الاستدلال البيزي لتقدير العائد على التعليم في فلسطين

**Bayesian Inference on Returns to Schooling in Palestine**

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# DEDICATION

*To the source of manhood and sacrifice, to my Father; Hussein Ayyash.*

*To the source of love and tenderness, to my Mother; Zakiyya Shehadah.*

*To those who are closer to my soul; to my brothers and sisters.*

*To those who felt happy, sincerity and faithfulness with them, to my friends and colleagues.*

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# Context

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**ملخص الدراسة:**

اهتم الباحثون حديثاً في دراسة الأجور ومحدداتها، حيث يعتبر التعليم انه آداة استثمار مهمة. والتي يمكن أن تُغيّر من إنتاجيّة العامل وتؤثر على النمو الاقتصادي بشكل عام ، وبالتالي فإن لها أثراً مهماً على الأجور. وتؤكد نظرية رأس المال البشري على أن الاستثمار في رأس المال البشري يؤثر بشكل واضح على نواتج سوق العمل، حيث يمكن تعريف الأجور المكتسبة والمتأتّية من التعليم على أنه عائد على الاستثمار. يُعرّف العائد على التعليم على أنه العائد الحدي للأجور بالنسبة لعدد سنوات الدراسة؛ أي أنه متوسط نسبة الزيادة في الأجور المرتبطة بزيادة سنوات التعليم سنة دراسية إضافيّة. إن الأسس النظرية لنموذج رأس المال البشري تم وضعها من قِبل الباحثين (Mincer ,1974) و (Backer ,1964) و (Schultz, 1961).

هناك العديد من طرق الاستدلال الإحصائي التي تم تطبيقها واستخدامها لتقدير العائد على التعليم. فطرق الاستدلال الاعتيادية (MLE و GLM و GLS و OLS) تعطي نتائج غير فعالة لمعاملات نموذج خط الانحدار، في غضون ذلك فإن استخدام الاستدلال البيزي يمكّننا من إيجاد حلول لبعض المشاكل الناجمة من استخدام طريقة المربعات الصغرى الاعتيادية او العامة، حيث إن الاستدلال البيزي يربط االمعلومات القبليّة أو السابقة بتوزيع الاحتمال للبيانات لايجاد التوزيع البَعدي للمَعلمات ( المعاملات )، وعلاوة على ذلك فإن هذه الطريقة تعتبر الأخطاء كمتغير عشوائي ، وبالتالي يمكن إيجاد التوزيع التقريبي للمعلمات، كذلك فان مقارنة النماذج باستخدام معامل بيز (Bayes Factor) تمكننا من تحديد النماذج الأفضل بشكل أكثر فعالية من الطرق الكلاسيكية (R-squared, AIC, ..etc). لهذا تُعزى أفضلية طريقة الاستدلال البيزي عن غيرها من طرق الاستدلال الاحصائي.

تهدف هذه الدراسة إلى تقدير العائد على التعليم في فلسطين. حيث تستخدم بشكل أساسي طريقة الاستدلال البيزي لدراسة العلاقة بين الاجور والتعليم. وتطبّقه على نموذج ( Mincer 1974,) الذي يدرس العلاقة بين الأجور ومجموعة من المتغيرات مثل: الجنس وعدد سنوات الدراسة و العمر أو الخبرة أو مستويات التعليم ومكان السكن وقطاع العمل. تقارن الدراسة بين نتائج تقدير معادلة خط الإنحدار بطريقة الاستدلال البيزي، ونتائج تقدير المعادلة نفسها بطريقة المربعات الصغرى. ومن أهم النتائج التي تم التوصل إليها أن طريقة الاستدلال البيزي فعالة أكثر

من طريقة المربعات الصغرى ، حيث أن الخطأ المعياري لمتوسطات المعاملات بطريقة الاستدلال البيزي أقل من الخطأ المعياري بطريقة المربعات الصغرى.

وتهدف هذه الدراسة أيضاً إلى تصحيح التحيز الناتج من الاختيار الذاتي (self-selection) ، حيث توصلت الدراسة إلى أن تقدير العائد على التعليم بطريقة الاستدلال البيزي مع تصحيح (Heckman ) باستخدام ( Logit) يختلف عن تقدير العائد على التعليم بطريقة الاستدلال البيزي مع تصحيح (Heckman) باستخدام (Probit) و طريقة الاستدلال البيزي بدون تصحيح (Heckman) ، وأن استخدام (Logit) أفضل من استخدام (Probit) في تصحيح(Heckman).

**Abstract:**

In recent decades, researchers focus on earnings and what determines it. Education is an important investment tool, which can improve workers' productivity and influence economic growth. As an important determinant of labor productivity, it also therefore has an important influence on earnings. The human capital theory emphasizes the impact of human capital investment on labor market outcomes. We can identify the earnings attainment derived from education as the return on an investment. Therefore, the rate of return to education is known as the average increase in wages associated with one year increase in education. The basic theoretical model for the human capital is considered by Mincer (1974), Backer (1964) and Schultz (1961).

There is various statistical inference methods have been applied to return to education. Inference methods like (OLS, GLS, GLM and MLE) produce an inefficient estimation of the parameters. Meanwhile, Bayesian inference methods can provide solutions to many problems in classical inference methods and may fit out them. Furthermore, model comparison using Bayes factor produce more efficient results than classical methods (R-squared, AIC,…etc).

The aim of this thesis is to highlight the investigations about the estimates of returns to education in Palestine. It's mainly uses Bayesian inference to identify the relationship between education (schooling) and wage controlling for other variables that will affect the relationship like gender, experience or age, educational levels, labor sector and place of residence and compares between OLS and Bayesian estimation. We find that Bayesian estimation method is more efficient than OLS estimation method since the

standard error of the mean for Bayesian method is lower than those found in OLS method. Finally, we correct for self-selection bias and we find that Bayesian estimation with $Logit$ Heckman correction differ and greater than from those we've got form Bayesian estimation with $Probit$ Heckman correction and Bayesian estimation without Heckman correction.

# Chapter One

## Introduction

Human Capital theory proposing that there are an intrinsic economic effects of education on both economic levels, i.e. micro and macro levels, that considers the expenditure on education as a human capital investment. Education is one of the major factors that affect earrings and wages for workers. Education may affect individual's life, participation in many economic activities, productivity of the workers and the overall economy in several ways. Since the individual who doesn't have basic education levels has difficult status to communicate everyone life. As education is a major way to human capital accumulation, the economic returns to education (RTE) has been one of central topics in labor economics and economics of education. The view point of individuals and government for the interest in education come from the importance of education to both. Government considers education as one of the most important determinants that will affect gross national product (GDP) in the long run, the person takes into his account cost and revenue when he will invest in education and compare between them by measuring the present value. From the standpoint of individuals, the education is considered to them have a better job with respect to wages, knowledge, job security and other features. The basic theoretical model for the human capital is considered by Mincer (1974), Backer (1964) and Schultz (1961). Accordingly, one can identify the earnings acquisition derived from education as the return on an investment. Therefore, the rate of return to education is known as the average increase in wages associated with one year increase in education.

We can use the human capital theory to derive and estimate many indicators such as the private rate of return to education and the social rate of return to education as well, where the return to education is not confined to the educated himself. The private rate of return to education presents the increasing in wages of educated persons by increasing the worker's productivity which depends on his knowledge, better skills and deep understanding of technology of production and accompanied with some economic and social features and positively effects on the society considered as externalities. The social rate of return to education indicates the changes in average wages in certain region because of changes in average schooling levels in that region.

Many researchers estimate Mincer human capital equation using various statistical inference methods. Linear regression methods like (OLS, GLS, GLM and MLE) produce an inefficient estimation of the parameters. Meanwhile, Bayesian inference methods can provide solutions to many problems in classical inference methods and may fit out them. Furthermore, model comparison using Bayes factor produce more efficient results than other methods (R-squared, AIC,…etc). OLS and Bayesian estimation suffer from three problems, self-selection bias (Heckman, 1979), ability bias (Altonji and Dunn, 1996) and endogeneity problems (Angrist and Kruger, 1991). Heckman (1976) shows that least square estimator is biased due to self-selection, especially for the groups that have low participation in the labor force i.e. women. Daoud (2005) corrects of self-selection bias using Heckman (1976) two-step procedure and he finds that education increased the labor force participation because years of schooling dummy coefficient is significant and positive. Moreover, the endogeneity problems carried out by Heckman and Vytlacil (1998) and Card (2001), they estimate RTE using instrumental variable methods and yield an unbiased estimation. But, normality assumption of errors is restricted since the wage distribution is skewed. Instead of the usual regression methods (OLS, GLS, ML), Bayesian inference methods help us to avoid some problems of estimation that exist in usual inference methods and may fit out them. Block, Hoogerheide and Thurik (2012) apply Bayesian inference using family background variables as instruments for education; they find different results by relaxing the strict exclusion restriction on the family background variables, and the width of the 95% posterior interval larger than the size of bias for the education coefficient in the IV model.

In this thesis, we aim to estimate the rate of return to education in Palestine using Palestinian Central Bureau of Statistics (PCBS) quarterly data of Palestinian labor force survey (PLFS) for the period 2006 – 2011. We mainly use Bayesian inference to identify the relationship between education (schooling) and wage controlling for other variables that will affect the relationship like gender, experience or age, educational levels, labor sector and place of residence and compares between OLS and Bayesian estimation. Moreover, we aim to find the better predictor of wages among three variables (i.e. potential experience, age and education levels). We find that Bayesian estimation method is more efficient than OLS estimation method since the standard error of the mean for Bayesian method is lower than those found in OLS method. Our results add further evidence of using age to estimate return to education instead of potential experience and education levels. Finally, return to education estimated by Bayes and OLS suffer from self-selection bias. We apply Bayesian inference to Heckman tow-step procedure with $Logit$ and $Probit$ models to correct for self-selection bias. We find that Bayesian estimation with $Logit$ Heckman correction differ from and greater than those we've got form Bayesian estimation with $Probit$ Heckman correction and Bayesian estimation without Heckman correction

# Chapter Two

## Literature review

The expenditure on the education appears to be an investment in human capital, based on this, the private returns to education interpreted as the increase of wage on cost from the increase of years of education by one year. Mincer (1974), Backer (1964) and Schultz (1961) put the basic theoretical model for the human capital that defines the education as a human capital, and in this model earnings depend on the years of schooling, experience (or age), and the square of experience (or age), to be concentrate on the convex of income function.

Hundreds of studies in many different countries and time periods estimate the returns to education. Psacharopoulos and Patrinos (2004) review a lot of researches that estimate the returns to education, and the study concludes that the returns to education are high in (Sub-Saharan Africa) and it was 37.6%, 24.6%, and 27.8% for primary, secondary, and tertiary respectively. In another study Psacharopoulos (2009) finds that there is a negative relationship between RTE and the individual earn from the domestic product adjusted PPP $. And these provide evidence on the negative tie between RTE and the levels of income.

