) |
| Reserves | -0 | -0 | -0 | -0 | -0 | -0* |
| | (0) | (0) | (0) | (0) | (0) | (0) |
| Openness | -0.00181 | -0.00163 | -0.00177 | 0.00204 | -0.00181 | 0.00434 |
| | (0.00447) | (0.00448) | (0.00488) | (0.00399) | (0.00442) | (0.00481) |
| Current Account Balance | 0.0648** | 0.0620** | 0.0631** | 0.0614 | 0.0645** | 0.0391 |
| | (0.0264) | (0.0276) | (0.0271) | (0.0484) | (0.0264) | (0.0488) |
| Claims on Government | -0.00557 | -0.00548 | -0.00655 | -0.0149 | -0.00551 | -0.0143 |
| | (0.00854) | (0.00849) | (0.00847) | (0.0173) | (0.00856) | (0.0172) |
| Unemployment | 0.0428 | 0.0434 | 0.0338 | 0.0394 | 0.0426 | 0.0419 |
| | (0.0279) | (0.0281) | (0.0302) | (0.0328) | (0.0281) | (0.0319) |
| Net Foreign Asset | | 0.000618 | | | | 0.00699 |
| | | (0.00238) | | | | (0.00493) |
| Political Rights | | | 0.0591** | | | 0.0670 |
| | | | (0.0295) | | | (0.0413) |
| REER | | | | 0.000125 | | 0.00318 |
| | | | | (0.00793) | | (0.0106) |
| Credit | | | | | -0 | |
| | | | | | (0) | |
| Number of Obs. | 1,585 | 1,585 | 1,583 | 1,076 | 1,585 | 1,076 |

Standard errors in parenthesis. ***(**,*) indicates statistical significance at the 1 (5,10) percent level.

Table 8: Wei,Lin, Weissfeld Estimations (Ordered Multiple Exit Data)

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Inflation | -0.000470 | -0.000529 | -0.000478 | -0.00569 | -0.000463 | -0.00466 |
| | (0.00132) | (0.00136) | (0.00131) | (0.00638) | (0.00131) | (0.00584) |
| GDP Growth | -0.175*** | -0.172*** | -0.193*** | -0.156** | -0.176*** | -0.173** |
| | (0.0311) | (0.0324) | (0.0376) | (0.0606) | (0.0328) | (0.0731) |
| Reserves | -0 | -0 | -0 | -0 | -0 | -0 |
| | (0) | (0) | (0) | (0) | (0) | (0) |
| Openness | -0.000601 | -0.000786 | -0.000598 | 0.00205 | -0.000608 | 0.00373 |
| | (0.00425) | (0.00430) | (0.00471) | (0.00461) | (0.00422) | (0.00520) |
| Current Account Balance | 0.0453 | 0.0494* | 0.0440 | 0.0385 | 0.0451 | 0.0253 |
| | (0.0277) | (0.0286) | (0.0286) | (0.0515) | (0.0278) | (0.0499) |
| Claims on Government | -0.00706 | -0.00717 | -0.00806 | -0.0216 | -0.00705 | -0.0202 |
| | (0.00844) | (0.00852) | (0.00840) | (0.0195) | (0.00844) | (0.0186) |
| Unemployment | 0.0390 | 0.0382 | 0.0287 | 0.0413 | 0.0389 | 0.0441 |
| | (0.0296) | (0.0301) | (0.0316) | (0.0333) | (0.0299) | (0.0328) |
| Net Foreign Asset | | -0.000861 | | | | 0.00445 |
| | | (0.00257) | | | | (0.00580) |
| Political Rights | | | 0.0625** | | | 0.0654 |
| | | | (0.0295) | | | (0.0418) |
| REER | | | | -0.00204 | | 0.00142 |
| | | | | (0.00903) | | (0.0116) |
| Credit | | | | | -0 | |
| | | | | | (0) | |
| Number of Obs. | 1,585 | 1,585 | 1,583 | 1,076 | 1,585 | 1,076 |

Standard errors in parenthesis. ***(**,*) indicates statistical significance at the 1 (5,10) percent level.

# Chapter II

# INFLATION UNCERTAINTY AND THE DECISION TO DEVALUE

## II.1 Introduction

In the typical rules-versus-discretion framework, e.g. Obstfeld (1997), the choice between fixed and flexible exchange rate regimes is a choice between financial stability and output stability. A fixed exchange rate regime delivers low inflation but it also restricts monetary policy. If the economy is growing the limits to stabilization policy are not a problem. However, a large negative economic shock could induce a switch to a flexible exchange rate regime as the benefits of expansionary policy become greater than the benefits of low inflation. Predicting whether a country would abandon its fixed exchange rate depends on the extent of economic hardship it is willing to bear.

That framework seems to explain behavior well with one caveat: many countries maintain their fixed exchange rate regimes despite extreme economic hardship. The recent experience of Bulgaria, Estonia, Latvia, and Lithuania, four countries with currency boards, exemplifies this "fear of floating," as termed by Calvo and Reinhart (2002). Each of these countries experienced double digit decline in output but did not float their currency. A decade earlier, Argentina opted for preserving its currency board despite a prolonged and deep decline in output until it was forced to devalue in 2001.

We explore this reluctance to devalue from one particular perspective. We argue that uncertainty about inflation under a floating exchange rate regime can act as a significant deterrent to the decision to devalue. Many countries hold their exchange rate fixed in order to stabilize prices after a period of high inflation, a legacy that raises concerns about the ability of the central bank to manage monetary policy. These doubts are further exacerbated by the lack of monetary policy experience while the country operates under a peg. Whether or not the central bank can deliver stable prices post-devaluation is a real concern in these circumstances.

We investigate the effect of inflation uncertainty on currency policy in a simple model that builds on the well-known and widely utilized fixed exchange rate with escape clause framework of Obstfeld (1997). A country operates on a fixed exchange rate regime and, after it experiences a negative economic shock, has to decide whether to continue operating the peg or to devalue. Assuming rational expectations, the possibility of a policy shift in case of a large negative shock is anticipated by economic agents. We introduce inflation uncertainty into that framework and investigate its effect on the decision to devalue. The rationale is based on bodies of literature dealing with credibility and reputation of monetary policy as in Kydland and Prescott (1977), Cukierman (1985), and Blackburn and Christensen (1989). We show that the size of the shock that is required to induce a switch from a peg to a float increases with inflation uncertainty. In other words, inflation uncertainty makes abandoning a fixed exchange rate regime less likely.

We test this prediction using survey data from Bulgaria's currency board. The survey data were collected at the height of economic hardship during the recent economic slowdown when, according to theory, removing the fixed exchange rate could gain significant support. Instead, the data show strong support for maintaining the currency board. The survey is uniquely useful for our purposes as it also asks respondents about inflation if the currency board were removed. This

allows us to establish that: 1) uncertainty about inflation is very high and 2) inflation uncertainty reduces substantially the support for moving to a floating exchange rate regime.

To our knowledge, the empirical part of this paper is the first investigation of the support for a fixed exchange rate regime on the micro level. The literature offers multiple analyses on the macro level investigating the determinants of exchange rate policy (Eichengreen et al. (1995), Szapary and Jakab (1998), Guobing (2003), and VonHagen and Zhou (2007)). The advantage of the micro-level analysis is that it allows us to investigate the heterogeneity within a country. For example, we show that the support for maintaining the currency board increases in age, risk aversion, and education. The literature has also investigated the triggers for a change from one currency regime to another (Frankel (1999), Velasco (2000), Williamson (2000), and Fischer (2001)). In contrast, our analysis focuses on the question why a change in regime did not occur.

The rest of the paper is structured as follows. The next section presents the theoretical model. Section 3 explains the significance of the timing of the survey. Section 4 describes the survey data and sections 5 and 6 provide empirical analysis. We conclude with final remarks in Section 7.

## II.2 Model

We present a simple Barro and Gordon (1983) type model where the central bank chooses between a fixed exchange rate regime without monetary policy and a floating exchange rate regime with discretionary monetary policy. There are two sources of uncertainty. A supply shock could impact the economy after agents have formed inflation expectations but before the central bank decides whether or not to devalue. A monetary shock could occur after the decision to devalue has been made,

driving inflation away from the target of the central bank. Thus, the central bank and the public face uncertainty about the inflation rate following devaluation.

### II.2.1 Basic Setup

The economy's level of output $y$ (all variables in logarithm) is given by the Philips curve:

$$y = \bar{y} + (\pi - E\pi) - u, \tag{12}$$

where $\bar{y}$ is the natural level of output, $\pi$ is inflation, $E\pi$ is expected inflation, and $u$ is a supply shock with mean zero and variance $\sigma_u^2$. The central bank's objective is to stabilize both output and inflation around the values $\tilde{y}$ and $\bar{\pi}$:

$$\min_{\pi} L = (y - \tilde{y})^2 + \alpha(\pi - \bar{\pi})^2, \tag{13}$$

where $\alpha > 0$ reflects its aversion to high inflation. The desired level of output is greater than the natural level of output so that $\tilde{y} - \bar{y} = k > 0$, a policy that generates the inflation bias of discretionary monetary policy.

The central bank is operating under a fixed exchange rate regime and purchasing power parity implies that $\pi = 0$. Agents expect the peg to be maintained with probability $q$ or abandoned with probability $(1 - q)$. Therefore, because inflation under the peg is zero, expected inflation is given by:

$$E\pi = (1 - q)\pi^e, \tag{14}$$

where $\pi^e$ is expected inflation conditional on removing the fixed exchange rate. The expectations are rational and formed before the realization of the shock $u$. After observing the shock $u$, the central bank can choose to keep or to abandon the peg. If the fixed exchange rate is abandoned, the central bank intends to set

inflation at  by solving (13). For simplicity, we assume that the target inflation rate under a flexible exchange rate is $\bar{\pi} = 0$.

If the central bank adopts a flexible exchange rate regime, actual inflation may differ from the intended level by the value of a monetary shock $\epsilon$ with mean 0 and variance $\sigma_\epsilon^2$ . Thus, actual inflation under discretion is $(\pi + \epsilon)$. Note that the monetary shock can affect the economy *only if* the central bank decides to float the currency. We assume that the supply shock and the monetary shock are independent.

We now proceed to find optimal inflation if the peg is abandoned. Substituting (14) into (12) and then (12) into (13) yields:

$$\min_{\pi} = (\pi + \epsilon - E[(1-q)(\pi+\epsilon)] - k - u)^2 + \alpha(\pi+\epsilon)^2. \tag{15}$$

Take the derivative of (15) with respect to inflation  and set equal to zero. This yields the first order condition:

$$[\pi + \epsilon - E(\pi - q\pi + \epsilon - q\epsilon) - u - k] + \alpha(\pi+\epsilon) = 0. \tag{16}$$

Next, taking expectations of equation (16) conditional on a switch to a discretionary regime and solving for $\pi^e$ yields:

$$\pi^e = \frac{k}{(\alpha+q)}. \tag{17}$$

Respectively, from (14), expected inflation is given by:

$$E\pi = (1-q)\frac{k}{(\alpha+q)}. \tag{18}$$

Note that if the likelihood of devaluation is zero, i.e. $q = 1$, then expected inflation is also zero. At the other extreme, when the likelihood of maintaining the

fixed exchange rate is zero, i.e. $q = 0$, expected inflation becomes $k/\alpha$, which is the solution to the standard one-period Barro-Gordon model.

Using our solution for expected inflation, we can then find the optimal inflation rate that minimizes the central bank's loss associated with a policy shift toward discretion:

$$\pi^* = \frac{k}{(\alpha + q)(1 + \alpha)} + \frac{k}{(1 + \alpha)} + \frac{u}{(1 + \alpha)}. \tag{19}$$

From (19), we see that inflation increases in $k$; that is, the greater the difference between the desired and the natural level of output, the more incentive the central bank has to boost output by increasing inflation. Inflation also increases with the size of the shock $u$ but decreases in $\alpha$, the central bank's aversion to high inflation.