Badescu, D'Hombres and Villalba (2011) estimate the private rate of returns to education using data from 24 analogous European countries and analogous methods (OLS and OLS controlling for family background variables). They find that the private rate of return to education vary frequently across the countries (i.e. highest rate in Portugal (98%) and lowest rate in Sweden (20%)), also they re-estimate it using OLS controlling the family background variables and they find that the estimation doesn't differ considerably. Tansel (1995) indicates that the RTE in Egypt for males increased by level of schooling, this rate rises from 0.9% with respect to the holders of elementary education, to 2.7% for the holders of a general secondary education, to 3.1% for the holders of technical secondary education, to 7.5% for the holders of university degree and to 11.8% for the holders of a higher university degree. However, the situation is different for females, where the rates of return on their education 9.9% for primary education, 8.2% for general secondary education and 6.1% for the technical high school, while the rates was 7.4% for the higher education. This trend although differs from the general trends in the Arab countries, but it's largely consistent with the global trends. However, the study of Salehi-Isfahani *et al* (2009) compares between the education systems, and the circumstances of the labor market in Egypt, Turkey, and Iran, and it uses data and methodology in the same fashion to study the effect of shape of labor market and the education system on RTE, the study concludes that the RTE is higher in Turkey than in Iran, and also higher than in Egypt ( 12.4%, 7.6%, 5.4%, respectively for year 2006 of Egypt and Iran, and 2003 of Turkey). The World Bank (2008) study concludes that there is a difference in the estimation of RTE. The estimations come from different models for different countries, and finds that the rate of return to education in the MENA region ranges from 4.4% for Tunisia, to 8% for Morocco, and the average is 5% for MENA countries. O'Donghue (1999) finds a result that is consistent with the other international comparisons, that is, the RTE tend to be diminishing with education level, and that the RTE for men is less than those for women.

OLS and Bayesian estimation suffer from three problems, self-selection bias (Heckman, 1979), ability bias (Altonji and Dunn, 1996) and endogeneity problems (Angrist and Kruger, 1991). Heckman and Vytlacil (1998) and Card (2001) estimate RTE using instrumental variable methods and yield an unbiased estimation. But, the normality assumption of errors is restricted since the wage distribution is skewed. Card (1995) compares between OLS and IV estimates. He considers the distance to college as an instrument for schooling and rely this to the higher level of education of men who take about four years of study in college. He finds that the return to education is 13.2% using instrumental variable compared to those found in OLS 7%. Altonji and Dunn (1996) indicate that the family educational background is an important factor in determining the return to education at the individual level. Wolter and Zbinden (2001) used Swiss results two-page questionnaire[1] that distributed in 10 Europe countries. They deduce that after graduation the point estimate of wages are close to the actual wages, while the real wage gain in the first ten years of vocational experience is significantly less than the expectation of wage gain, and base on the individual wages and cost expectations the rate of RTE can be partially interpreted by priority of students, self-assessment of their academic achievement and their particular job perception. Moreover, men expect significantly higher wages and higher wage gains than women.

Blundell, Dearden and Sianesi (2001) reviewed alternative methods and models for estimation RTE, especially the difference between single and multiple treatment

[1] - see Brunello et al. 2001 for the detailed questionnaire.

models[2]. They take three methods of estimation which depend on distinct assumptions (i.e. instrumental variable methods, control function methods and propensity score matching) for homogenous and heterogeneous[3] returns models. Regression of log earnings on schooling using OLS yields a biased estimation since there is a correlation between schooling and errors with three sources of bias ability, returns and measurement error bias. These biases originate from the correlation of the measures of the observable schooling with the unobservable in the earnings regression. For IV methods of estimation, we can get a consistent estimator of the returns if we can find an instrument that is uncorrelated with the unobservable ability, heterogeneity and measurement error terms but correlated with the true measure of schooling. Also, when the instrument has a little correlation with the schooling variable, the estimator is said to be efficient. Moreover, the issue of weak instrument occurred when the sample correlation is very weak and the true correlation is zero. So that with this situation the IV estimation will head for to the biased OLS estimator. In the heterogeneous returns model the IV estimate will diverge relying on the type of instrument is used. The control function method (CF) in a multiple treatment model permits for heterogeneity, however at the expense of the ability to create a collection of control function that is independently diverse. The matching method is a nonparametric method that its main objective is to re-set up the conditions of the trial when we don't have data. Aside from the loss of information problem, if the effect of treatment is homogenous, there is no more additional problems

[2] - One factor model: all schooling can be believed of as an investment in a single homogenous structure called human capital and the same return obtained from each additional unit.

[3] - The homogenous returns model considers the rate of return to gross earnings of a specified human capital investment doesn't vary among all individuals. If the returns are allowed to vary among all individuals, then the model is said to be heterogeneous returns model.

appears. A drawback of the CF method is that it is possible to get estimation that yield a change in the parameter being estimated if the effects vary towards treated individuals, so that we cannot identify the true parameter. In a single treatment models IV and CF estimates are higher than those for OLS and the upward bias in returns is caused by chooses of incorrect instruments, while matching estimates are below IV and CF estimates, but somewhere between highest and lowest OLS estimates. In multiple treatment models the OLS estimates are less than the IV estimates. The control function estimates are higher than the OLS estimates but slightly smaller than the IV estimates.

Angrist and Krueger (1991) aims to estimate the effect of the compulsory schooling laws in the US. They stratify a classical approach, two stages least squares method (2SLS), using data sets on individuals from all states of the US in order to form instrumental variables for years of schooling (i.e. they use date of birth as an instrument), that take an advantage of students born in distinct quarters, have distinct average of education. In particular, males born in later quarters are get more education, and more likely to graduate from high school and earn more than those who are born in earlier quarters. They find that the season of birth has a slightly effect on the level of education males lastly achieve, on the relation between the education achievement and the quarter of birth. This result is justified by the laws of mandatory schooling that instantly some students want to quit from the school when they achieve the statutory age of drop out and postsecondary years of education doesn't affect by the season of birth. Moreover, OLS and 2SLS result of monetary return to education doesn't vary salient, and the estimate differences are not statistically significant. They attribute these differences to some variables removals or error in measurements, in which the OLS estimates of the return to education may encouraged by a downward bias. Their main finding that the laws of mandatory education are influential in forcing some students to get education. Hoogerheide and Dijk (2006) reconsidered the analysis of the impact of the schooling on earnings by Angrist and Krueger (1991). They expanded the methodological and the experimental way. In the classical approach, they used two methods, i.e. two-stage least square (2SLS) and limited information maximum likelihood (LIML), in order to discuss the Angrist- Krueger IV model using US data in four Census regions. 2SLS estimation proposes that the US is roughly fully determined by the region south with small differences between the South and the 2SLS estimates for the US, and the US asymptotic standard error is not smaller than that for the South. This is may be due to the average education level for men born in 1930 – 1939 are higher for the other regions than in the South. Therefore the impact of the laws of mandatory schooling is smaller for the other regions than the region South, when much students wish to drop out from the school at once its permit. Thus the impact of quarter of birth in the Southern region is higher; hence the instruments are more powerful in the South. 2SLS estimator has a problem that in the case of low instruments it may experience a biased estimation, for the region South it has a very weak instruments with lower variance however larger bias. However, LIML estimation leads to overpower of the southern region with small distinction between the LIML estimates for the south and the US.

Furthermore, Hoogerheide abd Dijk (2006) reviewed the study of Angrist and Krueger (1991) using two Bayesian approaches; using flat prior of Dreze (1976) and the Jeffrey's prior. They find results like the results found from the two classical approaches, 2SLS and LIML. Under the prior of both flat and Jeffrey's the posterior distribution of the parameter for the US is roughly fully determined by the South region, that is, the discrepancy between the means or medians of the region south and the US is slight, and the 95% and 50% posterior density intervals and the posterior standard deviation for the US is not frequently smaller than those for the region South. Under Jeffrey's prior the posterior results supplemental point that the most powerful instruments in the region South are the quarters of birth, which is similar to the LIML estimator. The results from the flat prior estimation are stupendous the same for the estimator of the 2SLS method , that is, the posterior mean and the posterior standard deviation are close to those found in 2SLS. They conclude that under using flat prior we will get estimation closer to 2SLS than to LIML, and under the Jeffrey's prior estimation we will get estimation closer to those for LIML estimator.

Yu, Kerm and Zhang (2004) estimate RTE using Bayesian inference on quantile regression and they find that RTE varies toward quantiles of the conditional wage distribution, RTE is smaller at smaller quantiles than at higher quantiles which indicates that the spreads in the conditional wage distribution levels is also featured by an increase in spread not only by a change in location. By this method there is a smaller dispersion in the wages of less educated employers and we can't find it by regression. Block, Hoogerheide and Thurik (2012) apply Bayesian inference using family background variables as instruments for education; they find different results by relaxing the strict exclusion restriction on the family background variables, and the width of the 95% posterior interval larger than the size of bias for the education coefficient in the IV model. Lubrano and Ndoye (2012) proposed a Bayesian inference for an unconditional quintile regression model. Using a blend of normal densities they estimate the distribution of log wage and this procedure will give us better estimates in the upper tail of the wage distribution. Their method applied to a Mincer equation using data from the CPS (ORG) during the period 1992 to 2009 and find that the variation of RTE and gender discrimination are the main factors that affects the wage inequality.

Arabsheibani and Mussurov (2006) estimate the rate of return to schooling in Kazakhstan using OLS and IV methods. They use husband's education and smoking as instruments and provide estimates for males and females separately. They find significant estimates using OLS and lower rate of return to education for males 8% compared to 11.5% for females. Also they modify the sample using married males and finds the OLS estimates is 7.8% which less than the whole sample 8%. They use husband's education as instrumental variable and they find that this instrument is valid and the estimate of OLS of rate of returns is lower than IV estimates by 3.4%. Moreover, they apply 2SLS using husband's education and smoking as instrumental variables and they find results similar to those found using IV method. However, they modify the sample using married females and find that OLS estimates of rate of returns 11.9% which close to the result of the whole sample 11.5%, which is lower than the IV wife's education estimates 16.7% by 4.8%, and the wife's smoking is not a valid instrument since the proportion of females who smoked in both samples, the married and whole samples. The 2SLS estimates for this sample is less than IV estimates by 3% and greater than OLS estimates by 1.8%. They use education levels instead of years of schooling variable for males and females separately and find a low gender differences in returns to vocational and college qualifications. But, females have lower rates of return with higher levels of education and males have higher rate of return with higher levels of education. Buchinsky (2001) estimates women's return to schooling in U.S. He use quantile regression (QR) approach and applies on it a sample selection model. He verifies that the estimates of the sample selection equation using parametric Probit model are significantly different from those obtained for a semi-parametric model and that for all age categories and quantiles the sample selection bias is significant. Moreover, he finds that the returns to education increased slowly in older groups, but increased extremely for younger groups. Also the returns are greater at lower quantiles in the starting of the sample period, but in the termination of the sample period returns are greater at greater quantiles.

There are a few literatures on returns to education in Palestine, especially those that use Bayesian inference. Angrist (1995, 1996, and 1997) uses data from Israeli Official statistics to estimate the private rate of return to education in Palestine during the period 1981 -1991 and he was restricted his studies on males only. His main finding is that the direction of the private return to education is decreasing with time. He was attributed this result to an increase in the number of college graduate students during the eighties of the last century. Sayre (2001) uses the same data used by Angrist. He finds that the average wages for high school holders are less than for those who have university holders by 47% in 1981 and this difference is decreased approximately by 15% in 2001.