### II.2.2 The Decision to Devalue

After the shock $u$ is realized, the loss to the central bank associated with keeping the peg is given by:

$$L_P = [\bar{y} + (\bar{\pi} - E\pi) - u - \tilde{y}]^2 = (k + u + E\pi)^2. \tag{20}$$

The third term in the parenthesis $E\pi$ captures the loss from incomplete credibility of the fixed exchange rate. From (18) with $q < 1$, expected inflation is positive and works as a drag on economic activity via the Philip's curve equation. This raises the loss associated with the fixed exchange rate. With a fully credible fixed exchange rate regime ($q = 1$) expected inflation is zero and the loss depends only on the size of the economic shock $u$ whose impact cannot be softened under the peg and on the output objective $k$ that also cannot be met using monetary policy under the peg.

The loss if the peg is abandoned is random (through $\epsilon$), so we need to consider the expected loss, given by:

$$L_D = E\left[\left(\frac{(1+\alpha+q)}{(\alpha+q)}+\frac{u}{(1+\alpha)}+\epsilon-\frac{k}{(\alpha+q)}-k-u\right)^2 + \alpha\left(\left(\frac{(1+\alpha+q)k}{(\alpha+q)(1+\alpha)}+\frac{u}{(1+\alpha)}+\epsilon\right)^2\right]\right. \quad (21)$$

Note that the central bank calculates its losses under the different exchange rate regimes after observing the shock $u$ and therefore has no uncertainty associated with it. The only source of uncertainty comes through the monetary shock $\epsilon$. Taking expectations of (21) and rearranging terms yields:

$$L_D = \frac{\alpha}{(1+\alpha)}(k+u+E\pi)^2+(\alpha+1)\sigma_\epsilon^2. \quad (22)$$

Note that the loss associated with the flexible exchange rate regime is positively related to the variance of the money shock $\sigma_\epsilon^2$. The effect of inflation uncertainty on the loss is magnified by the term $\alpha$, the central bank's aversion to high inflation.

The switch to discretion occurs when $L_P - L_D > C$, where $C$ is the cost associated with abandoning the peg. This could reflect, for example, the loss of political support for the government and the loss of reputation for the central bank. We denote with $u^*$ the value of the supply shock $u$ that satisfies the condition with equality. Using (20) and (22) and rearranging terms we obtain:

$$u^* = \sqrt{(1+\alpha)[C+(1+\alpha)\sigma_\epsilon^2]}-k-E\pi. \quad (23)$$

In (23) the threshold value of the shock $u^*$ and expected inflation $E\pi$ are jointly determined as the probability that the peg will be maintained $q$ is a function of $u^*$

and, in turn, expected inflation depends on that probability through (18). The probability that the peg will be maintained can then be expressed by:

$$q = F(u^*), \tag{24}$$

where $F$ is the cumulative distribution function of the shock $u$. It follows that $\frac{dq}{du^*} = F'(u^*) = f(u^*) > 0$ and therefore $\frac{dE\pi}{du^*} < 0$.

Our primary analytical interest lies in the effect of $\sigma_\epsilon^2$ on $u^*$. Differentiating (12) with respect to $\sigma_\epsilon^2$ yields:

$$\frac{du^*}{d\sigma_\epsilon^2} = v - \frac{dE\pi}{du^*}\frac{du^*}{d\sigma_\epsilon^2}, \tag{25}$$

where $v > 0$ is the differential of the square rooted term in (23)[15] . We can rearrange equation (25) as follows:

$$\frac{du^*}{d\sigma_\epsilon^2}(1 + \frac{dE\pi}{du^*}) = v > 0. \tag{26}$$

Stability requires $\left|\frac{dE\pi}{du^*}\right| < 1$, which implies the following relationship[16]:

$$\frac{du^*}{d\sigma_\epsilon^2} > 0. \tag{27}$$

Equation (27) shows that uncertainty associated with the monetary shock raises the threshold value of the supply shock below which the central bank does not devalue. In other words, all else equal, the central bank is less likely to devalue and

[15]
$$v = \frac{(1+\alpha)^2}{2}((1+\alpha)[C + (1+\alpha)\sigma_\epsilon^2])^{-\frac{1}{2}}$$

[16]Carlson and Valev (2008) show that a small cost of devaluation, a high value for $k$, and a small value for $\alpha$ yield two solutions for $u^*$ (a low $u^*$ and a high $u^*$)as proposed by Obstfeld (1997). However, low $u^*$, obtained when $\frac{dE\pi}{du^*} < -1$, suggests that the central bank will devalue for shocks $u < u^*$ rather than for shocks $u > u^*$.Carlson and Valev (2008) further demonstrate that a low $u^*$ and an increase in $C$, the cost of devaluation, leads to greater rather than smaller likelihood of devaluations. These scenarios, while technically possible, run counter to basic intuition and are ruled out.

the population is less likely to support floating the currency if there is substantial uncertainty about the level of inflation following devaluation.

### II.3 Choosing Internal Adjustment in Bulgaria

The Bulgarian currency board was implemented in 1997 after a severe financial crisis that caused extreme exchange rate depreciation, hyperinflation, and the failure of many banks (Dobrinsky 2000) and (Berlemann et al. 2002). In January 1997, inflation reached 500 percent on an annual basis and the local currency (lev) depreciated multiple times in the first quarter of 1997. The central bank depleted its international reserves to less than two months worth of imports in an effort to soften the currency depreciation. The crisis sparked massive protests that brought down the government and the new administration opted to stabilize prices by implementing a currency board. The currency board was introduced a few months later on July 1, 1997.

The 1997 crisis was the most sweeping episode of high inflation in Bulgaria but it was not the first one. It was preceded by another period of high inflation and currency depreciation in 1994 and by an earlier similar episode in 1991. Therefore, by 1997 Bulgarians had drawn the conclusion that their central bank was not capable and/or is not allowed to manage monetary policy responsibly. They gave overwhelming parliamentary majority to a political party that promised to eliminate discretion over money supply by the law of the currency board. Thus, it is reasonable to assume that the memories from the period preceding the currency board are characterized by financial instability and monetary policy mismanagement.

A currency board is a variation of a fixed exchange rate regime where the change in money supply is linked to the balance of payments and the monetary authorities forgo discretionary control over the money supply. One important difference

between currency boards and a regular peg is that currency boards have a legal framework. The rules and legal framework of the Bulgarian currency board are written into the Law of the Bulgarian National Bank. Moreover, the central bank maintains foreign exchange reserves that cover the entire monetary base and is prohibited from lending to the government. Because of these features currency boards are often referred to as "hard" pegs, i.e. difficult to revoke. Removing the currency board would require an act of Parliament which makes this a much more political decision, a decision that has to carry the support of the majority of political representatives. This is important in our analysis because the survey data discussed next probes the opinions of the population. The legal framework of the currency board allows these opinions to have direct influence on actual policy.

Currency boards eliminate, or at least substantially restrict, the scope for monetary policy. Hence, at the time the data used in this paper were collected, the Bulgarian central bank had not utilized the tools of monetary policy for over a decade. Removing the currency board would necessitate the reintroduction and refinement of these tools. That, along with the memories of the pre-currency board inflation experience, could increase the uncertainty about monetary policy outcomes if the currency board is removed, i.e. it could raise $\sigma_\epsilon^2$.

Following the introduction of the currency board and a series of structural reforms, Bulgaria experienced a decade of significant economic growth. The prolonged period of financial stability as well as the membership in the European Union attracted substantial amounts of international investment. However, although the massive capital inflows helped raise living standards, they also contributed to a large current account deficits. By 2008, the current account deficit stood at over 25 percent of GDP (Figure 3). The sustainability of Bulgaria's external balances was a major policy concern even before the onset of the global financial crisis. The capital inflows had fueled relatively high inflation since 1997

which, along with the fixed exchange rate, contributed to declining competitiveness over time. The long-term positive impact of the capital flows on economic growth was also doubtful as much of the capital was directed to the real estate sector.

With the start of the financial crisis the Bulgarian economy slowed down substantially. GDP contracted by 5.1 percent in 2009 - the first decline since the crisis of 1996-1997- and unemployment sharply increased to double digits, creating a textbook scenario for considering devaluation. Large capital inflows leading to real appreciation and an unsustainable current account deficit, followed by a major economic shock usually form a lethal combination for currency pegs.

Yet, in the summer of 2010, in the midst of the economic hardship, Bulgarians went to the polls and elected a political party whose centerpiece economic policy item was to maintain financial stability under the currency board. With the support of the population, the policymakers chose internal adjustment through cuts in spending and high unemployment. The "sudden stop" of capital inflows was immediately followed by a sharp decline in income, consumption, and imports so that the current account deficit closed within a year. Although the drastic measures generated some public unrest and resentment, none of it appeared directed against the currency board.

## II.4 Survey Data on Currency Policy Preferences

The paper uses data from a national household survey in Bulgaria administered in November 2010. The sample contains responses from 1016 individuals and its demographic structure in terms of age, education level, income, and gender is representative of the population of 7.5 million. The survey was carried out by a network of professional interviewers for Vitosha Research, one of the major polling agencies in Bulgaria[17]. The survey included two questions that directly inquire

[17]The survey questionnaire and the data are available from the authors upon request.

about the choice of fixed vs. flexible exchange rate regimes. Specifically, respondents were asked whether they agreed or disagreed with the following two statements:

*Statement 1*: I would support removing the currency board and replacing it with a floating exchange rate regime.

*Statement 2*: I would support a political party that promises to remove the currency board and to replace it with a floating exchange rate regime.

Table 9 shows minimal support for switching to a floating exchange rate regime. Only 10 percent of the respondents agreed or strongly agreed with statement 1 and only 7 percent agreed or strongly agreed with statement 2. Approximately half of the respondents did not support either policy they either stated that they don't know or were indifferent between the two currency regimes. Of the ones who expressed an opinion with agree or disagree answers only 25 percent supported moving to a floating regime. The support for political parties that advocate removing the currency board is even weaker. Forty four percent of the respondents disagreed or strongly disagreed with such support.

The survey also inquired about uncertainty following a potential switch to a floating exchange rate regime by asking respondents whether they agreed or disagreed with the following statement:

*Statement 3*: It is very difficult to predict what the inflation rate would be if we remove the currency board and switch to a floating exchange rate regime.

Only 5 percent of the respondents disagreed or strongly disagreed with this statement while 24 percent strongly agreed that it would be difficult to predict inflation. Next, we investigate the effect of this uncertainty on respondents' preferences over currency policy.

## II.5 Support for Devaluation

The estimations in Table 10 investigate the determinants of the support for the currency board using two dependent variables. In columns (1)-(3) we estimate probit models with a dummy variable that equals 1 if a respondent either disagreed or strongly disagreed with removing the currency board , and zero otherwise. We report the marginal effects from the probit estimations instead of the estimated coefficients which makes the interpretation of the quantitative effects straightforward [18][19]. Then in columns (4) and (5) we use the ordered probit methodology and a dependent variable that takes five values ranging from 1 which indicates strong opposition to the currency board to 5 which indicates strong support for the currency board. The advantage of the ordered probit estimations compared to the probit model is that they utilize more of the variation in the data. However, the sizes of the estimated effects are not as directly obvious as in the probit model.

The explanatory variable of primary interest in this paper is based on the question about uncertainty regarding post-currency board inflation. Similar to the dependent variable, we construct two versions of this variable for the estimations. In some cases we use a dummy variable that equals 1 if a respondent either agreed or strongly agreed that inflation would be difficult to predict, and zero otherwise. In the other estimations we use a variable that ranges from 1 (inflation is easy to predict) to 5 (inflation is tough to predict).

The remaining control variables are of interest as well. We enter age in number of years. Older respondents may have stronger memories of the pre-currency board financial instability and may therefore be less supportive of moving back to a floating exchange rate regime. The currency board was implemented 13 years before

[18]Estimated marginal effects are calculated at the mean of the independent variable.
[19]Estimated coefficients for the probit models are found in Appendix B.

the survey and many younger people have no personal knowledge of the pre-crisis experience.