Least square estimators is biased due to self-selection bias, especially for the groups that have low participation in the labor force i.e. women, Heckman (1976). Daoud (2005) used data from Palestinian Central Bureau of Statistics; and he finds that the return to schooling is smaller for men by doing regression apart for men and women and during 2001 the gap in returns to schooling was diminished. Moreover, he concludes that the RTE is low compared with the other countries in the Middle East (i.e. 2.8% in 1999), also the private rate of return to education for men (2.8%) is lower than for women (6%); especially when the model for estimating the RTE is non-linear model in the level of schooling. Furthermore, he corrects for self-selection bias using Heckman (1976) two-step procedure and he finds that education increased the labor force participation because years of schooling dummy coefficient is significant and positive. He justified that Heckman two-step procedure is useful since $z - test$ of $\rho \neq 0$ is strongly significant and the self-selection term also significant. He showed that OLS overestimate the return to schooling. However, he obtained a negative coefficient of years of schooling for $Probit$ Heckman correction and solved that by defining dummy variables for educational levels[4]. One of the contributions of this thesis is that it finds that Logit Heckman correction yield positive and higher coefficient of years of schooling than OLS. Daoud and Sadeq (2012) used quarterly Palestinian labor force data for the period 1996- 2010. They estimate the private rate of return to schooling and what determine it. They Applied OLS and Hekman correction to Mincer's equation for males and females separately. They find that the private return to schooling is 1.8% - 2.8% for males and 6% - 12% for females, without using Heckman correction, and the fluctuation increased for this return with Heckman correction. Moreover, they use educational levels instead of years of schooling for both males and females. They find that the average difference in daily wages for females increase markedly for secondary or associate diploma holders compared to illiterates. However, the average difference in daily wages for males increase markedly for Bachelor and Master and PhD holders compared to illiterates. Furthermore, they conclude that the

[4] - Daoud (2005) use schooling dummy variable (0-12, 13-15 and 16 or more). For 13-15 years of schooling dummy variable worker can acquire 29.5%, 28.16% for the years 1999 and 2001 respectively. For further information see Daoud (2005), page 646.

difference between OLS and Heckman correction for females is high since their participation in labor force is low, while for males the difference is negligible between them. They also find that after 2007 there is a negative trend and the labor demand of unskilled labor by Israeli market is the significant determinant of the return to schooling. Aranki (2006) used the data from Palestinian Central Bureau of Statistics (1999-2003), he corrects the bias that is resulted from deleting the power variable from wage function using family background variables. This study confirmed that the RTE in Palestine were low. Mansour (2010) treats the labor force in Israel as a shock in the labor supply and finds that it's negatively affects the wages of unskilled workers and not skilled workers, which means that closing of Israeli labor markets contributes in raising the return to education. Tansel and Daoud (2011) compared the private return to education in Palestine and Turkey. They indicate that the gap in return to education between men and women in Palestine greater than those in Turkey, also the study found that the return to education increases by increasing the level of education, which means that the wage curve with respect to the number of years of schooling is convex and not linear, which is found by other studies, furthermore the study also found the direction of return to education is increasing with respect to the time in Turkey, and decreasing in Palestine.

# Chapter Three

## Methodology

## 3.1 Introduction

Recently, Bayesian inference methods have been widely used by researchers in the field of econometric analysis. The analysis is based on the little rules of probability which enable the researchers to make inference about the parameter and about the models. This analysis has the property, on the contrary to the classical approach, which it takes into account incorporating researcher's beliefs to the analysis.

Bayesian inference is an alternative way of all statistical inferences (i.e. least square, ML, Chi-Square testing, ANOVA, … etc.). The major challenges in order to make a Bayesian inference about the parameter θ, we have to choose an appropriate prior $P(\theta)$ for θ with the model $f(x|\theta)$ and an approximate calculation for the posterior $P(\theta|x)$.

In this thesis, we will use Palestinian Central Bureau of Statistics (PCBS) data of Palestinian labor force survey (PLFS) for the period 2006 – 2012, which contain information on education, wages, and other characteristics.

Based on Mincer (1974) wage equation, our model is given by:

$$\log w_i = \mathbf{X_i}\beta + rS_i + \delta x_i + \gamma x_i^2 + u_i$$

where $w_i$ is daily wage (earnings) measure for an individual $i$, $S_i$ represents a measure of their years of schooling, $x_i$ is an experience measure (typically age minus years of schooling-6) or age, $\mathbf{X_i}$ is a set of control variables (vector) assumed to affect wages (i.e. gender, marital status, place of residence,…, etc.) and $u_i$ is a disturbance term representing other unobservable factors which are not be explicitly measured, assumed independent of $\mathbf{X_i}$ and $S_i$.

Moreover, the thesis will use Bayesian inference to estimate the coefficients that would identify the effects of education on log-wages. Usage of Bayesian inference can be vindicated for different reasons; it can be applied in classical inference methods and give solutions to different problems. Also, uncertainty of the parameter is included and it allows us to find a posterior distribution by combining prior distributions of the parameters with probability distribution of the data. Moreover, we prefer a Bayesian inference because it assumes the parameters as a random variable, thus we proceed with this procedure and then find the approximate distribution of the parameters. On the contrary of likelihood, other regression methods (OLS and GLS) and instrumental variables procedures assume that the residuals are normally distributed using central limit theorem and provide an inefficient estimation. Thus, Bayesian inference usage can relax the normality assumption and may lead to find a more efficient estimation.

Bayesian analysis depends on Bayes' theorem of probability theory, Bayes (1973). It's given by:

$$P\,(\theta \mid y) = \frac{P(y|\theta)\,P(\theta)}{P(y)}$$

Where y([5]) represents the set of data, and θ represents the set of unknown parameters. $P\,(\theta)$ is the prior density function of the parameter $\theta$. $P(y)$ is the marginal

[5]- y is multivariate.

probability density of the data y. $P(y \mid \theta)$ is the conditional probability (likelihood) density function of the data given the unknown parameter $\theta$, and finally, $P(\theta \mid y)$ is the posterior density function of the parameter $\theta$ given the data y. we proceed with Bayesian inference to find out about the relation between two variables based on the principle

Posterior ∝ Prior x Likelihood,

The posterior distribution can be approximated by Markov Chain Monte Carlo (MCMC) simulations, where inference can be explored for the posterior distribution. The linear regression model with Gaussian error can be simulated Using Gibbs sampling[6] simulation and it generates a sample from the posterior distribution of this linear model.

The general multiple regression equation is given by:

$$y_i = \theta_0 + \theta_1 x_{i1} + \theta_2 x_{i2} + \cdots + \theta_k x_{ik} + u_i \qquad (3.1.1)$$

Where:

yi is the dependent variable, $x_{ik}$ is the independent variable for i= 1,2,…, N and k is the number of independent variables. We want to apply the data on the above equation.

For simplicity we use matrix form to show our estimation method as follows:

Let $Y$ be a $N \times 1$ vector of dependent variable

$Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_N \end{bmatrix}$ , U be an N × 1 vector of disturbances variable $U = \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_N \end{bmatrix}$ ,

[6] - With a multivariate Gaussian prior on the beta vector, and an inverse Gamma prior on the conditional error variance.

$\theta$ be the $(k+1)\times 1$ vector of coefficients $\theta = \begin{bmatrix} \theta_0 \\ \theta_1 \\ \vdots \\ \theta_k \end{bmatrix}$ , and $X$ the $N \times (k+1)$ matrix of

The independent variables X = $\begin{bmatrix} 1 & x_{12} & . & . & x_{1k} \\ 1 & x_{22} & . & . & x_{2k} \\ . & . & . & . & . \\ . & . & . & . & . \\ 1 & x_{N1} & . & . & x_{Nk} \end{bmatrix}$

Hence, the model can be written as $Y = X\theta + U$ (3.1.2)

Passing with our methodology framework, we introduce some notations. The one bar over the scripts is to denote to the prior, the two bars over the scripts are to denote to the posterior and the hat over the scripts is to denote to the OLS estimators.

## 3.2 The Likelihood Function

Likelihood function is joint probability density function for all the data conditional on the unknown parameters: $P(y|\theta, \sigma^2)$. In order to obtain the likelihood function we use the matrix notation and the assumption of the regression and the probability rules.

In matrix notation, the classical assumptions can be written as:

- The distribution of the error $(u)$ terms is a multivariate normal with $0_N$ mean and $\sigma^2 I_N$ covariance matrix, we can write this in notation as: $u \sim N(0_N, \sigma^2 I_N)$.
- The whole items of independent variable X are fixed; that is they are not random variables, if otherwise the whole items are independent of u with $P(y|\gamma)$ probability density function, where $\gamma$ is a vector of parameters that doesn't contain $\theta$ and $\frac{1}{\sigma^2}$ .

In the first assumption, the matrix which contains the variances on the diagonal and covariances everywhere else is called the variance-covariance matrix for the errors, and we can write it under the classical assumptions as follows:

$$var(u) \equiv \begin{bmatrix} var(u_1) & cov(u_1, u_2) & \cdots & cov(u_1, u_N) \\ cov(u_1, u_2) & var(u_2) & \cdots & \cdot \\ \cdot & cov(u_2, u_3) & \cdots & \cdot \\ \cdot & \cdot & \cdots & cov(u_{N-1}, u_N) \\ cov(u_1, u_N) & \cdot & \cdots & var(u_N) \end{bmatrix}$$

$$= \begin{bmatrix} \sigma^2 & 0 & \cdots & 0 \\ 0 & \sigma^2 & \cdots & \cdot \\ \cdot & \cdot & \sigma^2 & \cdot \\ \cdot & \cdot & \cdots & 0 \\ 0 & \cdot & \cdots & \sigma^2 \end{bmatrix}$$

Or we can write the term $var(u) = \sigma^2 I_N$ in tow components which are $var(u) = \sigma^2$ and $cov(u_i, u_j) = 0$ for i, j = 1, 2, 3,…, N and $i \neq j$.

The second assumption allows us to use conditionally on $X$ and address $P(y|X, \theta, \frac{1}{\sigma^2})$ considering it the likelihood function; we can eliminate the term $X$ to facilitate the notation.

Thus we can write the likelihood function benefiting from the definition of the multivariate Normal density:

$$P(y|\theta,\frac{1}{\sigma^2}) = \frac{(\frac{1}{\sigma^2})^{\frac{N}{2}}}{(2\pi)^{\frac{N}{2}}}\left\{exp\left[-\frac{1}{2\sigma^2}\,(y-X\theta)'\,(y-X\theta)\right]\right\} \tag{3.2.3}$$

As with simple regression, likelihood function can be written in terms of OLS quantities as follows:

$$d = N - k \tag{3.2.4}$$

$$\hat{\theta} = (X'X)^{-1}\,X'y \tag{3.2.5}$$

$$s^2 = \frac{(y-X\hat{\theta})'\;(y-X\hat{\theta})}{d} \tag{3.2.6}$$

So that the likelihood function can be expressed by using matrix extension:

$$P(y|\theta,\frac{1}{\sigma^2}) = \frac{1}{(2\pi)^{\frac{N}{2}}}\left\{\left(\frac{1}{\sigma^2}\right)^2\,exp\left[-\frac{1}{2\sigma^2}\,(y-X\theta)'\,X'X(y-X\theta)\right]\right\}\left\{(\frac{1}{\sigma^2})^{\frac{d}{2}}\,\exp\left[-\frac{d}{2s^2\,\sigma^2}\right]\right\} \tag{3.2.7}$$

## 3.3 Prior distribution

Prior probabilities do not depend on the data. Accordingly, before seeing the data the prior summarizes what we know about the parameter and show the information that we suggest before any new evidence is exposed. So they can take any form. There are many forms of priors and we want to use the Natural Conjugate Priors. A prior is conjugate to likelihood if the posterior is in the same class of distributions as prior. Basically, conjugate priors are like the posterior from some imaginary dataset with a diffuse prior. Also, as the likelihood function formula; the natural conjugate priors have an identical form.

The distribution of $\theta$ conditional on $\frac{1}{\sigma^2}$ is given by:

$$P(\theta| \frac{1}{\sigma^2}) \sim N(\bar{\theta}, \frac{1}{\sigma^2}\bar{D})$$

And the prior distribution of $\frac{1}{\sigma^2}$ has the form

$$P(\frac{1}{\sigma^2}) \sim G(\frac{1}{\bar{s}^2}, \bar{d})$$

By multiplying $P(\theta| \frac{1}{\sigma^2}) \times P(\frac{1}{\sigma^2})$ we obtain the form of the posterior distribution, which appears to be a Normal-Gamma distribution

$$P\left(\theta, \frac{1}{\sigma^2}\right) \sim NG(\bar{\theta}, \bar{D}, \frac{1}{\bar{s}^2}, \bar{d}) \quad (3.3.8)$$

Note that $\bar{\theta}$ is a k- vector which consists of the means of the prior for the k-regression coefficients $\theta_1, \theta_2, \cdots, \theta_k$, and $\bar{D}$ is the covariance matrix for the prior with dimension k× k and have a positive values.