We also account for respondents' level of education and think of it as a proxy for how informed a respondent is about the economy. The effect of education is ambiguous. One could argue that removing the currency board and the ensuing currency depreciation would give a boost to economic activity. However, devaluations could also be very disruptive with negative effects on the overall economy or particular social groups. Thus, the opinion of an informed person is difficult to predict.

The models also include income as individuals with higher income might have a greater stake in preserving financial stability. Arguably, people with higher incomes also have greater assets whose value might decline in case of devaluation and high inflation. We also include a dummy variable for employment status that equals 1 for unemployed individuals. Unlike high income individuals, unemployed people might perceive a greater benefit from a flexible exchange rate regime that gives more flexibility to the authorities to engage in activist policy.

The model also includes a measure of risk aversion based on whether a respondent agreed or disagreed with the following statement: "One must always wear a seat belt when driving." While removed from the monetary issues investigated in the paper, this question has been used in the earlier literature to measure risk aversion Bellante and Link (1981). People who strongly agree that one should wear a seat belt are considered more risk averse than the rest of the respondents. In the Bulgarian survey, 67 percent of the respondents believed that one must always wear a seat belt. Our hypothesis is that these respondents would be more likely to support the *status quo*, i.e. the currency board. Finally, the models also include gender. Details about the construction and summary statistics of all variables used in the models are presented in the Appendix B.

The first column in Table 10 reports a probit model with the dummy dependent variable and the dummy variable for inflation uncertainty. The model excludes all respondents who answered I don't know or did not provide any answer. The estimations show that respondents who are uncertain about inflation following devaluation are 25 percentage points more likely to support keeping the currency board. The coefficient estimate on this effect is highly statistically significant. We observe the same effect in column 2 where we include the I don't know responses. The direction of the effect and its statistical significance is confirmed in column 3 where we use the dummy dependent variable but we switch to the inflation uncertainty variable that takes five different values. In this model, a one step increase in uncertainty leads to about 9 percentage points greater support for the currency board.

In the next two columns we employ the ordered probit methodology with a dependent variable that takes five different values and obtain similar qualitative results[20]. Finally, in the last column we report the estimation of a Heckman selection model where we estimate jointly the decision to give an answer to the question about currency policy and the determinants of the support for the currency board. The motivation for estimating this model is that the decision to give an answer might be correlated with the decision to give a particular answer. Therefore, not accounting for the former might bias the estimation of the latter. In our case, the correlation coefficient is not statistically significant indicating that selection bias is not an issue[21].

Looking at the remaining explanatory variables, we observe that age, higher income, and risk aversion are indeed associated with greater support for keeping the currency board. Education also increases the level of support for the currency board

[20]For the specification of the ordered probit model refer to Appendix B.

[21]For robustness we also estimated the models without income as about 20 percent of the respondents did not provide answers to that question which reduces the sizes of our samples. We obtain the same effects as those reported in the paper.

while being unemployed has no statistically significant effect of these preferences. We experimented with non-linear terms for age and income as well as alternative formulations for the education and employment status variables but the results seem to be fairly linear and no additional statistically significant results were obtained.

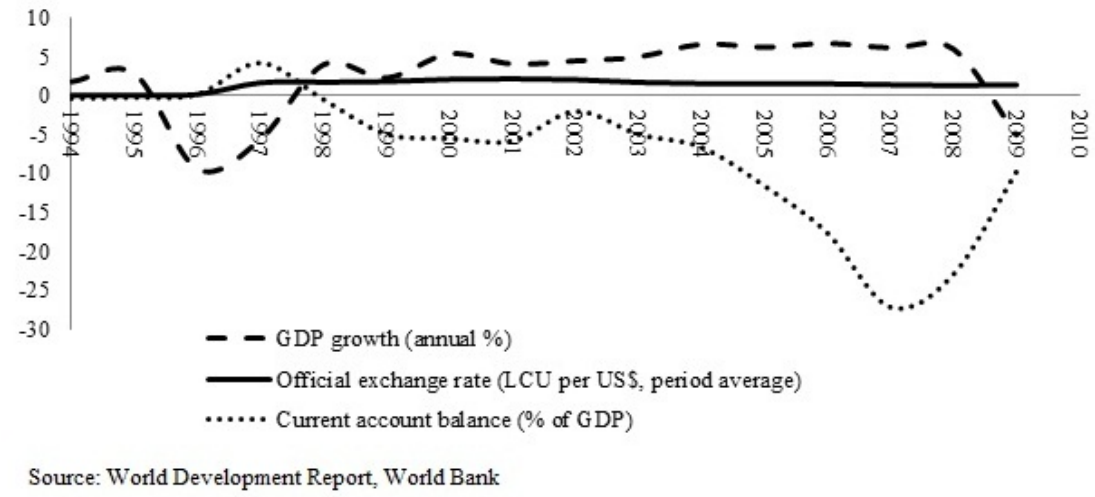
Table 11 reports the results of the same estimations as in Table 10 but investigating the support for political parties that would keep the currency board. As could be expected, the estimation results are almost identical. Nonetheless, the similarity of estimations confirms that currency policy preferences carry over to political choices. Given the opinions expressed in the survey, it is no wonder that each political party is firmly committed to keeping the currency board and that, therefore, the currency board is maintained despite economic hardship.

## II.6 Final Remarks

The theory and evidence presented in this paper show that fixed exchange rate regimes can enjoy substantial support despite their limitations on stabilization policy. This support is partly explained by the uncertainty associated with a switch to flexible exchange rates and discretionary policy. The *status quo* of financial stability and output volatility is preferred to a currency policy change with an uncertain inflation outcome. The evidence suggests why countries might be unwilling to abandon fixed exchange rate regimes despite the extreme economic hardship brought by internal adjustment.

We should finish with a caveat about our particular case study. Bulgaria is also considering entry into the European Monetary Union and adopting the euro as official currency. In principle, this could encourage Bulgarians and their government to sustain the currency board despite the economic hardship and make a direct transition to the euro. In a parallel paper, we show that, although adopting the euro is more popular than moving to a flexible exchange rate regime, it has much

weaker public support compared to the currency board. This lack of support is also explained by uncertainty about the impacts of the euro on the economy. It seems that uncertainty is a significant deterrent to make any switch in currency policy. Therefore, to build support, the expected benefits of a new currency regime would have to be substantial enough to compensate for the risk of change.




Source: World Development Report, World Bank

Figure 4: Bulgaria's GDP Annual Growth, Current Account, and Official Exchange Rate (1994-2004)

Table 9: Currency Policy Preferences and Inflation Uncertainty

| | Statement 1 (Support for Devaluation) | Statement 2 (Support for pro-devaluation party) | Statement 3 (Inflation Uncertainty) |
|---|---|---|---|
| Strongly Agree | 2.5 | 2.2 | 24.1 |
| Agree | 7.7 | 4.3 | 38.3 |
| Neither agree or disagree | 18.5 | 15.7 | 12.1 |
| Disagree | 24.8 | 23.9 | 4.0 |
| Strongly Disagree | 12.7 | 19.8 | 1.5 |
| I don't know | 33.9 | 34.0 | 20.0 |
| Total | 100.0 | 100.0 | 100.0 |

Notes: The numbers of the table are percent of the total by type of response.
Statement 1: I would support removing the currency board and moving towards a float.
Statement 2: I would vote for a party that proposes removing the currency board and letting the lev float.
Statement 3: It is very difficult to predict what the inflation rat would be if we remove the currency board.

Table 10: Support for the Currency Board

| | Dependent Variable: Support for the currency board | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Uncertain | 0.252*** | 0.294*** | 0.0901*** | 0.363*** | 0.180*** | 0.386*** |
| | (0.0506) | (0.0325) | (0.0258) | (0.118) | (0.0661) | (0.0743) |
| Education | 0.0741 | 0.150*** | 0.0714 | 0.0871 | 0.0819 | -0.0673 |
| | (0.0533) | (0.0486) | (0.0529) | (0.106) | (0.106) | (0.123) |
| Male | 0.0399 | 0.0493 | 0.0378 | 0.0595 | 0.0610 | -0.0347 |
| | (0.0458) | (0.0370) | (0.0457) | (0.0936) | (0.0938) | (0.0927) |
| Age | 0.0601*** | 0.0444*** | 0.0599*** | 0.152*** | 0.156*** | 0.114*** |
| | (0.0139) | (0.0111) | (0.0137) | (0.0282) | (0.0279) | (0.0195) |
| Income | 0.0208** | 0.0304*** | 0.0204** | 0.0669*** | 0.0681*** | -0.0103 |
| | (0.00864) | (0.00703) | (0.00862) | (0.0177) | (0.0177) | (0.0176) |
| Unemployed | -0.0382 | -0.0116 | -0.0393 | 0.00973 | 0.0123 | -0.0606 |
| | (0.0689) | (0.0555) | (0.0689) | (0.142) | (0.143) | (0.115) |
| Risk averse | 0.154*** | 0.102*** | 0.160*** | 0.226** | 0.230** | 0.246*** |
| | (0.0480) | (0.0370) | (0.0475) | (0.0986) | (0.0981) | (0.0796) |
| Constant(cut 1) | | | | -0.270 | 0.198 | -0.429*** |
| | | | | (0.271) | (0.355) | (0.112) |
| Constant(cut 2 | | | | 0.626** | 1.087*** | |
| | | | | (0.256) | (0.347) | |
| Constant(cut 3) | | | | 1.580*** | 2.038*** | |
| | | | | (0.259) | (0.351) | |
| Constant (cut 4) | | | | 2.668*** | 3.130*** | |
| | | | | (0.273) | (0.365) | |
| Participation Equation | Dependent Variable: 1 if the respondent provided an answer, 0 otherwise | | | | | |
| Education | | | | | | 0.735*** |
| | | | | | | (0.147) |
| Male | | | | | | 0.244*** |
| | | | | | | (0.0907) |
| Age | | | | | | -7.30e-06 |
| | | | | | | (0.0231) |
| Income | | | | | | 0.104*** |
| | | | | | | (0.0186) |
| Employed | | | | | | 0.0204 |
| | | | | | | (0.0972) |
| Constant | | | | | | -0.346** |
| | | | | | | (0.159) |
| Model Wald Chi(7) | 56.04*** | 129.77*** | 48.33*** | 52.34*** | 52.76*** | 271.94*** |
| Wald test of ind. Eq. | | | | | | 0.4218 |
| Prob > chi2 | | | | | | |
| Number of Obs. | 533 | 809 | 533 | 533 | 533 | 809 |

Notes: The reported coefficients in columns (1), (2), and (3) are marginal effects. Columns (4) and (5) report coefficient estimates of an ordered probit model. Column (6) reports the coefficients of a Heckman selection (probit)model. Standard errors in parenthesis. ***(**,*) indicates statistical significance at the 1 (5,10) percent level.