## 3.4 Posterior distribution

The posterior density $P(\theta|y)$ is our major interest. The posterior outlines all information about the parameter $\theta$ which allow updating the prior information about $\theta$ and $\frac{1}{\sigma^2}$. The outcome here is the posterior which integrates the data and non-data information. As we know from the traditional Bayes that the posterior is approximately proportional to the likelihood times the prior. So we multiply equations (3.2.7) and (3.3.8) to obtain the posterior as shown below:

$$(\theta, \frac{1}{\sigma^2} \mid y) \sim NG(\bar{\bar{\theta}}, \bar{\bar{D}}, \frac{1}{\bar{\bar{s}}^2}, \bar{\bar{d}}) \qquad (3.4.9)$$

Where

$$\bar{\bar{D}} = (\bar{D}^{-1} + X'X)^{-1} \qquad (3.4.10)$$

$$\bar{\bar{\theta}} = \bar{\bar{D}}\,(\bar{D}^{-1}\,\bar{\theta} + X'X\,\hat{\theta}) \qquad (3.4.11)$$

$$\bar{\bar{d}} = \bar{d} + N \qquad (3.4.12)$$

and implicitly we can define $(\frac{1}{\bar{\bar{s}}^2})$ by the following equation:

$$\bar{\bar{d}}\bar{\bar{s}}^2 = \bar{d}\bar{s}^2 + ds^2 + (\hat{\theta} - \bar{\theta})'[\bar{D} + (X'X)']^{-1}(\hat{\theta} - \bar{\theta}) \qquad (3.4.13)$$

Thus the posterior distribution is summarized by the preceding equations. Integrating out on $\frac{1}{\sigma^2}$, we would get the marginal posterior for $\theta$ (i.e. using the result $p(\theta|y) = \int P\left(\theta, \frac{1}{\sigma^2}\middle|y\right) d\frac{1}{\sigma^2}$). The marginal posterior for $\theta$ has a multivariate Normal t-distribution and we write it as shown below:

$$\theta|y \sim t(\bar{\bar{\theta}}, \bar{\bar{s}}^2, \bar{\bar{D}}, \bar{\bar{d}}) \qquad (3.4.14)$$

The expected value and variance of $\theta|y$ using the definition of the t- distribution are:

$$E(\theta|y) = \bar{\bar{\theta}} \qquad (3.4.15)$$

And

$$var(\theta|y) = \frac{\bar{\bar{d}}\bar{\bar{s}}^2}{\bar{\bar{d}}-2}\bar{\bar{D}} \qquad (3.4.16)$$

In order to find the mean and variance of the errors of the term $\frac{1}{\sigma^2}|y$. Utilizing form the properties of the Normal-Gamma distribution we have:

$$\frac{1}{\sigma^2}|y \sim G(\frac{1}{\bar{\bar{s}}^2}, \bar{\bar{d}}) \qquad (3.4.17)$$

and, hence, we have

$$E\left(\frac{1}{\sigma^2}\middle|y\right) = \frac{1}{\bar{\bar{s}}^2} \qquad (3.4.18)$$

and

$$var\left(\frac{1}{\sigma^2}\middle|y\right) = \frac{2}{\bar{\bar{s}}^2\,\bar{\bar{d}}} \qquad (3.4.19)$$

Equations (3.4.10) and (3.4.19) supply us a closer look at how Bayesian methods join prior and data information. Researchers dealing with Bayesian analysis prefer to summarize all information analytically without using integration and no posterior simulation. So we are interested in dealing with the linear regression with Normal-Gamma natural conjugate prior where posterior simulation is not required.

The OLS estimate of $\theta$ is $\hat{\theta}$ where the researchers often use. The weighted average of the OLS estimate and the prior mean, $\bar{\theta}$ is equal to the point estimate of Bayesian model, $\bar{\bar{\theta}}$, the comparative strength of the prior and data information reflected by the weights; which is proportional to the data $X'X$ and $\bar{D}^{-1}$, and the confidence in the prior is showed by the term $\bar{D}^{-1}$.

The posterior variance (3.4.16) is the basic of Bayesian analysis which combine both the prior and the data information. For example equation (3.4.10) can be explained in an informal basis as; the precision of the posterior is the average of data $X'X$ and the precision of the prior $\bar{D}^{-1}$. Also we can explain equation (3.4.13) in the same way, that is, posterior sum of squared errors ($\bar{\bar{d}}\bar{\bar{s}}^2$) is the sum of prior sum of squared errors ($\bar{d}\,\bar{s}^2$), OLS sum of squared errors ($ds^2$), and a term which measures the conflict between prior and data information ($(\hat{\theta} - \bar{\theta})'[\bar{D} + (X'X)']^{-1}(\hat{\theta} - \bar{\theta})$). Moreover, the Natural Conjugate Prior reveals that the explanation of the prior appears to be imaginary set (i.e. $\bar{d}$ and N play the same role in equations (3.4.12) and (3.4.13), hence, it can be shown that $\bar{d}$ can be considered as a prior sample size). Bayesian analysis can be carried out in terms of two ways, the prior sensitivity and non-informative prior. We perform the prior sensitivity prior analysis using several priors to present the empirical results. If we get similar results across all the sensible priors, then we are agree with different beliefs about the data. If otherwise, that is, we get sensitive results in selecting the priors, then we haven't strong evidence on the data in order to be acceptable with several prior visions.

The non-informative prior is the second way of the analysis. This is the prior that gives us no information and have the smallest effect on the data and final results of inference. Using the explanation of the natural Conjugate prior in order to guarantee that the posterior is not supplied by information from the prior we can get the relatively non-informative prior by considering $\bar{d}$ being small with respect to N and $\bar{D}$ large to large value. So by this discussion and setting $\bar{d} = 0$ and setting a small value of $\bar{D}^{-1}$ (i.e.

$\bar{D}^{-1} = mI_k$, where m is a constant and we will consider it to be equal 0). Thus we find that:

$$\theta, \frac{1}{\sigma^2} \mid y \sim NG(\bar{\bar{\theta}}, \bar{\bar{D}}, \frac{1}{\bar{\bar{s}}^2}, \bar{\bar{d}})$$

Where

$$\bar{\bar{D}} = (X'X)^{-1} \qquad (3.4.20)$$

$$\bar{\bar{\theta}} = \hat{\theta} \qquad (3.4.21)$$

$$\bar{\bar{d}} = N \qquad (3.4.22)$$

and

$$\bar{\bar{d}}\bar{\bar{s}}^2 = ds^2 \qquad (3.4.23)$$

We see that these formulas are close to the OLS results and consist of the all information of the data only. Dealing with this non-informative prior lead us to have an improper non-informative prior which is cannot be inferable and invalid density. To show this property, (3.4.20) and (3.4.21) can be vindicated by joining the likelihood with this prior density; $P\left(\theta, \frac{1}{\sigma^2}\right) = \sigma^2$ where $\sigma^2 \in (0, \infty)$, integrating it over $(0, \infty)$, we will get $\infty$. So that, most Bayesian models face improper non-informative priors.

Often we write the Bayesian prior as:

$$P\left(\theta, \frac{1}{\sigma^2}\right) \propto \sigma^2 \qquad (3.4.24)$$

## 3.5 Model Comparison

Model comparison is required for a diversity of activities, including variable selection in regression, will not inform about which model is `true', but rather about the preference for the model given the data and other information. These preferences can be used to choose a single `best' model. Bayesian inferences carry out the analysis of model comparisons in addition of the inference taken about the parameter. In this section we compare between models of linear regression using equality restrictions, with two types of model comparison. First, we begin with the restriction in $M_1$ which assess $R\theta = r$ to the other model without this restriction $M_2$. If we put the restrictions $R\theta = r$ on the latest parameters from $M_2$, then we got $M_1$(i.e. we refer to $M_1$ as nested in $M_2$). The second type of model comparison which is the case of non-nested (i.e. by defining another model $M_3$ including $X = [X_1, X_2]$ independent variables, doing this, then both $M_1$ and $M_2$ would be nested in $M_3$). We want to compare the two models:

$M_1: y = X_1\theta_{(1)} + u_1$

$M_2: y = X_2\theta_{(2)} + u_2$

Where $X_1$ and $X_2$ are matrices including fully distinct independent variables. We can rewrite the previous two models in general as follow:

$$M_j: y_j = X_j\theta_{(j)} + u_j \qquad (3.5.25)$$

Where $j = 1,2$ referring to the two models, $X_j$ is a matrix of independent variables with dimension $N \times k_j$, the $k_j$- vector of the regression coefficients $\theta_{(j)}$ is a $k_j$- vector and the N-vector errors $u_j$ which distributed as $N \sim (0_N, \frac{1}{\sigma_j^2}^{-1} I_N)$.

By setting $y_1 = y_2$ we can handle the analysis of the case of a non-nested model comparison. Starting with unrestricted model of equation (3.1.1), we can work on $M_1$, which is assess $R\theta = r$ , can be handled by assessing the restriction on the independent variables. $M_2$ is unrestricted model, that is, we set $y_2 = y$ , $X_2 = X$ and $\theta_2 = \theta$.

For the two models the priors are distributed Normal-Gamma and it can be written as shown below:

$$\theta_{(j)} ,\frac{1}{\sigma_j{}^2} |M_j \sim NG(\bar{\theta}_j, \bar{D}_j, \frac{1}{\bar{s}^2{}_j} ,\bar{d}_j) \qquad (3.5.26)$$

And the posteriors densities are given by:

$$\theta_{(j)} ,\frac{1}{\sigma_j{}^2} |y_j \sim NG(\bar{\bar{\theta}}_j, \bar{\bar{D}}_j, \frac{1}{\bar{\bar{s}}^2{}_j} ,\bar{\bar{d}}_j) \qquad (3.5.27)$$

Where

$$\bar{\bar{D}}_j = (\bar{D}_j{}^{-1} + X_j{}'X_j)^{-1} \qquad (3.5.28)$$

$$\bar{\bar{\theta}}_j = \bar{\bar{D}}_j{}^{-1}(\bar{D}_j{}^{-1}\bar{\theta}_j + X_j{}'X_j\hat{\theta}_j) \qquad (3.5.29)$$

$$\bar{\bar{d}}_j = \bar{d}_j + N \qquad (3.5.30)$$

and implicitly we can define $\bar{\bar{s}}_j{}^{-2}$ through the following equation

$$\bar{\bar{d}}_j\bar{\bar{s}}_j{}^2 = \bar{d}_j\bar{s}_j{}^2 + d_js_j{}^2 + (\hat{\theta}_j - \bar{\theta}_j)'[(\bar{D}_j + (X_j{}'X_j)^{-1} I^{-1}]^{-1}(\hat{\theta}_j - \bar{\theta}_j) \qquad (3.5.31)$$

We see from equations (3.5.30) and (3.5.31) results that they are equivalent to the OLS like equations (3.2.4) – (3.2.6). In either of the two models we will use equations (3.5.27) – (3.5.31) to proceed the inference of posterior. For each model we can obtain the marginal likelihood and the posterior odds ratio. In this case we can write the marginal likelihood as:

$$P(y_j|M_j) = m_j\left(\frac{|\bar{D}_j|}{|D_j|}\right)^{\frac{1}{2}} (\bar{\bar{d}}_j{}^2\bar{\bar{s}}_j{}^2)^{\frac{-\bar{\bar{d}}_j}{2}} \qquad (3.5.32)$$

for $j = 1\,, 2$, where

$$m_j = \frac{\Gamma\left(\frac{\bar{d}_j}{2}\right)(\bar{d}_j\bar{s}_j{}^2)}{\Gamma\left(\frac{d_j}{2}\right)\pi^{\frac{N}{2}}} \qquad (3.5.33)$$