Table 11: Support for the Political Party Maintaining the Currency Board

| | Dependent Variable: Support a pro-currency board political party | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Uncertain | 0.249*** | 0.329*** | 0.0816*** | 0.343*** | 0.149** | 0.406*** |
| | (0.0520) | (0.0338) | (0.0249) | (0.116) | (0.0594) | (0.0893) |
| Education | 0.154*** | 0.199*** | 0.150*** | 0.294*** | 0.289*** | 0.135 |
| | (0.0501) | (0.0492) | (0.0500) | (0.105) | (0.105) | (0.130) |
| Male | 0.0255 | 0.0276 | 0.0239 | 0.108 | 0.107 | -0.0650 |
| | (0.0453) | (0.0385) | (0.0450) | (0.0938) | (0.0938) | (0.0998) |
| Age | 0.0480*** | 0.0324*** | 0.0479*** | 0.0647** | 0.0667** | 0.0939*** |
| | (0.0138) | (0.0115) | (0.0136) | (0.0285) | (0.0282) | (0.0297) |
| Income | 0.0234*** | 0.0337*** | 0.0229*** | 0.0351* | 0.0354** | 0.000274 |
| | (0.00853) | (0.00724) | (0.00848) | (0.0180) | (0.0179) | (0.0193) |
| Unemployed | -0.00331 | 0.00406 | -0.00600 | -0.0441 | -0.0440 | -0.0245 |
| | (0.0669) | (0.0571) | (0.0674) | (0.158) | (0.158) | (0.128) |
| Risk averse | 0.167*** | 0.121*** | 0.174*** | 0.125 | 0.133 | 0.304*** |
| | (0.0479) | (0.0388) | (0.0473) | (0.101) | (0.101) | (0.0872) |
| Constant(cut 1) | | | | -0.861*** | -0.515 | -0.372 |
| | | | | (0.264) | (0.331) | (0.258) |
| Constant(cut 2) | | | | -0.340 | 0.00261 | |
| | | | | (0.260) | (0.335) | |
| Constant(cut 3) | | | | 0.600** | 0.935*** | |
| | | | | (0.262) | (0.340) | |
| Constant(cut 4) | | | | 1.538*** | 1.873*** | |
| | | | | (0.272) | (0.350) | |
| Constant(cut 5) | | | | 2.591*** | 2.931*** | |
| | | | | (0.298) | (0.373) | |
| Participation Equation | Dependent Variable: 1 if the respondent provided an answer, 0 otherwise | | | | | |
| Education | | | | | | 0.725*** |
| | | | | | | (0.148) |
| Male | | | | | | 0.242** |
| | | | | | | (0.0975) |
| Age | | | | | | 0.00214 |
| | | | | | | (0.0286) |
| Income | | | | | | 0.108*** |
| | | | | | | (0.0203) |
| Employed | | | | | | 0.0148 |
| | | | | | | (0.108) |
| Constant | | | | | | -0.377* |
| | | | | | | (0.225) |
| Wald Chi(7) | 61.60*** | 147.96*** | 43.29*** | 35.58*** | 32.23*** | 48.22*** |
| Wald test of ind. Eq. | | | | | | 0.7131 |
| Prob > chi2 | | | | | | |
| Number of Obs. | 533 | 809 | 533 | 533 | 533 | 809 |

Notes: The reported coefficients in columns (1), (2), and (3) are marginal effects. Columns (4) and (5) report coefficient estimates of an ordered probit model. Column (6) reports the coefficients of a Heckman selection (probit)model. Standard errors in parenthesis. ***(**,*) indicates statistical significance at the 1 (5,10) percent level.

# Chapter III

# SAFETY IN NUMBERS: PUBLIC ATTITUDE TOWARDS ADOPTING THE EURO IN BULGARIA

## III.1 Introduction

The decision to join a currency union, such as the European Monetary Union (EMU), is a choice to join a fixed exchange rate regime and to abandon monetary autonomy. Once a country enters a currency union, the utilization of a common currency will permanently affect the economic conditions in the country. As such, the choice to join a currency union, namely the EMU, must be preceded by a cost-benefit analysis by periphery countries. On the benefit side, currency unions eliminate exchange rate fluctuations among the countries involved as well as the costs associated with them, resulting in the promotion of trade and investment among the countries in the Union. Furthermore, currency unions can enhance an inflation-prone country's credibility in fighting inflation Agenor (1994), Giavazzi and Pagano (1988). Against these benefits of currency unions must be set the loss of monetary policy as an independent policy instrument. Countries that join a currency union lose their individual currencies and along with it the ability to use the exchange rate as a buffer against domestic and foreign disturbances. Economic shocks will affect each member of the currency union differently. Yet, each member of the currency union no longer has the ability to take an individual policy response to economic shocks.

The cost-benefit analysis for periphery countries $vis-\grave{a}-vis$ joining the EMU was altered by the global financial crisis that took place during 2007-2009. The financial crisis was unexpectedly severe. Although at the heart of the crisis was a disruption of the financial sector (Gorton (2010), Kindleberger and Aliber (2005)), the impact was soon after experienced in the real economy, as production, consumption, growth and unemployment suffered significantly (Dewatripont et al. 2010). The detrimental effects of the economic crisis were particularly harsh for countries in the EMU resulting in sovereign debt crisis for some nations. Consequently, European policy makers have taken a number of unprecedented measures. EU governments and the IMF provided low-interest loans- essentially a bailout-to Greece, Ireland, and Portugal. The European Central Bank (ECB) intervened by buying government securities on secondary markets (Buiter and Rahbari 2010). In addition, the *European Financial Stability Facility* and the *European Financial Stabilization Mechanism2* were created to channel resources to EU countries that should come to face fiscal difficulties in the future (Sibert 2010). This paper contributes to the literature on the choice of an exchange rate regime by answering the question whether expected bailout is a driving force in public support for and opposition to joining a currency union. In particular, we use a unique survey data to reveal if the recent actions of the EU governments and the ECB have affected public attitude towards adopting the euro in Bulgaria.

The bailing out of Greece, Iceland, and Portugal has institutionalized the lender of last resort (LOLR) in the European Central Bank (ECB) as well as other EU governments, in particular Germany. When an enterprise, organization, or in this case a country expects to be bailed during financial troubles, then the country will face a soft-budget constraint (Korani 1986). As such the new institutionalization of LOLR who provides a soft-budget constraint has reweighed the cost-benefit analysis that is associated with joining the EMU for periphery countries which could

inevitably distort countries' (both in the Eurozone and in the periphery) action. This institutionalization of LOLR gives rise to a moral hazard problem where shielding a party from risk will invariably change its behavior compared to how it would behave lacking security (Steigner 2004)[22].

Having operated a currency board since its 1997 financial crisis, Bulgaria makes an interesting case as it has a currency board with a peg to the euro that paves the way for a relatively seamless transition to Eurozone membership. The currency board was implemented after a severe financial crisis that caused extreme exchange rate depreciation, hyperinflation, and the failure of many banks (see Dobrinsky (2000) and Berlemann et al. (2002) for a detailed account)[23]. In addition, Bulgaria has been a member of the European Union (EU) since 2007, and seemed bound to join the European Monetary Union (EMU) with substantial public support. However, the two recent developments- the current financial and economic crisis and the bailing out of poorly performing EMU members (i.e. Greece, Ireland, and Portugal) by better situated member countries (i.e. Germany) may have an important impact on the decision to join the EMU. In particular, the crisis in Greece, Bulgaria's neighbor in the north, could be at least partially attributed to its EMU membership, due to moral hazard, large capital inflows, and loss of competitiveness. That lesson should make Eurozone membership less attractive. On the other hand, the Greek bailout confirms that Eurozone countries in financial

[22]While the proponents of LOLR bail-outs argue that it may be efficient (Mishkin 1995),(Santomero and Hoffman 1998), (Freixas et al. 1998), many have criticized LOLR bailouts arguing that bailouts distort incentives and leads to excessive risk taking entities (Goodfriend and King 1988), (Bordo and Schwartz 2000).

[23]The 1997 crisis was the most sweeping episode of high inflation in Bulgaria but it was not the first one. It was preceded by another period of high inflation and currency depreciation in 1994 and by an earlier similar episode in 1991. Therefore, by 1997 Bulgarians had drawn the conclusion that their central bank was not capable and/or is not allowed to manage monetary policy responsibly. They gave overwhelming parliamentary majority to a political party that promised to eliminate discretion over money supply by the law of he currency board. Thus, it is reasonable to assume that the memories from the period preceding the currency board are characterized by financial instability and monetary policy mismanagement.

trouble would receive help, making membership in the EMU to be an insurance mechanism. Thus, the signals are mixed.

Adopting the euro will move Bulgaria from a currency board to a currency union, which is essentially a move from one type of fixed exchange rate system to another fixed exchange rate regime. While such fixed exchange rate regime delivers low inflation, it restricts monetary policy and eliminates monetary autonomy. If the economy is growing the limits to stabilization policy are not a problem. However, a large negative economic shock could induce a switch to a flexible exchange rate regime as the benefits of expansionary policy become greater than the benefits of low inflation. The greatest gain from adopting the euro in Bulgaria is to eliminate the possibility of the collapse of the currency board, which will result in devaluation with dire financial consequences. Furthermore, a large set of literature suggest currency union reduces transaction costs thereby enhancing trade (Rose 2000), (Frankel and Rose 2002), (Rose and Stanley 2005). Moreover, by adopting the currency of a low-inflation country a higher inflation country can import credibility (Herrendorf 1997), (Alesina et al. 2003). On the other hand the main cost of adopting the euro instead of maintaining the currency board is the loss of seignorage and the loss of monetary policy autonomy, not to mention the costs associated with the conversion to the euro which can be substantial. Therefore, in face of economic hardship and in light of the recent events in the Eurozone, Bulgaria needs to reevaluate its pursuit of membership into the EMU.

We explore whether the dynamics of bailouts have affected the attitude about the euro in Bulgaria. We use survey data from Bulgaria collected at the height of economic hardship during the recent economic slowdown. The survey is uniquely useful for our purposes as it asks respondents about expected costs and benefits from adopting the euro. In addition, the survey also inquires about the perceived gains and losses that the neighboring country Greece had to withstand due to its

membership in the EMU. The literature offers multiple analyses on the macro level investigating the determinants of exchange rate policy (Edwards (1996), Szapary and Jakab (1998), Guobing (2003),Hagen and Zhou (2004)). However, the advantage of the micro-level analysis is that it allows us to investigate the heterogeneity within a country. Another advantage of using the survey data is that it allows us to examine whether the costs and benefits of adopting the euro as calculated by economists are the same as those expected by the population.

The survey results show that the global financial crisis as well as the problems with the euro itself has not eliminated the willingness of periphery countries to enter the Eurozone. Although the problems in Greece have highlighted the shortcomings of the euro the recent bailout of countries in the Eurozone have strengthened the perception that the Eurozone acts as an "insurance mechanism". Even though respondents expect the euro to have a negative effect on their personal economic situation as well as that of the average Bulgarian households, they continue to support the adoption of the euro with the expectation that if Bulgaria is part of the currency union it would likely receive help in times of economic difficulties. We also find that support for the Eurozone membership is strongly driven by the degree of trust people have in the EU and Bulgarian institutions. Moreover, we find that younger individuals are more likely to support entering the EMU.

The rest of the paper is structured as follows. The next section presents the survey data. Section 3 discusses expected costs and benefits of adopting the euro in Bulgaria. Section 4 provides empirical analysis and we conclude with final remarks in section 5.

## III.2 Survey Data

A currency board is a variation of a fixed exchange rate regime where the change in money supply is linked to the balance of payments and the monetary authorities

forgo discretionary control over the money supply. One important difference between currency boards and a regular peg is that currency boards have a legal framework. The rules and legal framework of the Bulgarian currency board are written into the Law of the Bulgarian National Bank. Moreover, the central bank maintains foreign exchange reserves that cover the entire monetary base and is prohibited from lending to the government. Because of these features currency boards are often difficult to revoke. Removing the currency board would require an act of Parliament which makes this a much more political decision, a decision that has to carry the support of the majority of political representatives. This is important in our analysis because the survey data discussed probes the opinions of the population. The legal framework of the currency board allows these opinions to have direct influence on actual policy.

The paper uses data from a national household survey in Bulgaria administered in February 2012, during a sever financial crisis and in the midst of the administration of bailouts to Eurozone countries. The sample contains response from 1006 individuals and its demographic structure in terms of age, education level, income, and gender is representative of the population of 7.5 million. The survey was carried out by a network of professional interviewers for Vitosha Research, one of the major polling agencies in Bulgaria.[24]

The survey included the question which directly inquires about the support for adopting the euro through the European Monetary Union (EMU). Specifically, respondents were asked whether they believed the following statement was a very good idea, a good idea, a bad idea, a very bad idea, or didn't know:

*Statement 1*: The adoption of the euro through the European Monetary Union (EMU).

[24]The survey questionnaire and the data are available from the authors upon request.

In addition respondents were asked about the economy-wide potential benefits and costs of adopting the euro. In particular, respondents could respond whether they thought certain macroeconomic variables would improve, not change, deteriorate, or indicate that they did not know with EMU membership. The macroeconomic variables stated were *Price Stability*, *level of Output*, *level of Exports*, and *Employment Rate*. Furthermore, respondents were asked if they expected an improvement, deterioration, or no change to *the Economic Condition of the Average Bulgarian* as well as their *Own Personal Economic Situation* or indicate that they didn't know. The distinction between personal economic situation and that of the average Bulgarian is motivated by the political science literature, which studies the effect of economic conditions on voting. Kinder and Kiewiet (1979) and Kinder and Kiewiet (1981) find that voting decision in the United States are influenced primarily by national economic conditions and much less by individual economic circumstances. As such the differentiation in the survey questions will enable us to observe if there is a *sociotropic* or *egocentric* voting trend in Bulgaria $vis - \grave{a} - vis$ the adoption of the euro.

The questions of primary interest, Bulgarians' perceptions about the advantage of joining the EMU after the recent global financial crisis as well as the role of the euro in the recent crisis in Greece, were asked in the survey through several questions. Respondents could answer that they strongly agreed, agreed, neither agreed nor disagreed, disagreed, strongly disagreed, or didn't know to the following statements:

*Statement 2*: Membership in the EMU is an insurance mechanism, it may cost money, but a country can receive financial help if it needs it.

*Statement 3*: If the country is a member of the EMU, it could borrow more because it would receive the help from the Union in case it cannot pay it back.

*Statement 4*: The problems in Greece are more difficult because Greece uses the euro.

*Statement 5*: Greece receives financial help from European countries because they are part of the Eurozone.

Statement 2 and Statement 3 reveal the perceived benefits of adopting the euro after Bulgarians have observed country members of the European Monetary Union serving as lenders of resorts for economically troubled countries in the union. Statements 4 and 5 are an attempt to gauge how much Bulgarians believe that the troubles that have been plaguing Greece could be attributed to the use of the euro in Greece, as well as the benefits that Greece has received as a member of the EMU (i.e. bailouts from Germany).

Next we present a summary of the survey results. In section 4 we use demographic variables along answer to Statements 2-5 to investigate the effect of the perceived costs and benefits of adopting the euro on respondents' preferences over currency policy.

### III.3 Expected Benefits and Costs of Adopting the Euro

As a member of the European Union (EU) with a pending membership to the EMU, Bulgarians have witnessed the potential benefits and costs associated with the euro through the current global financial crisis and subsequent euro crisis. As such the effects of the violation of the *Maasticht Treaty* with regards to bailing-out highly indebted EMU countries plays an important role in Bulgarians' expectations about the gains and cost of the EMU membership. Table 12 reports Bulgarians' view about the purpose of membership in the EMU beyond potential stability of prices and/or output. The variable of interest, the view of EMU membership serving as an insurance mechanism, has a support of 58 percent of the respondents with an

opinion [25]. In addition, about 45 percent of Bulgarians either strongly agree or agree to Statement 3, indicating that membership in the EMU is believed to allow Bulgaria to borrow more as a member state than it could otherwise as a lone standing country because lenders will be willing to lend to any country at high interest rate taking into account that Europe would refund the debt should the country fail. Furthermore, if a country is able to borrow more the government would be able to increase its public spending potentially improving employment in the country. Therefore, it is safe to say that Bulgarians believe that membership in the EMU could be a shelter from crisis and a source for more funds from investors, potentially leading to a moral hazard problem.

On the other hand, the problems experienced in Greece and other countries that utilize the euro should be a deterrent from adopting the euro as we have seen countries struggle to recover from the global financial crisis. The inability to devalue their currency due to the lack of an autonomous central bank has forced countries such as Greece, Iceland, and Spain to adopt severe austerity measures. Specifically, Greece had to implement steep tax increases, severe government spending cuts, civil service job cuts, and make its economy competitive by cutting the cost of doing business in Greece. Yet as can be seen from Table 12, Bulgarians do not blame the economic hardships of their neighboring country Greece on the adoption of the euro. In fact, 53 percent of the respondents with an opinion do not associate Greece's economic problems with membership in the EMU. Moreover, the belief that the Eurozone serves as an insurance mechanism among Bulgarians is reiterated by the fact that of the respondents who provided an opinion, about 68 percent either strongly agree or agreed with Statement 4, indicating that they believe that due to its membership in the EMU, Greece receives financial assistance from its fellow union countries which it could not have had otherwise.

[25]Respondents that have an opinion are those who didn't respond "neither agree nor disagree" and "I don't know". They either strongly agreed, agreed, disagreed, or strongly disagreed.

Table 13 presents the percent of survey respondents who declared support for or opposition to the adoption of the euro. About 6 percent of the respondents did not express an opinion regarding the adoption of the euro. Of those who did provide their opinion, there are about 43 percent supporting adopting the euro. The relatively high support for the adoption of the euro is surprising; especially given that many of the respondents do not expect much gain in terms of macroeconomic improvement through the adoption of the euro. Table 14 shows the expected benefits and costs associated with adopting the euro. The greatest expected benefit associated with adopting the euro is in exports; 32 percent of the respondents with an opinion believe that exports will increase with the adoption of the euro indicating that by joining the EMU trade is expected to increase as pointed out in the finance literature. Another important expected benefit from adopting the euro is an increase in overall production, with 27 percent of respondents expecting overall production improvement.

In opposition, the highest expected cost of the adoption of the euro is associated with price stability. An overwhelming 46 percent of the respondents with opinion believe that price stability will deteriorate with the adoption of the euro. With fixed exchange rate there is a concern of importing inflation; unlike a floating exchange rate, a country can't appreciate or depreciate its currency in order to not be affected by rising import prices (Edwards 1996). In addition, a very large percentage of the respondents were concerned that adopting the euro will deteriorate their own economic standing as well as other Bulgarian citizens. Only 21 percent of respondents answered that they would experience personal benefit from the adoption of the euro, while 40 percent answered that they would be hurt by the adoption of the euro. Furthermore, while another 33 percent believed that the adoption of the euro would have no effect on them, 6 percent answered that they did not know what kind of effect joining the EMU would have. Expectations of

national cost are well aligned with the expected personal costs associated with adopting the euro. Indeed, of those who responded, 23 of the respondents expected benefits at the national level, 23 percent expected no change, and 42 percent expected costs on the national level associated with the adoption of the euro.

Clearly, even though Bulgarians do not expect gains from adopting the euro both at the personal and national level, they support joining the EMU. However, there is an expected benefit of insurance and the ability to borrow more as demonstrated through the bail-out benefits that Greece has received from its EMU counterparts.

### III.4 Explaining the Support for the Adoption of the Euro

In order to see if Bulgarians adapt their expected cost and benefit analysis based on recent events in the Eurozone, we investigate the determinants of support for the adoption of the euro using demographic variables as well as several variables based on the question discussed above. Table 15 presents the estimated results of probit models with the dependent variable being a dummy variable that equals 1 if a respondent believe that adopting the euro is either a good idea or a very good idea, and zero otherwise. We report the marginal effects from the probit estimations instead of the estimated coefficients, which makes the interpretation of the quantitative effects more straightforward[26][27].

The explanatory variable of primary interest in this paper is based on the question about expected bailouts or the insurance mechanism associated with adopting the euro. Similar to the dependent variable, we construct a dummy variable *Insurance*, which equals 1 if a respondent either agreed or strongly agreed that membership in the EMU serves as an insurance mechanism, and zero otherwise for the estimations. In the same manner we create dummy variables *Borrowing Capacity*, *Difficulty in Greece*, and *Financial help to Greece*, which equal 1 if a

[26]Estimated marginal effects are calculated at the mean of the independent variable.
[27]Estimated coefficients for the probit models are found in Appendix C.

respondent either agreed or strongly agreed to Statements 3-5 respectively, and zero otherwise.

The variable *Insurance* measures respondents' view that joining the EMU will serve as an insurance mechanism. When Germany and the ECB violated the *Maastricht Treaty* and bailed out Greece and other struggling member countries, in essence they created a precedent for other countries to potentially be bailed out in times of financial difficulty. Such a precedent would allow countries like Bulgaria to consider the benefit of having a soft-budget constraint through potential bailouts in their decision to join the EMU.

The variable *Borrowing Capacity* reflects respondents' expectation that joining the EMU implies that Bulgaria will be able to borrow more. The increased ability to borrow knowing that there will be help if a country cannot pay back would allow the Bulgarian government to borrow more than it could have if it was functioning outside the parameter of the EMU. Because more funds available will lead to more government spending, we expect the ability to borrow more would increase the support for the adoption of the euro. The support for joining the EMU for bailout purposes is further re-iterated by the variable *Financial Help to Greece*, which reaffirms the fact that respondents do believe that the EMU does provide help for its member countries as demonstrated through its actions towards Greece during the financial crisis. While the Greek bailout confirms that Eurozone countries in financial trouble would receive help, the problems in Greece could be attributed to its EMU membership induced by moral hazard, large capital inflows, and loss of competitiveness. Through *Difficulty in Greece*, we measure Bulgarians' awareness and expected negative impact of adopting the euro through the anecdotal case of Greece.

In each of the equations reported in Table 15 we include other control variables which are of interest as well. We enter a variable for education equal to 1 if a

respondent had higher education and 0 otherwise, a variable for gender equal to 1 for male respondents and 0 for male respondents, income in terms of income groups, and age in number of years. Respondents' level of education can be thought of as a proxy for how informed respondents are about the economy. The effect of education is ambiguous. One could argue that removing the currency board and the ensuing the adoption of the euro would give a boost to economic activity through increased trade with Europe. However, joining a currency union could also be detrimental with the country having no monetary autonomy to adjust to its own business cycles. Thus, the opinion of an informed person is difficult to predict. $Vis-\grave{a}-vis$ the variable age, older respondents may have stronger memories of the pre-currency board financial instability and may therefore be more supportive of moving from a currency board to another fixed exchange rate regime. The currency board was implemented 13 years before the survey and many younger people have no personal knowledge of the pre-crisis experience. In the same token, individuals with higher income might have a greater stake in preserving financial stability.

In the first column of Table 15 the equation reported includes the variable *Insurance*, which captures the effect of the expected insurance benefits on the support for the adoption of euro, and demographic variables. In addition to the variable *Insurance* and demographics, the equations reported in the second column of Table 15 includes two additional variables describing expected benefits from the adoption of the euro. Namely, these variables are *National benefits*, which equals 1 if a respondent believes that adopting the euro will improve the economic situation of the average Bulgarian, and 0 otherwise and the variable *Personal benefits*, which equals 1 if a respondent believes that adopting the euro will improve his own personal economic status, and 0 otherwise. These two variables enable us to compare the relative effects of personal versus national effects on the support for the adoption of the euro.

The third column includes the variable *Borrowing Capacity*, *National benefits*, *Personal benefits* and demographic variables, while column four and five include the variables *Difficulty in Greece* and *Financial help*, respectively instead of *Borrowing Capacity* in addition to the same variables as in column three. Finally, column six of Table 15 includes both *Insurance* and *Borrowing Capacity* with expected national and personal benefits, while controlling for education, age, gender, and income.

The results in Table 15 show that respondents' belief that the EMU serves as an insurance mechanism increases the support for the adoption of the euro, emphasizing the fact that potential bailouts makes the EMU more attractive [28]. The expected benefits of joining the EMU are further re-enforced through the positive and significant effect of expected increase in borrowing capacity with lower possibility of default on the support for the adoption of the euro. The significant positive relationship associated with insurance and borrowing with regards to the support for moving from a currency board to a currency union suggest that the perceived expected benefits of an insurance mechanism outweigh the economic hardships that come from not stimulating output through devaluation, especially during the current severe recession.