Also, we can write the posterior odds ratio comparing $M_1$ to $M_2$ as:

$$PO_{12} = \frac{m_1\left(\frac{|\bar{D}_1|}{|D_1|}\right)^{\frac{1}{2}}(\bar{d}_1\bar{s}_1{}^2)^{\frac{-\bar{d}_1}{2}}P(M_1)}{m_2\left(\frac{|\bar{D}_2|}{|D_2|}\right)^{\frac{1}{2}}(\bar{d}_2\bar{s}_2{}^2)^{\frac{-\bar{d}_2}{2}}P(M_2)} \qquad (3.5.34)$$

In order to calculate the posterior model probability we can use the posterior odds ratio, $P(M_j|y)$, using this criteria:

$$P(M_1|y) = \frac{PO_{12}}{1+PO_{12}} \quad \text{and} \quad P(M_2|y) = \frac{1}{1+PO_{12}}$$

The analysis of the equation (3.5.34) leads us to know the factors that affect the model comparison and the posterior odds ratio. The first factor is, when the odds ratio, $\frac{p(M_1)}{p(M_2)}$ , is large, $M_1$ is highly supported. The second factor is that the errors sum of square $d_j s_j{}^2$ is included in the term $\bar{\bar{d}}_j s_j{}^2$. It's a good criterion to determine if the model fit the data (i.e. the lower value of the errors sum of squares, the model is fit better). From this point the posterior odds ratio payoff for models that fit better. The third factor is when there are a greatest consistency between the prior and the information of the data which is supported by the posterior odds ratio with ceteris-paribus. Finally, $\left(\frac{\bar{\bar{D}}_1}{\bar{D}_1}\right)$ is the ratio of posterior to prior variances that can be explained as the model with high information from the prior with respect to the information from the posterior generally more supported, holding other things to be equal. Furthermore, the posterior odds ratio prefers the models with a few number of parameters, that is, it's a littleness payoff. We proceed the model comparison with the tow models that have the same number of parameters (i.e. $\theta_j$ and $\frac{1}{\sigma_j^2}$ ), and this payoff of littleness is not clear. Otherwise, it's a serious characteristic of posterior odds ratio. One problem arise when we are dealing with model comparison is that posterior odds ratio can't be defined when the prior is non-informative.

In this section we want to express the non-informative prior disjoint using two steps. The first step we consider a prior where $\bar{d} = 0$ and $\bar{D}^{-1} = mI_k$. The second step we define a non-informative prior as one where $m$ is a scalar considered to be zero. The important result is to consider non-informative priors for $\frac{1}{\sigma_j^2}$ for $j = 1, 2$ and not use it for $\theta_{(j)}$. Since the parameter of the error precision exists in both models which explained similarly. But $\theta_{(1)}$ and $\theta_{(2)}$ are different in two models. Problems arise when we use non-informative priors for $\theta_{(j)}'s$ in the case of $k_1 \neq k_2$.

So to be in the secure way, we have to use non-informative prior in the case of $k_1 = k_2$. This will shackle a posterior odds ratio in the form

$$PO_{12} = \frac{\left(|X_1{}'X_1|\right)^{\frac{1}{2}} (d_1 s_1{}^2)^{-\frac{N}{2}} P(M_1)}{\left(|X_2{}'X_2|\right)^{\frac{1}{2}} (d_2 s_2{}^2)^{-\frac{N}{2}} P(M_2)} \qquad (3.5.35)$$

Equation (3.5.35) depends on the unit of measurement.

## 3.6 Highest Posterior Density Intervals (HPDI)

We are interested in the model testing and comparison with non-informative prior. To do so there are some techniques can be used. One of them is the HPDI and present how we can use it in an *ad hoc* mode in order to compare nested models. HPDIs are a very common device which can be used with the non-informative prior. In all times it exists when we are dealing with the posterior estimation. Before showing our analysis we consider some definitions of the basic connotation with the situation that the vector of parameters $\theta$ in the normal linear regression model. Suppose that the elements of $\theta$ vector each belong to the interval $(-\infty, \infty)$, denote it as $\theta \in R^k$. Let $w = l(\theta)$ be some $n$ vector of functions of $\theta$ which is defined over a region,$\Omega$, where $k \geq n$. Let $V$ be a subset of $\Omega$, denoted by $V \subseteq \Omega$.

Definition (1): credible sets

We say to the set $V \subseteq \Omega$ is a $(1-\alpha) \times 100\%$ credible set with respect to $p(w|y)$ if:

$$p(w \in V|y) = \int_V p(w|y)dw = 1 - \alpha$$

Definition (2): Highest Posterior Density Intervals (HPDI)

A $(1-\alpha) \times 100\%$ credible interval for $w$ with the lower area than any other credible area for $w$ is said to be $(1-\alpha) \times 100\%$ the highest posterior density interval for $w$.

The researcher must provide HPDI in addition of obtaining the mean posterior of $\theta_j$. We interpret HPDI that the researcher is $(1-\alpha) \times 100\%$ confident that $\theta_j$ falls in the HPDI. To show this, we consider the two Normal Linear models as in equation

(3.1.2) which has an attention to what independent variable included and not included in the model. Thus the two models become:

$$M_1: \theta_j = 0$$

and

$$M_2: \theta_j \neq 0$$

As summarized in equations (3.5.26) – (3.5.31) we can perform posterior inference under $M_2$, and based on the t distribution we can estimate the $\theta_j's$ HPDI. The criterion to find which model is preferred is that if the zero is contained in HPDI, then we are preferred $M_1$. If the zero does not contain in HPDI, then we does not prefer $M_1$.

# Chapter Four

## 4.1 Analysis and Results

### 4.1.1 Bayesian inference – OLS inference

Mincer (1974) model is the most used model in order to study the human capital and to estimate the returns to education. This model links daily wages (dependent variable) with set of predictor variables i.e. age, potential experience, years of schooling, labor sector and place of residence.

$$lnW_i = \beta_0 + \beta_1 S_i + \alpha_1 X_i + \alpha_2 {X_i}^2 + u_i \quad (4.1.1)$$

Where $W$ refers to daily wage and we take $lnW$ to be able to estimate the rate of change in daily wage, $S$ indicates the years of schooling, $X$ indicates the age or potential experience and $u$ represents the random error for the model, note that the coefficients ($\beta_0$ , $\beta_1$ , $\alpha_1$ , $\alpha_2$) are constants.

We add to equation (4.1.1) some control variables like place of residence, labor sector, occupation and /or education qualitative. Since these variables are qualitative variables we define dummy variables that represent each category for each variable. For example, the place of residence variable takes three categories (Urban, Rural, and Camp), so we can define and enter a dummy variable that represents who is reside in Camp and take a value of 1 and 0 otherwise. By this way we can interpret this dummy variable as the average difference of daily wage between Camp residence and non-Camp residence. We are interested in three models. We use potential experience in the first model i.e. the reference model. Hence, equation (4.1.1) can be expressed by:

$$lnW_i = \beta_0 + \beta_1 S_i + \beta_2 {S_i}^2 + \alpha_1 pexp_i + \alpha_2 {pexp_i}^2 + sex + \gamma_1 ld_i + \gamma_2 td_i + \gamma_3 rd_i + \gamma_4 ad_i + \gamma_5 vd_i + \gamma_6 md_i + \gamma_7 wbgd_i + \gamma_8 cad_i + \gamma_9 gd_i + \gamma_{10} isd_i + u_i$$

(4.1.2)

In the second model we use age instead of potential experience. Hence, equation (4.1.1) can be expressed by:

$$lnW_i = \beta_0 + \beta_1 S_i + \beta_2 {S_i}^2 + \alpha_1 age_i + \alpha_2 {age_i}^2 + sex + \gamma_1 ld_i + \gamma_2 td_i + \gamma_3 rd_i + \gamma_4 ad_i + \gamma_5 vd_i + \gamma_6 md_i + \gamma_7 wbgd_i + \gamma_8 cad_i + \gamma_9 gd_i + \gamma_{10} isd_i + u_i$$

(4.1.3)

In the third model we use potential experience and replace years of schooling (S) and squared years of schooling ($S^2$) variables by dummy variables of educational levels. Hence, equation (4.1.1) can be expressed by:

$$lnW_i = \beta_0 + \beta_1 ltd_i + \beta_2 crwd_i + \beta_3 ed_i + \beta_4 sd_i + \beta_5 add_i + \beta_6 bad_i + \beta_7 hdd_i + \beta_8 mad_i + \beta_9 phd_i + \alpha_1 pexp + \alpha_2 {pexp_i}^2 + sex + \gamma_1 ld_i + \gamma_2 td_i + \gamma_3 rd_i + \gamma_4 ad_i + \gamma_5 vd_i + \gamma_6 md_i + \gamma_7 wbgd_i + \gamma_8 cad_i + \gamma_9 gd_i + \gamma_{10} isd_i + u_i$$

(4.1.4)

Where:

- pexp: potential experience (= age – years of schooling – 6).
- $pexp^2$: squared potential experience.
- ld: dummy variable takes a value of 1 for legislators, senior officials and managers category and 0 for the remaining categories.
- td: dummy variable takes a value of 1 for professionals, technical, associate and clerks category and 0 for the remaining categories.

- rd: dummy variable takes a value of 1 for service, shop and market workers category and 0 for the remaining categories.
- ad: dummy variable takes a value of 1 for skilled agriculture and fishery workers category and 0 for the remaining categories.
- vd: dummy variable takes a value of 1 for craft and related trade workers category and 0 for the remaining categories.
- md: dummy variable takes a value of 1 for plant and machine operators and assemblers category and 0 for the remaining categories.
- wbgd: dummy variable takes a value of 1 for West Bank region category and 0 for Gaza Strip region.
- cad: dummy variable takes a value of 1 for Camp residence category and 0 for the remaining categories.
- gd: dummy variable takes a value of 1 for employees in national government category and 0 for the remaining categories.
- isd: dummy variable takes a value of 1 for Israel and the settlements category and 0 for the remaining categories.
- ltd: dummy variable takes a value of 1 for whose education attainment is literate category and 0 for the remaining categories.
- crd: dummy variable takes a value of 1 for whose education attainment is can read and write category and 0 for the remaining categories.

- ed: dummy variable takes a value of 1 for whose education attainment is elementary category and 0 for the remaining categories.
- sd: dummy variable takes a value of 1 for whose education attainment is secondary category and 0 for the remaining categories.
- add: dummy variable takes a value of 1 for whose education attainment is associated diploma category and 0 for the remaining categories.
- bad: dummy variable takes a value of 1 for whose education attainment is BA/ BSc category and 0 for the remaining categories.
- hdd: dummy variable takes a value of 1 for whose education attainment is higher diploma category and 0 for the remaining categories.
- mad: dummy variable takes a value of 1 for whose education attainment is master degree category and 0 for the remaining categories.
- phd: dummy variable takes a value of 1 for whose education attainment is Ph.D category and 0 for the remaining categories.

Note that the preparatory educational level is considered as the reference category for education. Moreover, the elementary occupation is the reference category for occupation.

We will apply OLS and Bayesian linear Regressions on equations (2), (3) and (4) ,using **R** software, for each quarter for the years 2006-2011 which provides us a fairly long time series data to compare between the estimates and standard error for the three equations. These equations can be applied only on paid workers ($W_i$ observed only for this category) and the estimates OLS and Bayesian regression will be biased or confined to paid employees category and doesn't take into account who doesn't participate in labor force; since the wage paid or offers they receive doesn't exceed the reservation wage even the individual accept to enter the labor market.