In addition, the perception of both national and personal benefits of adopting the euro has a positive and statistically significant effect on support for joining the EMU. The results highlight that respondents who perceive national benefits and personal benefits from adopting the euro are more likely to support it. The sizes of the marginal effects suggest a strong effect of the expected national benefits as compared to personal benefits. In fact, the marginal effect of *National Benefits* is more than twice larger than the marginal effects of *Personal Benefits*. As such it is clear to observe that there is a more *sociotropic* (instead of *egocentric*) voting trend in Bulgaria with regards to the adoption of the euro.

[28] We observe the same positive and statistically significant effects when we exclude "I don't know" responses.

The estimates for the variables associated with the crisis in Greece, *Difficulty Greece* and *Financial help to Greece*, have a statistically significant effect on the support for adopting the euro. The results in Table 15 show that Bulgarians understand the problems that Greece is facing by having its hands tied through membership in the EMU. In fact respondents who perceive that the woes of Greece are associated with Greece's membership in the EMU are about 18 percent less likely to support the adoption of the Euro. Moreover, the positive and significant marginal effect of *Financial help to Greece* confirm the expected assistance among Bulgarians as a member country of the EMU based on the actions of the richer EMU member countries towards Greece during its troubled times.

The results also suggest that older respondents are more likely to support adopting the euro in each of the specifications. This result could be explained by a lack of trust in an independent monetary authority (central bank) by older respondents based on negative past experience with discretionary monetary policy. As such the older generation is less willing to support policy changes that do not tie the hands of the central bank despite economic hardship.

In Table 16 we add two more variables related to credibility in all the four specifications. The first variable, *Trust in EU Institutions*, takes on the value of 1 if respondents believe that you can trust the European Union institutions. It measures the confidence in the infrastructure surrounding the euro. The second variable, *Trust in Bulgarian Institutions*, constructed in a similar manner measures the credibility of Bulgarian institutions. In the fourth column of Table 16 we also add variables associated with national and personal costs of adopting the euro. The variable *National Cost* equals 1 if a respondent expects the economic situation of the average Bulgarian to deteriorate, and zero otherwise. The variable *Personal Cost* is constructed in the same way, if a respondent expects his own personal economic status to deteriorate then the variable takes on the value of 1, and zero otherwise.

The purpose of including these variables is to test for asymmetries of the perceived costs and benefits of adopting the euro (i.e. whether perceived costs would lead to stronger support for the adoption of the euro as opposed to the perceived benefits).

The results reported in Table 16 echo the results in Table 15 in that the variable *Insurance* is positive and statistically significant implying that the perception of EMU as a safety net leads to greater support for the adoption of the euro. Additionally, older respondent are still in support of adopting the euro even after we control for credibility of institutions and perceived gains and losses associated with the adoption of the euro. We also observe that that if the population has more trust in European institutions then they are about 20 percent more likely to support the adoption of the euro, similar to the scenario of having more trust in Bulgarian institutions albeit smaller marginal effects. It appears that Bulgarians believe in the credibility of the euro and the European Central Bank (ECB) implying that the euro and its institutions has expected stability associated with it. Furthermore, the positive and significant effect associated with *Trust in Bulgarian Institutions* demonstrates Bulgarians' support of their government's policy which is to join the EMU [29]. Moreover, the estimated results in the fourth specification of Table 16 show that the perception of national and personal cost of adopting the euro has a statistically significant negative effect on support for adopting the euro [30].

In order to check for the robustness of the results presented in the previous tables we utilize different estimation methods, the results of which are reported in Table 17. In the first and second column we have estimated ordered probit models, where the dependent variable takes five values ranging from 1 which indicates

[29]Bulgaria's entry in to the Eurozone, initially scheduled for 2010, has been set back for some time around 2012-2013. The entry is conditional on continued fiscal prudence and lower inflation.

[30]We also estimate models controlling for expected costs and benefits of adopting the euro $Vis-\grave{a}-vis$ macroeconomic indicators, namely price, output, employment, and exports. The results show that the expected gains in relation to adopting the euro lead to more support for the adoption of the euro, while expected costs result in less support for the adoption of the euro. Most importantly, even controlling for macroeconomic indicators the support for adopting the euro still increases with perceived insurance mechanism among respondents.

strong support to adopting the euro to 5 which indicates strong opposition for the adoption of the euro[31]. However, for the variable of interest, *Insurance*, we construct two versions for the estimations. In column (1) we use a dummy variable that equal 1 if a respondent either agreed or strongly agreed that joining the EMU serves an insurance mechanism, and zero otherwise. In column (2) we use a variable that ranges from 1 (strongly believe that EMU serves as an insurance mechanism) to 5 (do not believe that EMU serves as an insurance mechanism). The advantage of the ordered probit estimations compared to the probit model is that they utilize more of the variation in the data. However, the sizes of the estimated effects are not as directly obvious as in the probit model. Equally important, about 5 percent of the respondents answered that they could not provide an opinion on the preference to adopt the euro. As such in column (3) of Table 17 we implement the Heckman (1979) estimation method to correct for self-selection bias. The dependent variable equals 1 if respondents support the adoption of the euro, and zero otherwise. Similarly, the variable of interest, *Insurance*, takes on the value of 1 if EMU is perceived to serve as an insurance mechanism, and zero otherwise.

The estimations of the first specification, an ordered probit methodology with a dependent variable that takes five different values, show that respondents who perceive EMU to be an insurance mechanism are more likely to support the adoption of the euro. The coefficient estimate on this effect is highly statistically significant. The direction of the effect and its statistical significance is confirmed in column (2) where we use the dummy dependent variable but we switch to the insurance variable that takes five different values. In this model, a one-step increase in perception of insurance leads to about 12 percentage points greater support for the adoption of the euro. Finally, in the last column we report the estimation of a Heckman selection model where we estimate jointly the decision to give an answer

[31]For the specification of the ordered probit model refer to Appendix C.

to the question about currency policy and the determinants of the support for the adoption of the euro. The motivation for estimating this model is that the decision to give an answer might be correlated with the decision to give a particular answer. Therefore, not accounting for the former might bias the estimation of the latter. Whether or not this concern for a selection bias is justified is indicated by the significance of $\rho$, the correlation coefficient of the standard errors from the two equations. In our case, the correlation coefficient is not statistically significant indicating that selection bias is not an issue. Furthermore, the insurance variable is positive and significant, indicating that support for the adoption of the euro increases by 39 percent if the EMU is considered to be a safety net. Looking at the remaining explanatory variables, we observe that age, trust in EU institutions, and trust in Bulgarian institutions, as well as expected benefits $vis-\grave{a}-vis$ output, employment, and price are indeed associated with greater support for adopting the euro.

## III.5 Final Remarks

Bulgaria currently has a currency board pegging the local currency to the euro putting it one step away from adopting the euro. As one of the new EU member states, Bulgaria has to decide whether to press for the Eurozone membership. According to macroeconomic theory, however, the path to Eurozone membership should be less appealing due the recent global financial crisis. A move from a currency board to a currency union (a move from a peg to another peg) would be less beneficial for Bulgaria than say a devaluation which will enable it to stimulate economic activity.

However, despite economic hardship as experienced by its neighboring country of Greece associated with the use of the euro, we find that the desire to enter the Eurozone has not decreased in Bulgaria. On one hand, the problems in Greece could

be attributed to its EMU membership due to moral hazard, large capital inflows, and loss of competitiveness. That lesson should make European Monetary Union membership less attractive. On the other hand, the Greek bailout confirms that Eurozone countries in financial trouble would receive help. Thus, the signals are mixed.

The survey data analyzed in this paper reveals that there exists a strong support for the adoption of the euro among Bulgarians. The survey shows that the population expects the euro to have a relatively negative impact on various macroeconomic indicators and their own personal economic situation as well as the economic situation of the average household. These expectations work to lower the support for EMU membership. However, a large fraction of the population views the EMU as an insurance mechanism. They believe that if Bulgaria is part of the Eurozone and experiences financial difficulties it would receive help, as epitomize by the anecdotal case of Greece. That perception has a strong positive impact on people's attitude toward adopting the euro.

Table 12: Problems and Benefits Associated with Membership in EMU

| | EMU membership means receive financial ass. | EMU membership means borrow more | Problems in Greece are associated with the Euro | Greece receives financial ass. because of EMU |
|---|---|---|---|---|
| Strongly Agree | 19.58 | 9.05 | 9.74 | 30.02 |
| Agree | 47.32 | 36.08 | 16.00 | 45.13 |
| Neither Agree nor Disagree | 10.14 | 11.33 | 5.67 | 5.37 |
| Disagree | 14.51 | 26.84 | 41.65 | 10.93 |
| Strongly Disagree | 5.57 | 9.54 | 19.48 | 4.08 |
| I don't know | 2.88 | 7.16 | 7.46 | 4.47 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 |

Notes:The numbers of the table are percent of the total by type of response.
Statement 2: Membership in the EMU is an insurance mechanism, it may cost money, but a country can receive financial help if it needs it.
Statement 3: If the country is a member of the EMU, it could borrow more because it would receive the help from the Union in case it cannot pay it back.
Statement 4: The problems in Greece are more difficult because Greece uses the euro.
Statemetn 5: Greece receives financial help form European countries because they are part of the Eurozone.

Table 13: Support for Adoption of the Euro in Bulgaria

| | Adopting the Euro |
|---|---|
| Very good idea | 12.0 |
| Good idea | 33.0 |
| Bad idea | 37.9 |
| Very bad idea | 11.6 |
| I don't know | 5.5 |
| Total | 100.0 |

Notes: The numbers of the table are percent of the total by type of response.

Table 14: Expected Effects on Macroeconomic Indicators from Adopting the Euro in Bulgaria

| | Price Stability | Output | Employment | Exports | Economic Situation of Avg. Bulgarian | Personal Income |
|---|---|---|---|---|---|---|
| Will Improve | 24.65 | 31.41 | 27.93 | 37.48 | 24.06 | 21.07 |
| No Change | 15.81 | 27.63 | 28.73 | 24.25 | 24.75 | 32.9 |
| Will Deteriorate | 51.09 | 28.63 | 31.71 | 23.16 | 44.93 | 40.36 |
| I don't know | 8.45 | 12.33 | 11.63 | 15.11 | 6.26 | 5.67 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |

Notes: The numbers of the table are percent of the total by type of response.

Table 15: Support for the Adoption of the Euro (part 1)

| | Dependent variable: 1 if adopting the euro is a good/very good idea, 0 otherwise | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Insurance | 0.277*** | 0.237*** | | | | 0.227*** |
| | (0.0328) | (0.0347) | | | | (0.0351) |
| Borrow | | | 0.179*** | | | |
| | | | (0.0348) | | | |
| Greece problems | | | | -0.190*** | | -0.176*** |
| | | | | (0.0372) | | (0.0380) |
| Financial help | | | | | 0.0776* | |
| | | | | | (0.0403) | |
| National benefits | | 0.350*** | 0.365*** | 0.363*** | 0.368*** | 0.345*** |
| | | (0.0513) | (0.0498) | (0.0501) | (0.0492) | (0.0521) |
| Personal benefits | | 0.114* | 0.112* | 0.128** | 0.129** | 0.113* |
| | | (0.0607) | (0.0607) | (0.0607) | (0.0596) | (0.0615) |
| Education | -0.0306 | -0.0140 | 0.00564 | 0.00637 | 0.00169 | -0.0113 |
| | (0.0344) | (0.0362) | (0.0361) | (0.0359) | (0.0358) | (0.0364) |
| Male | 0.0206 | 0.0213 | 0.0203 | 0.0264 | 0.0309 | 0.0179 |
| | (0.0341) | (0.0357) | (0.0357) | (0.0355) | (0.0353) | (0.0360) |
| Age | 0.0282** | 0.0355*** | 0.0413*** | 0.0344*** | 0.0374*** | 0.0351*** |
| | (0.0112) | (0.0119) | (0.0117) | (0.0117) | (0.0117) | (0.0120) |
| Income | 0.00120 | 0.00159 | 0.00174 | 0.00139 | 0.00163 | 0.00133 |
| | (0.00141) | (0.00140) | (0.00143) | (0.00139) | (0.00139) | (0.00140) |
| Model Chi2(7) | 67.15 | 155.12 | 146.96 | 143.83 | 129.66 | 163.98 |
| Number of Obs. | 904 | 904 | 904 | 904 | 904 | 904 |

Notes: The reported coefficients in columns (1)-(6) are marginal effects. Standard errors in parenthesis. ***(**,*) indicates statistical significance at the 1 (5,10) percent level.