The economic theory indicates that the income curve is concave down in age or experience, and the individual reaches the maximum value of income in his middle age. Supported results of this theory in tables 4.1, 4.2 and 4.3 in Appendix for the models (1), (2) and (3) respectively indicate that OLS and Bayesian regression methods estimates of the mean are approximately the same but the standard error estimates of the mean using Bayesian method is less than the standard error estimates of the mean using OLS method. Thus, we conclude that Bayesian regression method is more efficient than OLS method. This result fits the results of Block, Hoogerheide and Thurik (2012). That is, the posterior standard error is less than OLS standard error. Also, we find that the coefficient of squared years of schooling is positive and significant in most quarters for each of the two methods, which means that there is a nonlinear relation between daily wages and years of schooling and it indicates that the difference in wages for each year of schooling is low for lower levels of education but high for higher levels of education. Also we find that the coefficient of squared potential experience in model (1) and the coefficient of squared age in model (2) are negative and significant in most quarters for each of the two methods, which means that the relationship between daily wages and age or experience is concave. This result compatible to the results found of Tansel and Daoud (2011). They show that the relation between wages and years of schooling is convex and not linear.

In Model (3) we use the educational levels which will help us to see the concavity of income curve and to find out at what level of education the rate of return to schooling is higher. Results in Table 4.3 in Appendix indicate that the coefficients of illiterates, can reads and writes, elementary, secondary, associate diploma, Bachelor and Master dummy variables are significant, while the coefficients of higher diploma and PhD dummy variables are not significant in most of the quarters in each of the two methods of estimation. This Table indicates that the average differences in daily wages for workers is increasing for levels secondary, Bachelor and Master, compared to preparatory level. This underlines the concavity of the income curve with educational levels. For higher diploma and PhD level, the low number of observations having these degrees increases the standard error. This implies that the coefficients of higher diploma and PhD are non-significant in many cases. Here we review the interpretation of the coefficient of dummy variables of educational levels.

- The average daily wage for illiterates is lower than preparatory degree holders by 2.0% - 20.5%.
- The Average daily wage for can reads and writes is lower than preparatory degree holders by 2.0% - 7.6%.
- The Average daily wage for elementary holders is lower than preparatory degree holders by 1.5% - 4.6%.
- The Average daily wage for secondary is higher than preparatory degree holders by 1.5% - 5.5%.

- The Average daily wage for associate diploma holders is higher than preparatory degree holders by 2.8% - 6.5%.
- The Average daily wage for Bachelor holders is higher than preparatory degree holders by 3.7% - 12.8%.
- The Average daily wage for Masters is higher than preparatory degree holders by 8.6% - 26%.

### 4.1.2 Model Comparison

In model comparison we are interested to find which model is better. We compare between the three models considered in our analysis. We show in table 4.4 the values of R squared for OLS estimates and the values of log Bayes Factor (BF) for Bayesian estimation, in each quarter for each model. By considering model (1) as the reference model, we find in most of the quarters that R squared for the second model (2) is greater than the other two models, so we conclude that model (2) is the better model using OLS. Also, Bayes Factor for each quarter indicates that model (2) is the most preferred for other models. Moreover, we find that model (1) is better than model (3) in Bayesian method since BF for model (1) is greater than those for model (3). Meanwhile Model (3) is better than model (1) since R squared for model (3) is greater than those for model (1) in some quarters, but model (1) was found better in some other cases. Anyway, R-squared of models (1) and (3) are very close, but less than model (2). This result indicates that age is a better predictor of wages than experience. Moreover, years of schooling is found a better predictor than educational levels. This result is confirmed using R- squared and Bayes Factor. However, Bayes factor may find different results if the difference between R-squared of two models (1 and 3) is very small. Daoud and Sadeq (2012) use age instead of potential experience in Mincer equation and they justify the usage of age since the adjusted R-squared for the model that contains age is higher than the adjusted R-squared for the model that contains the potential experience.

### 4.1.3 HPDI

To find out which variable has a significant relation with the natural logarithm of daily wages. We use the t-test in OLS and HPDI in Bayesian regressions. Tables 4.5, 4.6 and 4.7 show the HPDI for each variable in regression equation for each of the three models. HPDI criterion says that if the 0 is not contained in interval, then there is a statistically significant relationship between the dependent variable and the predictor variable, otherwise there is no significant relationship between them. Our results of HPDI are similar to the t-test results, that is, the variables that are statistically significant in OLS method are statistically significant using Bayesian method.

## 4.2 Heckman Correction using $Logit$ and $Probit$ Models

OLS and Bayesian estimation suffer from three problems, self-selection bias (Heckman, 1979), ability bias (Altonji and Dunn, 1996) and endogeneity problems (Angrist and Kruger, 1991). In this thesis, we try to correct the problem of self-selection bias. We apply Bayesian inference to Heckman's (1976) two-step procedure in order to correct this problem using $Logit$ and $Probit$ models. We define a dummy variable $(emd)$ that takes a value of 1 for wage employed persons and 0 for unemployed and out of labor force persons. We add some variables like marital status and place of residence to $Logit$ and $Probit$ models and we drop occupation and status in employment variables.

We regress $(emd)$ on years of schooling, squared years of schooling, age, squared age, marital status, region and camp residence variables. Furthermore, to find out which model best fits and predicts daily wages, we compare between Bayesian estimation with Heckman $Logit$ model and Bayesian estimation with Heckman $Probit$ model using Bayes Factor. The estimated model using Bayesian inference without Heckman correction is not included in model comparison since it suffers from selectivity bias.

We review Heckman's (1976) two-step procedure. Individuals decide to participate in the labor force if the market wage $(w)$ exceeds the reservation wage $(w^*)$. We observe $w$ if $w > w^*$ and if otherwise we do not observe it. Define a dummy variable (H) that takes a value of 1 for employed individuals and 0 otherwise,

$$H_i = K_i \gamma + u_{i1} > 0 \qquad (4.2.1)$$

$$W_i = X \beta + \delta u_{i2} \qquad (4.2.2)$$

Where H is observed only if $w > w*$, this equation is named by participation equation; which links participation with set of variables $(K)$ that affect individual's decision to work like number of children and marital status ... etc. Equation (4.2.1) estimated simultaneously with equation (4.2.2) and with self-selection, Heckman (1976). After that, Heckman added to equation (4.1.1) some independent variables $(K)$ that exist in equation (4.2.1) multiplied by their coefficients and Invers Mills's ratio, $\lambda$. Using Heckman correction on equation (4.1.1) it becomes:

$$ln\, W_i = \beta_0 + \beta X_i + \lambda K_i \gamma + d_i \qquad (4.2.3)$$

Where $\lambda = \rho\, \delta_{u_2}$ , $\delta_u$ indicates the standard error of equation (4.2.2), $\rho$ indicates the coefficient of correlation of residuals in equation (4.2.1) and residuals in equation (4.2.2). $X$ represents the set of independent variables mentioned in equation (4.1.3) and $K$ represents some variables that will affect individual's participation in the labor force like marital status, residence in camp and household size, Daoud (1999) and Daoud and Sadeq (2012).

Estimation results of Heckman correction using $Logit$ model indicate that the estimated coefficient of years of schooling is greater than those we've got from Bayesian and OLS estimation and it is positive. However, estimation results of Heckman correction using $Probit$ model indicate that the coefficient of years of schooling slightly differs from those we've got form Bayesian and OLS estimation and it is negative in most of the quarters. Tables 4.8 and 4.9 show the estimation results of Heckman correction $Logit$ and $Probit$ models respectively. Daoud and Sadeq (2012) find that Heckman correction does not vary from OLS estimates of return to schooling for males. However, they find that the difference in estimates of return to schooling for females using Heckman correction is higher compared to OLS estimates and they vindicate this high difference by lower participation rate in the labor force for females[7] .

Table 4.10 represents model comparison using Bayes factor between Bayesian estimation with $Logit$ Heckman correction and $Probit$ Heckman correction. We find that applying $Logit$ Heckman correction using Bayesian inference is the best model to predict individual's wages and estimates of return to education.

[7] - According to PCBS Labor force survey (2011), labor force participation rate is 66.8% of males and 14.7% of females.

## 4.3 Conclusions and Recommendations

We conclude that Bayesian inference method produce more efficient estimation than OLS inference method. The posterior standard error using Bayesian inference is less than the standard error of the mean using OLS. Moreover, usage of age in Mincer (1974) human capital equation is better than usage of potential experience and education levels. Since in either of the two methods R-squared and Bayes factor in the model that consists of age is greater than those found in the other two models used in this thesis. Therefore, age is a better predictor of wages.

Estimation results of daily wages equation indicate that the wages equation is convex with respect to the years of schooling in both models (1) and (2). And this means that the private rate of return to schooling increase with the level of education.

Moreover, in order to correct for self-selection bias, we contribute that $Logit$ Heckman correction using Bayesian inference do a good job of estimation and it is better than $Probit$ Heckman correction and Bayesian inference with no Heckman correction.

For future research consideration we can estimate the return to education using panel data of Palestinian labor force for the period 1995 – 2012. Furthermore, we can use two level hierarchical models in order to estimate the social return to education.

Since OLS and Bayesian inference on linear regression models of wages suffer from endogeneity and ability bias in addition to self-selection bias, we recommend for further research in Bayesian methods of solving bias.