Table 16: Support for the Adoption of the Euro (part 2)

| | Dependent variable: 1 if adopting the euro is a good/very good idea, 0 otherwise | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Insurance | 0.179*** | 0.217*** | 0.165*** | 0.165*** |
| | (0.0377) | (0.0356) | (0.0382) | (0.0386) |
| National benefits | 0.348*** | 0.342*** | 0.342*** | 0.251*** |
| | (0.0518) | (0.0519) | (0.0524) | (0.0604) |
| Personal benefits | 0.0948 | 0.115* | 0.0966 | 0.0460 |
| | (0.0617) | (0.0610) | (0.0620) | (0.0641) |
| National costs | | | | -0.137*** |
| | | | | (0.0505) |
| Personal costs | | | | -0.109** |
| | | | | (0.0504) |
| Trust in EU institutions | 0.206*** | | 0.195*** | 0.183*** |
| | (0.0384) | | (0.0390) | (0.0400) |
| Trust in Bulgarian Institutions | | 0.127*** | 0.106** | 0.109*** |
| | | (0.0404) | (0.0412) | (0.0418) |
| Education | -0.0235 | -0.0136 | -0.0226 | -0.0127 |
| | (0.0368) | (0.0363) | (0.0368) | (0.0372) |
| Male | 0.0140 | 0.0202 | 0.0130 | 0.0119 |
| | (0.0362) | (0.0358) | (0.0363) | (0.0366) |
| Age | 0.0407*** | 0.0315*** | 0.0371*** | 0.0343*** |
| | (0.0120) | (0.0121) | (0.0122) | (0.0123) |
| Income | 0.00190 | 0.00143 | 0.00173 | 0.00169 |
| | (0.00141) | (0.00140) | (0.00142) | (0.00140) |
| Model Chi2(7) | 175.92 | 160.39 | 178.99 | 201.84 |
| Number of Obs. | 904 | 904 | 904 | 904 |

Notes: The reported coefficients in columns (1)-(4) are marginal effects. Standard errors in parenthesis. ***(**,*) indicates statistical significance at the 1 (5,10) percent level.

Table 17: Support for the Adoption of the Euro (Ordered Probit and Probit with Sample Selection Analysis)

| | Dep. variable:takes on values 1-9 | | Dep. variable: takes on values 1 or 0, |
|---|---|---|---|
| | Insurance takes on values 1 or 0 | Insurance takes values 1-9 | Heckman Selection Model |
| | (1) | (2) | (3) |
| Insurance | -0.377*** | 0.120*** | 0.393*** |
| | (0.0766) | (0.0267) | (0.0982) |
| National benefits | -0.631*** | -0.646*** | 0.916*** |
| | (0.119) | (0.118) | (0.150) |
| Personal benefits | -0.304** | -0.285** | 0.167 |
| | (0.119) | (0.118) | (0.155) |
| Trust in EU | -0.336*** | -0.338*** | 0.482*** |
| | (0.0776) | (0.0782) | (0.0977) |
| Institutions | | | |
| | (0.0776) | (0.0782) | (0.0977) |
| Trust in Bulgarian Institutions | -0.151* | -0.166** | 0.256** |
| | (0.0839) | (0.0840) | (0.0999) |
| Education | -0.0562 | -0.0441 | -0.0665 |
| | (0.0734) | (0.0741) | (0.0914) |
| Male | -0.0904 | -0.0887 | -0.0279 |
| | (0.0721) | (0.0723) | (0.0903) |
| Age | -0.0550** | -0.0619** | 0.111*** |
| | (0.0242) | (0.0242) | (0.0299) |
| Income | -0.00111 | -0.00114 | 0.00451 |
| | (0.00315) | (0.00299) | (0.00349) |
| Constant (cut1) | -2.448*** | -1.922*** | -1.455*** |
| | (0.182) | (0.194) | (0.202) |
| Constant (cut2) | -1.215*** | -0.691*** | |
| | (0.164) | (0.178) | |
| Constatn (cut 3) | -0.0114 | 0.516*** | |
| | (0.154) | (0.174) | |
| Constant (cut 4) | 0.669*** | 1.203*** | |
| | (0.152) | (0.177) | |
| | Participation equation. Dependent variable: 1 if a respondent provided an answer, 0 otherwise | | |
| Age | | | -0.0288 |
| | | | (0.0453) |
| Education | | | 0.0454 |
| | | | (0.142) |
| Male | | | 0.218 |
| | | | (0.140) |
| Income | | | -0.00130 |
| | | | (0.00511) |
| High Social Status | | | 0.236* |
| | | | (0.136) |
| Constant | | | 1.511*** |
| | | | (0.285) |
| | | | (1.675) |
| Model Chi2(9) | 180.40 | 175.06 | 177.30 |
| Wald test of ind Eq. Prob>chi2 | | | 0.4840 |
| Number of Obs. | 904 | 904 | 904 |

Notes: Columns (1) and (2) report coefficient estimates of an ordered probit model. Column (3) reports the coefficients of a Heckman selection (probit)model. Standard errors in parenthesis. ***(**,*) indicates statistical significance at the 1 (5,10) percent level.

# Appendix A

## APPENDIX TO CHAPTER I

Table 18: Exchange Rate Regime Classification, Reinhart and Rogoff (2004)

| Regime | Coarse Grid |
|---|---|
| No Separate legal tender | 1 |
| Pre announced peg or currency board arrangement | 1 |
| Pre announced horizontal band that is narrower than or equal to + \−2% | 1 |
| De facto peg | 1 |
| Pre announced crawling peg | 2 |
| Pre announced crawling band that is narrower than or equal to +\−2% | 2 |
| De facto crawling peg | 2 |
| De facto crawling band that is narrower than or equal to +\−2% | 2 |
| Pre announced crawling peg that is narrower than or equal to +\−5% | 3 |
| Moving band that is narrower than or equal to +\−2% (i.e. allows for both appreciation and depreciation over time) | 3 |
| Managed floating | 3 |
| Freely floating | 4 |
| Freely falling | 5 |
| Dual market in which parallel market data is missing | 6 |

Table 19: Variable Definitions and Summary Statistics

| Source | Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| Reinhart and Rogoff (2004) | RR Classification | 4390 | 2.258 | 1.310 | 1.000 | 6.000 |
| | Peg | 4390 | 0.652 | 0.476 | 0.000 | 1.000 |
| | Exit from a Peg | 4242 | 0.024 | 0.154 | 0.000 | 1.000 |
| WDI, World Bank | Growth (annual %) | 4561 | 3.835 | 6.474 | -51.031 | 106.280 |
| WDI, World Bank | Inflation (% CPI) | 4116 | 39.314 | 475.896 | -100.000 | 24411.030 |
| WDI, World Bank | Current Account Balance | 3766 | -3.012 | 9.661 | -240.496 | 56.698 |
| WDI, World Bank | Openness | 4537 | 69.870 | 40.448 | 0.309 | 438.092 |
| WDI, World Bank | Claims on Government (% GDP) | 4439 | 10.941 | 22.851 | -86.547 | 272.697 |
| WDI, World Bank | REER | 2068 | 3747.840 | 132249.600 | 26.821 | 5965760.000 |
| WDI, World Bank | Reserves (minus gold) | 4575 | $9.90e^{9}$ | $4.85e^{10}$ | -628535.5 | $1.53e^{12}$ |
| Lane and Milesi-Ferreti(2007) | Net Foreign Asset | 4643 | -8377.156 | 137769.500 | -2359118.000 | 2180352.000 |
| WDI, World Bank | Employment (%) | 1707 | 99.016 | 3.952 | 43.500 | 102.500 |
| WDI, World Bank | Unemployment (%) | 1796 | 8.896 | 5.789 | 0.154 | 39.285 |
| WDI, World Bank | Credit (domestic) | 4576 | $1.41e^{13}$ | $1.06e^{14}$ | $-1.34e^{12}$ | $1.60e^{15}$ |
| Polity IV Project | Political Rights | 4902 | 0.858 | 7.470 | -10.000 | 10.000 |

# Appendix B

## APPENDIX TO CHAPTER II

Table 20: Variable Definitions and Summary Statistics for National Survey, Bulgaria 2010

| *Variables* | *Definition* | *No. Obs.* | *Mean* | *Std. Dev.* | *Min* | *Max* |
|---|---|---|---|---|---|---|
| Support currency board | 1 if a respondent strongly disagrees or disagrees with statement 1, 0 otherwise | 646 | 0.56 | 0.50 | 0 | 1 |
| Uncertain | if a respondent strongly disagrees or disagrees with statement 3, 0 otherwise | 646 | 0.76 | 0.43 | 0 | 1 |
| Education | 1 if respondent has a high school education or higher, 0 otherwise | 646 | 0.29 | 0.45 | 0 | 1 |
| Male | 1 if a respondent is male, 0 for female | 646 | 0.46 | 0.50 | 0 | 1 |
| Age | age of respondent | 646 | 5.14 | 1.83 | 1.8 | 9.9 |
| Income | Income group of the individual | 533 | 6.71 | 3.00 | 1 | 11 |
| Unemployed | 1 if a respondent is unemployed,0 otherwise | 646 | 0.13 | 0.34 | 0 | 1 |
| Risk averse | 1 if respondent agrees or strongly agrees with the statement, "one should wear seatbelts while driving", 0 otherwise | 646 | 0.68 | 0.47 | 0 | 1 |

Statement 1: I would support removing the currency board and moving towards a float.

Statement 3: It is very difficult to predict what the inflation rate would be if we remove the currency board.

**Ordered Probit Model Specification Utilized in Table 10 and Table 11**

The variable to be modeled is a an observed and coded discrete response variable, $y_i$ which takes on $J(J = 6)$ different values, which are naturally ordered.

$$y_i = \begin{cases} 1 & (StronglyAgree) \\ 2 & (Agree) \\ 3 & (NeitherAgreenorDisagree) \\ 4 & (Disagree) \\ 5 & (StronglyDisagree) \\ 9 & (Idon'tknow) \end{cases}$$

where $i = 1, 2, ...., n$.

As with the probit model we assume that the observed $y_i$ is generated by a latent variable $y_i^*$. $y_i^*$ is then given by

$$y_i^* = x'\beta + \epsilon_i$$

where $\beta$ is a vector of parameters to be estimated and $\epsilon_i$ is a random error term (assumed to follow a standard normal distribution).

The link between the latent and observed data is then given as follows:

$$y_i = \begin{cases} 1 & \text{if } -\infty \leq y_i^* \leq \alpha_1 \\ 2 & \text{if } \alpha_1 < y_i^* \leq \alpha_2 \\ 3 & \text{if } \alpha_2 < y_i^* \leq \alpha_3 \\ 4 & \text{if } \alpha_3 < y_i^* \leq \alpha_4 \\ 5 & \text{if } \alpha_4 < y_i^* \leq \alpha_5 \\ 9 & \text{if } \alpha_5 < y_i^* \leq \infty \end{cases}$$

where the $\alpha_i$ represent thresholds (cut points) to be estimated.