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# Appendix A

**Table 4.1:** Estimation results for daily wages for model 1 using OLS and Bayes.

Table 4.1: Estimation Results for Daily Wages Equation Using OLS and Bayes

| year | 2006: Model1: lnw = yerschol + s2 + pexp + pexp2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad +gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.277 | 0.0164 | 4.277 | 0.0001646 | 4.28 | 0.01621 | 4.28 | 0.0001626 | 4.262 | 0.01675 | 4.262 | 0.000168 | 4.275 | 0.01678 | 4.276 | 0.0001684 |
| S | 0.00146 | 0.002773 | 0.01453 | 0.0000278 | 0.01942 | 0.002739 | 0.01934 | 0.00002747 | 0.0136 | 0.002798 | 0.01353 | 0.00002805 | 0.008847 | 0.002828 | 0.008775 | 0.00002836 |
| S2 | -0.00001515 | 0.0001522 | -0.00001128 | 0.000001528 | -0.0003138 | 0.0001508 | -0.0003099 | 0.000001514 | -0.00004362 | 0.0001516 | -3.978E-05 | 0.000001522 | 0.00006718 | 0.0001538 | 0.00007108 | 0.000001545 |
| Pexp | 0.0001994 | 0.0004334 | 0.002003 | 0.000004317 | 0.000797 | 0.0004337 | 0.0008063 | 0.0000007772 | 0.001733 | 0.0004223 | 0.001742 | 0.000004206 | 0.002378 | 0.0004338 | 0.002387 | 0.000004321 |
| Pexp2 | -0.0000422 | 0.000007728 | -0.00004237 | 0.0000000769 | -0.00001224 | 0.00000781 | -0.00001242 | 0.0000007772 | -0.00001579 | 0.000007687 | -1.597E-05 | 0.00000007649 | -0.00003249 | 0.000007876 | -0.00003267 | 0.00000007837 |
| sex | 0.003086 | 0.005843 | 0.0308 | 0.00005879 | 0.03711 | 0.005808 | 0.03706 | 0.00005844 | 0.04877 | 0.005841 | 0.04872 | 0.00005877 | 0.0471 | 0.005866 | 0.04705 | 0.00005903 |
| ld | -0.009096 | 0.02802 | -0.09144 | 0.0002779 | 0.02141 | 0.03016 | 0.02091 | 0.0002991 | 0.02577 | 0.03088 | 0.02527 | 0.0003061 | 0.1539 | 0.03087 | 0.1534 | 0.0003061 |
| td | 0.0002817 | 0.01404 | 0.0002009 | 0.0001406 | 0.0296 | 0.01385 | 0.02952 | 0.0001387 | 0.01437 | 0.01398 | 0.01429 | 0.00014 | 0.02824 | 0.01417 | 0.02815 | 0.0001419 |
| rd | 0.007393 | 0.01314 | 0.07387 | 0.0001301 | 0.08141 | 0.01293 | 0.08136 | 0.0001281 | 0.09966 | 0.01255 | 0.09962 | 0.0001243 | 0.09116 | 0.01274 | 0.09111 | 0.0001262 |
| vd | 0.01035 | 0.01358 | 0.1037 | 0.0001354 | 0.1145 | 0.01351 | 0.1147 | 0.0001347 | 0.01109 | 0.01321 | 0.1111 | 0.0001318 | 0.1084 | 0.01365 | 0.1086 | 0.0001361 |
| ad | -0.04483 | 0.01386 | -0.04468 | 0.0001399 | -0.03415 | 0.01284 | -0.03401 | 0.0001296 | -0.06377 | 0.01303 | -0.06363 | 0.0001316 | -0.09167 | 0.01058 | -0.09154 | 0.0001069 |
| md | 0.07377 | 0.01804 | 0.07366 | 0.0001791 | 0.05849 | 0.01752 | 0.05838 | 0.0001738 | 0.07334 | 0.01774 | 0.07323 | 0.0001761 | 0.09833 | 0.01852 | 0.09822 | 0.0001839 |
| wbgd | -0.1185 | 0.005924 | -0.1185 | 0.00005923 | -0.1254 | 0.0059 | -0.1254 | 0.000059 | -0.07113 | 0.005892 | -0.07109 | 0.00005893 | -0.05276 | 0.005951 | -0.05273 | 0.00005952 |
| isd | -0.02131 | 0.01701 | -0.02141 | 0.0001721 | -0.05392 | 0.0171 | -0.05401 | 0.000173 | -0.0443 | 0.01637 | -0.0444 | 0.0001656 | -0.01283 | 0.01725 | -0.01292 | 0.0001744 |
| cad | -0.306 | 0.007076 | -0.3059 | 0.00007042 | -0.3154 | 0.007089 | -0.3153 | 0.00007054 | -0.3339 | 0.007016 | -0.3339 | 0.00006982 | -0.3226 | 0.007043 | -0.3225 | 0.00007011 |
| gd | -0.1125 | 0.03357 | -0.1123 | 0.0003376 | -0.09383 | 0.03203 | -0.0936 | 0.0003222 | -0.0424 | 0.02948 | -0.04219 | 0.0002966 | -0.04782 | 0.02953 | -0.04761 | 0.000297 |
| | | sigma2 | 0.2123 | 0.00001745 | | sigma2 | 0.2072 | 0.00001712 | | sigma2 | 0.2069 | 0.00001718 | | sigma2 | 0.2149 | 0.00001772 |

Cells shaded in blue have a statistically significant at a confidence level of 5% in each of the two methods of estimation (OLS and Bayes)

Table 4.1 continued

| year | Table A Continued | | | | 2007: Model1: lnw = yerschol + s2 + pexp + pexp2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad +gd | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.343 | 0.01624 | 4.343 | 0.000163 | 4.357 | 0.01646 | 4.357 | 0.0001651 | 4.345 | 0.0177 | 4.345 | 0.0001776 | 4.713 | 0.01812 | 4.7131873 | 0.0001818 |
| S | 0.003726 | 0.002744 | 0.003655 | 0.00002751 | 0.003142 | 0.00278 | 0.003071 | 0.00002788 | -0.001709 | 0.002958 | -0.001785 | 0.00002966 | -0.008123 | 0.003007 | -0.0081997 | 0.00003015 |
| S2 | 0.0003625 | 0.0001502 | 0.0003663 | 0.000001508 | 0.0003291 | 0.000152 | 0.0003329 | 0.000001526 | 0.0005412 | 0.0001597 | 0.0005453 | 0.000001604 | 0.0009405 | 0.0001627 | 0.0009446 | 0.000001634 |
| Pexp | 0.002854 | 0.0004326 | 0.002864 | 0.000004309 | 0.001572 | 0.0004396 | 0.001581 | 0.000004379 | 0.0027 | 0.0004416 | 0.002709 | 0.000004398 | 0.004489 | 0.0004572 | 0.004499 | 0.000004554 |
| Pexp2 | -0.00006498 | 7.749E-06 | -0.00006516 | 0.00000007711 | -4.128E-05 | 0.000007934 | -4.147E-05 | 0.00000007895 | -0.00005418 | 8.012E-06 | -5.437E-05 | 0.00000007973 | -0.0001077 | 8.221E-06 | -0.0001079 | 0.00000008181 |
| sex | 0.05486 | 0.005751 | 0.05481 | 0.00005786 | 0.06223 | 0.005862 | 0.06218 | 0.00005899 | 0.05852 | 0.006119 | 0.05846 | 0.00006156 | 0.05069 | 0.006248 | 0.050627 | 0.00006288 |
| ld | 0.06697 | 0.02931 | 0.06647 | 0.0002907 | 0.06712 | 0.02899 | 0.06663 | 0.0002875 | 0.07196 | 0.0279 | 0.07151 | 0.0002766 | 0.05133 | 0.02734 | 0.0508671 | 0.0002712 |
| td | -0.005145 | 0.01365 | -0.005233 | 0.0001367 | 0.05256 | 0.01388 | 0.05248 | 0.000139 | 0.04113 | 0.01448 | 0.04105 | 0.0001449 | 0.01039 | 0.01493 | 0.0102884 | 0.0001495 |
| rd | 0.09802 | 0.01242 | 0.09797 | 0.0001229 | 0.1092 | 0.01221 | 0.1091 | 0.0001209 | 0.08737 | 0.0127 | 0.08733 | 0.0001257 | 0.07821 | 0.01331 | 0.0781535 | 0.0001318 |
| vd | 0.1506 | 0.01347 | 0.1508 | 0.0001343 | 1361 | 0.01297 | 0.1363 | 0.0001294 | 0.09708 | 0.01381 | 0.09728 | 0.0001377 | 0.09611 | 0.01431 | 0.0963052 | 0.0001427 |
| ad | -0.1602 | 0.01148 | -0.1601 | 0.0001161 | -0.1281 | 0.01074 | -0.128 | 0.0001086 | -0.1747 | 0.01157 | -0.1746 | 0.0117 | -0.1971 | 0.01225 | -0.1969138 | 0.0001239 |
| md | 0.07741 | 0.01665 | 0.07731 | 0.0001653 | 0.07078 | 0.01709 | 0.07068 | 0.0001696 | 0.05937 | 0.01767 | 0.05926 | 0.0001753 | 0.05714 | 0.01855 | 0.0570223 | 0.0001841 |
| wbgd | -0.09805 | 0.005821 | -0.09802 | 0.0000582 | -0.09352 | 0.005931 | -0.09349 | 0.00005932 | -0.04202 | 0.006112 | -0.04199 | 0.00006114 | -0.3695 | 0.006617 | -0.3694594 | 0.00006616 |
| isd | -0.03324 | 0.01655 | -0.03334 | 0.0001674 | -0.04875 | 0.01651 | -0.04884 | 0.000167 | 0.0161 | 0.0169 | 0.016 | 0.000171 | 0.01559 | 0.01651 | 0.0154934 | 0.000167 |
| cad | -0.3296 | 0.00691 | -0.3295 | 0.00006879 | -0.3271 | 0.007057 | -0.327 | 0.00007023 | -0.2605 | 0.007368 | -0.2604 | 0.00007333 | -0.3444 | 0.00776 | -0.3442932 | 0.00007727 |
| gd | -0.07085 | 0.02857 | -0.07063 | 0.0002873 | -0.09808 | 0.02811 | -0.09789 | 0.0002828 | -0.126 | 0.02977 | -0.1258 | 0.0002995 | -0.1004 | 0.03491 | -0.100127 | 0.0003511 |
| | | sigma2 | 0.2044 | 0.00001688 | | sigma2 | 0.2089 | 0.00001735 | | sigma2 | 0.2245 | 0.00001872 | | sigma2 | 0.2164399 | 0.00001886 |

Table 4.1 continued

| year | 2008: Model1: lnw = yerschol + s2 + pexp + pexp2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad +gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.769 | 0.01718 | 4.769 | 0.0001724 | 4.868 | 0.01919 | 4.869 | 0.0001925 | 4.389 | 0.01762 | 4.389 | 0.0001768 | 4.73 | 0.01853 | 4.73 | 0.0001859 |
| S | -0.006911 | 0.002863 | -0.006984 | 0.00002871 | 0.003378 | 0.003156 | 0.003297 | 0.00003164 | -0.003525 | 0.002941 | -0.003599 | 0.00002949 | -0.004631 | 0.003092 | -0.00471 | 0.000031 |
| S2 | 0.0008617 | 0.0001554 | 0.0008656 | 0.000001561 | 0.0002003 | 0.0001702 | 0.0002046 | 0.000001709 | 0.000599 | 0.0001568 | 0.000603 | 0.000001575 | 0.0008225 | 0.000167 | 0.0008267 | 0.000001677 |
| Pexp | 0.002514 | 0.0004468 | 0.002524 | 0.000004451 | 0.002541 | 0.0004782 | 0.002551 | 0.000004764 | 0.002173 | 0.0004263 | 0.002182 | 0.000004247 | 0.001518 | 0.000451 | 0.001528 | 0.000004493 |
| Pexp2 | -0.00007476 | 8.023E-06 | -0.00007496 | 0.00000007984 | -0.00006507 | 0.000008662 | -0.00006528 | 0.0000000862 | -0.00005756 | 0.000007882 | -0.00005775 | 0.00000007842 | -0.00005025 | 0.000008235 | -0.00005046 | 0.00000008194 |
| sex | 0.04854 | 0.005963 | 0.04848 | 0.00006001 | 0.05367 | 0.006487 | 0.0536 | 0.0000653 | 0.004972 | 0.005931 | 0.04967 | 0.00005967 | 0.04613 | 0.006239 | 0.04607 | 0.00006279 |
| ld | -0.01199 | 0.02658 | -0.01245 | 0.0002637 | 0.106 | 0.02968 | 0.1055 | 0.0002943 | 0.09625 | 0.02706 | 0.0958 | 0.0002683 | 0.08026 | 0.02952 | 0.07977 | 0.0002927 |
| td | 0.006763 | 0.01401 | 0.00667 | 0.0001403 | 0.05798 | 0.01538 | 0.05788 | 0.0001541 | 0.05179 | 0.01424 | 0.05171 | 0.0001426 | 0.0395 | 0.01486 | 0.0394 | 0.0001488 |
| rd | 0.08466 | 0.01257 | 0.0846 | 0.0001245 | 0.09457 | 0.01388 | 0.09451 | 0.0001374 | 0.1264 | 0.01243 | 0.1264 | 0.0001231 | 0.1086 | 0.01382 | 0.1085 | 0.0001369 |
| vd | 0.09539 | 0.01358 | 0.09558 | 0.0001354 | 0.09821 | 0.01486 | 0.0984 | 0.0001481 | 0.08862 | 0.0138 | 0.08881 | 0.0001376 | 0.1275 | 0.01524 | 0.1277 | 0.0001519 |
| ad | -0.2106 | 0.01245 | -0.2105 | 0.0001258 | -0.1209 | 0.01278 | -0.1207 | 0.0001291 | -0.07933 | 0.01257 | 0.07918 | 0.0001269 | -0.0784 | 0.01444 | -0.07824 | 0.0001458 |
| md | 0.06264 | 0.01832 | 0.06252 | 0.0001818 | 0.05784 | 0.02051 | 0.05771 | 0.0002036 | 0.09808 | 0.0194 | 0.09796 | 0.0001926 | 0.0928 | 0.02051 | 0.09266 | 0.0002036 |
| wbgd | -0.4167 | 0.006388 | -0.4167 | 0.00006387 | -0.5693 | 0.007301 | -0.5693 | 0.00007299 | -0.06432 | 0.006071 | -0.06429 | 0.00006072 | -0.3932 | 0.006721 | -0.3932 | 0.00006721 |
| isd | 0.03049 | 0.01593 | 0.03039 | 0.0001612 | -0.02557 | 0.01696 | -0.02566 | 0.0001717 | 0.04448 | 0.01619 | 0.04439 | 0.0001638 | 0.04917 | 0.01641 | 0.04907 | 0.0001661 |
| cad | -0.2997 | 0.007359 | -0.2996 | 0.00007326 | -0.3378 | 0.00821 | -0.3377 | 0.00008171 | -0.2267 | 0.007191 | -0.2266 | 0.00007156 | -0.2615 | 0.007769 | -0.2615 | 0.00007734 |
| gd | -0.06603 | 0.03251 | -0.06579 | 0.0003269 | -0.1049 | 0.03582 | -0.1047 | 0.0003603 | -0.1306 | 0.03125 | -0.1304 | 0.0003144 | -0.1349 | 0.03491 | -0.1347 | 0.0003511 |
| | | sigma2 | 0.1986 | 0.00001729 | | sigma2 | 0.2283 | 0.00002031 | | sigma2 | 0.2195 | 0.00001813 | | sigma2 | 0.2211 | 0.00001921 |