Table 21: Support for Currency Board

| Dependent Variable: Support for currency board | | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Uncertain | 0.643*** | 0.845*** | 0.228*** |
| | (0.134) | (0.103) | (0.0655) |
| Education | 0.189 | 0.389*** | 0.182 |
| | (0.138) | (0.124) | (0.137) |
| Male | 0.101 | 0.131 | 0.0960 |
| | (0.116) | (0.0982) | (0.116) |
| Age | 0.152*** | 0.119*** | 0.152*** |
| | (0.0352) | (0.0298) | (0.0349) |
| Income | 0.0526** | 0.0813*** | 0.0517** |
| | (0.0219) | (0.0188) | (0.0218) |
| Unemployed | -0.0962 | -0.0311 | -0.0992 |
| | (0.173) | (0.150) | (0.173) |
| Riskaverse | 0.390*** | 0.279*** | 0.406*** |
| | (0.122) | (0.104) | (0.121) |
| Constant | -1.855*** | -2.348*** | -2.253*** |
| | (0.322) | (0.265) | (0.405) |
| Number of Obs. | 533 | 809 | 533 |

The reported estimates are coefficients of a probit model.
Standard errors in parenthesis. ***(**, *) indicates statistical significance at the 1 (5,10) percent level.

Table 22: Support for Political Party Maintaining the Currency Board

| Dependent Variable: Support for pro-Currency Board Political Party | | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Uncertain | 0.638*** | 0.891*** | 0.213*** |
| | (0.135) | (0.101) | (0.0652) |
| Education | 0.418*** | 0.505*** | 0.405*** |
| | (0.143) | (0.127) | (0.142) |
| Male | 0.0666 | 0.0704 | 0.0624 |
| | (0.119) | (0.0981) | (0.118) |
| Age | 0.125*** | 0.0828*** | 0.125*** |
| | (0.0360) | (0.0294) | (0.0356) |
| Income | 0.0611*** | 0.0861*** | 0.0598*** |
| | (0.0223) | (0.0185) | (0.0222) |
| Unemployed | -0.00863 | 0.0104 | -0.0157 |
| | (0.174) | (0.146) | (0.176) |
| Riskaverse | 0.432*** | 0.313*** | 0.448*** |
| | (0.123) | (0.103) | (0.122) |
| Constant | -1.712*** | -2.074*** | -2.054*** |
| | (0.329) | (0.261) | (0.408) |
| Number of Obs. | 533 | 809 | 533 |

The reported estimates are coefficients of a probit model.
Standard errors in parenthesis. ***(**, *) indicates statistical significance at the 1 (5,10) percent level.

# Appendix C

# APPENDIX TO CHAPTER III

Table 23: Variable Definitions and Summary Statistics for National Survey, Bulgaria 2012

| *Variables* | *Definition* | *No. Obs.* | *Mean* | *Std. Dev.* | *Min* | *Max* |
|---|---|---|---|---|---|---|
| Support for adoption of the euro | 1 if respondents believe adopting the euro is a very good or good idea, 0 otherwise | 1006 | 0.45 | 0.50 | 0 | 1 |
| Insurance | 1 if a respondent strongly disagrees or disagrees with statement 2, 0 otherwise | 1006 | 0.67 | 0.47 | 0 | 1 |
| Borrowing Capacity | 1 if a respondent strongly disagrees or disagrees with statement 3, 0 otherwise | 1006 | 0.45 | 0.50 | 0 | 1 |
| Difficulties in Greece | 1 if a respondent strongly disagrees or disagrees with statement 4, 0 otherwise | 1006 | 0.26 | 0.44 | 0 | 1 |
| Financial Help | 1 if a respondent strongly disagrees or disagrees with statement 5, 0 otherwise | 1006 | 0.75 | 0.43 | 0 | 1 |
| National Benefits | 1 if respondents believe adopting the euro will improve the economic situation of the avergage Bulgarian, 0 otherwise | 1006 | 0.24 | 0.43 | 0 | 1 |
| Personal Benefits | 1 if respondents believe adopting the euro will improve their personal income, 0 otherwise | 1006 | 0.21 | 0.41 | 0 | 1 |
| National Costs | 1 if respondents believe adopting the euro will deteriorate the economic situation of the avergage Bulgarian, 0 otherwise | 1006 | 0.45 | 0.50 | 0 | 1 |
| Personal Costs | 1 if respondents believe adopting the euro will deteriorate their personal income, 0 otherwise | 1006 | 0.40 | 0.49 | 0 | 1 |
| Trust in EU Institutions | 1 if respondents strongly agree or agree that one can trust EU Institutions, 0 otherwise | 1006 | 0.68 | 0.47 | 0 | 1 |
| Trust in Bulgrian Institutions | 1 if respondents strongly agree or agree that one can trust Bulgarian Institutions, 0 otherwise | 1006 | 0.28 | 0.45 | 0 | 1 |
| Education | 1 if respondent has a high school education or higher, 0 otherwise | 1006 | 0.41 | 0.49 | 0 | 1 |
| Male | 1 if a respondent is male, 0 for female | 1006 | 0.47 | 0.50 | 0 | 1 |
| Age | age of respondent | 1006 | 50.00 | 15.90 | 18 | 99 |
| Income | Income group of the indvidual | 905 | 9.38 | 12.60 | 1 | 97 |
| High Social Status | 1 if a respondent is in the top 2 classification of social status, 0 otherwise | 1006 | 0.61 | 0.49 | 0 | 1 |

Statement 2: Membership in the EMU is an insurance mechanism, it may cost money, but a country can receive financial help if it needs it.
Statement 3: If the country is a member of the EMU, it could borrow more because it would receive the help from the Union in case it cannot pay it back.
Statement 4: The problems in Greece are more difficult because Greece uses the euro.
Statement 5: Greece receives financial help from European countries because they are part of the Eurozone.

**Ordered Probit Model Specification Utilized in Table 17**

The variable to be modeled is a an observed and coded discrete response variable, $y_i$ which takes on $J(J = 5)$ different values, which are naturally ordered.

$$y_i = \begin{cases} 1 & (VeryGoodIdea) \\ 2 & (GoodIdea) \\ 3 & (BadIdea) \\ 4 & (VeryBadIdea) \\ 9 & (Idon'tknow) \end{cases}$$

where $i = 1, 2, ...., n$.

As with the probit model we assume that the observed $y_i$ is generated by a latent variable $y_i^*$. $y_i^*$ is then given by

$$y_i^* = x'\beta + \epsilon_i$$

where $\beta$ is a vector of parameters to be estimated and $\epsilon_i$ is a random error term (assumed to follow a standard normal distribution).

The link between the latent and observed data is then given as follows:

$$y_i = \begin{cases} 1 & \text{if } -\infty \leq y_i^* \leq \alpha_1 \\ 2 & \text{if } \alpha_1 < y_i^* \leq \alpha_2 \\ 3 & \text{if } \alpha_3 < y_i^* \leq \alpha_4 \\ 4 & \text{if } \alpha_4 < y_i^* \leq \alpha_5 \\ 9 & \text{if } \alpha_5 < y_i^* \leq \infty \end{cases}$$

where the $\alpha_i$ represent thresholds (cut points) to be estimated.

Table 24: Support for the Adoption of the Euro in Bulgaria

| Dependent Variable: 1 if adopting the euro is a good/very good idea, 0 otherwise | | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Insurance | 0.731*** | 0.617*** | | | | 0.593*** |
| | (0.0935) | (0.0954) | | | | (0.0963) |
| Borrow | | | 0.454*** | | | |
| | | | (0.0897) | | | |
| Greece problems | | | | -0.494*** | | -0.458*** |
| | | | | (0.101) | | (0.103) |
| Financial help | | | | | 0.197* | |
| | | | | | (0.104) | |
| National benefit | | 0.913*** | 0.958*** | 0.952*** | 0.968*** | 0.899*** |
| | | (0.148) | (0.146) | (0.147) | (0.145) | (0.149) |
| Personal benefit | | 0.288* | 0.281* | 0.322** | 0.325** | 0.285* |
| | | (0.153) | (0.153) | (0.154) | (0.151) | (0.155) |
| Education | -0.0774 | -0.0354 | 0.0142 | 0.0161 | 0.00427 | -0.0286 |
| | (0.0872) | (0.0914) | (0.0909) | (0.0907) | (0.0903) | (0.0920) |
| Male | 0.0521 | 0.0538 | 0.0511 | 0.0666 | 0.0780 | 0.0453 |
| | (0.0862) | (0.0901) | (0.0900) | (0.0897) | (0.0891) | (0.0908) |
| Age | 0.0713** | 0.0897*** | 0.104*** | 0.0869*** | 0.0942*** | 0.0887*** |
| | (0.0284) | (0.0301) | (0.0295) | (0.0295) | (0.0295) | (0.0303) |
| Income | 0.00303 | 0.00402 | 0.00438 | 0.00352 | 0.00411 | 0.00337 |
| | (0.00357) | (0.00354) | (0.00361) | (0.00352) | (0.00350) | (0.00354) |
| Constant | -1.002*** | -1.323*** | -1.211*** | -0.801*** | -1.120*** | -1.178*** |
| | (0.184) | (0.191) | (0.185) | (0.182) | (0.201) | (0.195) |
| Number of Obs. | 904 | 904 | 904 | 904 | 904 | 904 |

The reported estimates are coefficients of a probit model.
Standard errors in parenthesis. ***(**, *) indicates statistical significance at the 1 (5,10) percent level.

Table 25: Support for the Adoption of the Euro in Bulgaria

| Dependent Variable: 1 if adopting the euro is a good/very good idea, 0 otherwise | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Insurance | 0.462*** | 0.564*** | 0.425*** | 0.426*** |
| | (0.100) | (0.0967) | (0.101) | (0.102) |
| National benefit | 0.907*** | 0.891*** | 0.891*** | 0.641*** |
| | (0.148) | (0.148) | (0.149) | (0.160) |
| Persoal benefit | 0.239 | 0.290* | 0.243 | 0.116 |
| | (0.155) | (0.154) | (0.156) | (0.161) |
| National costs | | | | -0.350*** |
| | | | | (0.131) |
| Persoal costs | | | | -0.279** |
| | | | | (0.130) |
| Trust in EU institions | 0.534*** | | 0.505*** | 0.475*** |
| | (0.104) | | (0.105) | (0.108) |
| Trust in Bulgarian Institutions | | 0.321*** | 0.266** | 0.275*** |
| | | (0.102) | (0.104) | (0.106) |
| Education | -0.0593 | -0.0344 | -0.0571 | -0.0322 |
| | (0.0931) | (0.0918) | (0.0933) | (0.0943) |
| Male | 0.0353 | 0.0509 | 0.0328 | 0.0301 |
| | (0.0914) | (0.0904) | (0.0916) | (0.0926) |
| Age | 0.103*** | 0.0796*** | 0.0937*** | 0.0869*** |
| | (0.0303) | (0.0306) | (0.0309) | (0.0310) |
| Income | 0.00479 | 0.00361 | 0.00438 | 0.00427 |
| | (0.00358) | (0.00354) | (0.00358) | (0.00354) |
| Constant | -1.629*** | -1.316*** | -1.606*** | -1.212*** |
| | (0.201) | (0.193) | (0.202) | (0.216) |
| Number of Obs. | 904 | 904 | 904 | 904 |

The reported estimates are coefficients of a probit model.
Standard errors in parenthesis. ***(**, *) indicates statistical significance at the 1 (5,10) percent level.

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# VITA

Menna Bizuneh was born in Addis Ababa, Ethiopia on December 8, 1980. She holds a Bachelor of Arts in Economics from Emory University (Atlanta, GA), a Bachelor of Science in Industrial and Systems Engineering from Georgia Institute of Technology (Atlanta, GA), and a Masters of Science in Economics from the University of Illinois at Urbana-Champaign (Champaign, IL).

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While at Georgia State Menna has been the recipient of several awards. In 2008 she received the George Malanos Scholarship in recognition of her commitment to the exchange of ideas and the creation of a community of scholars. In 2010 she received the Service Award for her leadership as the President of the Graduate Student Association, and in 2011 she received the Theodor C. Boyden Excellence in Teaching Economics Award.

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