Table 4.1 continued

| year | 2009: Model1: lnw = yerschol + s2 + pexp + pexp2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad +gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.528 | 0.01682 | 4.528 | 0.0001687 | 4.745 | 0.01978 | 4.746 | 0.0001985 | 4.493 | 0.01885 | 4.493 | 0.0001891 | 4.536 | 0.01842 | 4.536 | 0.0001848 |
| S | -0.0116 | 0.002826 | -0.01167 | 0.00002834 | -0.00232 | 0.003331 | -0.002405 | 0.00003341 | -0.003669 | 0.003123 | -0.003748 | 0.00003132 | -0.01541 | 0.003096 | -0.01549 | 0.00003104 |
| S2 | 0.0008884 | 0.000151 | 0.0008922 | 0.000001516 | 0.0004952 | 0.0001759 | 0.0004997 | 0.000001766 | 0.0005681 | 0.0001646 | 0.0005723 | 0.000001653 | 0.001089 | 0.0001644 | 0.001094 | 0.00000165 |
| Pexp | 0.001571 | 0.0004338 | 0.00158 | 0.000004322 | 0.000009183 | 0.0005194 | 0.00002105 | 0.000005175 | -0.0001812 | 0.0004648 | -0.0001709 | 0.000004631 | 0.0005543 | 0.0004656 | 0.0005648 | 0.000004639 |
| Pexp2 | -0.00006466 | 0.000007861 | -0.00006485 | 0.0000007823 | -0.0000272 | 0.00000966 | -0.00002743 | 0.0000009612 | -0.00003155 | 0.000008583 | -0.00003175 | 0.000000854 | -0.00004636 | 0.000008589 | -0.00004657 | 0.0000008546 |
| sex | 0.0509 | 0.005831 | 0.05085 | 0.00005867 | 0.03729 | 0.006793 | 0.03723 | 0.00006835 | 0.04187 | 0.00641 | 0.04182 | 0.00006449 | 0.04494 | 0.006318 | 0.04489 | 0.00006355 |
| ld | 0.07224 | 0.02584 | 0.0718 | 0.0002563 | 0.07343 | 0.02662 | 0.07297 | 0.0002642 | 0.1195 | 0.02457 | 0.119 | 0.0002438 | 0.1163 | 0.0277 | 0.1158 | 0.0002748 |
| td | 0.03997 | 0.01427 | 0.03989 | 0.000143 | 0.09364 | 0.01628 | 0.09354 | 0.000163 | 0.1036 | 0.01568 | 0.1035 | 0.000157 | 0.06085 | 0.01578 | 0.06076 | 0.000158 |
| rd | 0.1131 | 0.01285 | 0.1131 | 0.0001274 | 0.11 | 0.01462 | 0.1099 | 0.0001448 | 0.1495 | 0.01414 | 0.1495 | 0.0001401 | 0.1233 | 0.01404 | 0.1233 | 0.0001391 |
| vd | 0.1335 | 0.01316 | 0.1336 | 0.0001312 | 0.01402 | 0.01484 | 0.1404 | 0.000148 | 0.1576 | 0.01495 | 0.1578 | 0.0001491 | 0.1729 | 0.01485 | 0.1731 | 0.000148 |
| ad | -0.1147 | 0.01363 | -0.1145 | 0.0001376 | -0.1968 | 0.01472 | -0.1966 | 0.0001485 | -0.1418 | 0.01536 | -0.1417 | 0.000155 | -0.1399 | 0.01498 | -0.1397 | 0.0001512 |
| md | 0.1089 | 0.01791 | 0.1088 | 0.0001778 | 0.1315 | 0.02104 | 0.1313 | 0.0002088 | 0.1187 | 0.01976 | 0.1186 | 0.0001962 | 0.1135 | 0.01907 | 0.1134 | 0.0001893 |
| wbgd | -0.1198 | 0.005848 | -0.1198 | 0.00005848 | -0.3712 | 0.007101 | -0.3712 | 0.00007096 | -0.1077 | 0.006468 | -0.1077 | 0.00006469 | -0.1027 | 0.006296 | -0.1027 | 0.00006296 |
| isd | -0.008583 | 0.01528 | -0.008667 | 0.0001547 | -0.06163 | 0.01691 | -0.06173 | 0.0001711 | -0.055 | 0.01671 | -0.0551 | 0.0001691 | -0.03938 | 0.01679 | -0.03948 | 0.0001701 |
| cad | -0.5297 | 0.007377 | -0.5296 | 0.00007336 | -0.4515 | 0.008979 | -0.4514 | 0.00008931 | -0.4816 | 0.008245 | -0.4815 | 0.00008203 | -0.5693 | 0.008025 | -0.5692 | 0.00007982 |
| gd | -0.02034 | 0.01326 | -0.02024 | 0.0001334 | -0.0832 | 0.01524 | -0.08307 | 0.0001533 | -0.09964 | 0.01476 | -0.09952 | 0.0001485 | -0.05997 | 0.01471 | -0.05985 | 0.000148 |
| | | sigma2 | 0.2105 | 0.0000173 | | sigma2 | 0.2575 | 0.00002221 | | sigma2 | 0.2534 | 0.00002087 | | sigma2 | 0.2524 | 0.00002057 |

Table 4.1 continued

| year | 2010: Model1: lnw = yerschol + s2 + pexp + pexp2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad +gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.577 | 0.01903 | 4.577 | 0.0001909 | 4.556 | 0.02021 | 4.557 | 0.0002028 | 4.598 | 0.02083 | 4.598 | 0.000209 | 4.701 | 0.02017 | 4.701697 | 0.0002024 |
| S | -0.006015 | 0.003189 | -0.006096 | 0.00003198 | 0.002902 | 0.00338 | 0.002816 | 0.00003389 | -0.003385 | 0.003458 | -0.003472 | 0.00003467 | -0.01339 | 0.003364 | -0.013474 | 0.00003373 |
| S2 | 0.0005036 | 0.0001689 | 0.0005079 | 0.000001696 | 0.0001207 | 0.0001784 | 0.0001252 | 0.000001791 | 0.0005066 | 0.0001801 | 0.0005112 | 0.000001808 | 0..0009232 | 0.000176 | 0.0009277 | 0.000001767 |
| Pexp | 0.0004684 | 0.0004944 | 0.0004797 | 0.000004926 | -0.001037 | 0.0005302 | -0.001025 | 0.000005283 | -0.000787 | 0.0005145 | -0.0007753 | 0.000005126 | 0.0002616 | 0.0005075 | 0.0002732 | 0.000005056 |
| Pexp2 | -0.0000364 | 0.000009031 | -0.00003662 | 0.00000008986 | -0.000004347 | 0.000009736 | -0.000004582 | 0.00000009688 | -0.00002416 | 0.000009517 | -0.00002439 | 0.0000000947 | -0.0000468 | 0.00000935 | -0.0000471 | 0.00000009303 |
| sex | 0.02688 | 0.006648 | 0.02683 | 0.00006688 | 0.02067 | 0.007063 | 0.02061 | 0.00007105 | 0.04183 | 0.007082 | 0.04178 | 0.00007125 | 0.04987 | 0.006889 | 0.0498101 | 0.0000693 |
| ld | 0.0762 | 0.02563 | 0.07582 | 0.0002544 | 0.03814 | 0.02935 | 0.03763 | 0.0002911 | 0.09827 | 0.03085 | 0.09773 | 0.000306 | 0.06858 | 0.03014 | 0.0680479 | 0.000299 |
| td | 0.07033 | 0.01651 | 0.07024 | 0.0001654 | 0.05115 | 0.01721 | 0.05105 | 0.0001724 | 0.03818 | 0.01759 | 0.03808 | 0.0001761 | 0.09315 | 0.0169 | 0.0930494 | 0.0001693 |
| rd | 0.08955 | 0.0149 | 0.0895 | 0.0001476 | 0.1091 | 0.01562 | 0.109 | 0.0001548 | 0.14 | 0.01565 | 0.1399 | 0.000155 | 0.1329 | 0.0152 | 0.1328589 | 0.0001506 |
| vd | 0.1468 | 0.01499 | 0.147 | 0.0001494 | 0.1741 | 0.01637 | 0.1743 | 0.0001632 | 0.161 | 0.01639 | 0.1612 | 0.0001634 | 0.1747 | 0.01591 | 0.174915 | 0.0001586 |
| ad | -0.114 | 0.0169 | -0.1138 | 0.0001706 | -0.08792 | 0.01684 | -0.08772 | 0.00017 | -0.08539 | 0.0184 | -0.08518 | 0.0001856 | -0.1734 | 0.01628 | -0.1732726 | 0.0001643 |
| md | 0.1111 | 0.02052 | 0.111 | 0.0002037 | 0.1125 | 0.0222 | 0.1124 | 0.0002204 | 0.1208 | 0.02412 | 0.1206 | 0.0002395 | 0.1259 | 0.0231 | 0.1257854 | 0.0002293 |
| wbgd | -0.1579 | 0.006549 | -0.1579 | 0.00006549 | -0.171 | 0.007043 | -0.1709 | 0.00007045 | -0.183 | 0.007086 | -0.1829 | 0.0000709 | -0.2568 | 0.006959 | -0.2567814 | 0.00006961 |
| isd | -0.02116 | 0.01744 | -0.02127 | 0.0001766 | -0.07868 | 0.01901 | -0.07879 | 0.0001924 | -0.05158 | 0.01901 | -0.0517 | 0.0001923 | -0.02962 | 0.0183 | -0.0297409 | 0.0001852 |
| cad | 0.01744 | 0.008278 | -0.5878 | 0.00008232 | -0.4759 | 0.009193 | -0.4758 | 0.0000914 | -0.4644 | 0.009367 | -0.4643 | 0.00009318 | -0.51 | 0.009104 | -0.5099277 | 0.00009056 |
| gd | -0.05193 | 0.01528 | -0.05181 | 0.0001537 | -0.05511 | 0.01613 | -0.05497 | 0.0001622 | -0.06765 | 0.01636 | -0.0675 | 0.0001645 | -0.11 | 0.01572 | -0.1098961 | 0.0001581 |
| | | sigma2 | 0.2747 | 0.00002242 | | sigma2 | 0.3079 | 0.00002534 | | sigma2 | 0.3009 | 0.0000252 | | sigma2 | 0.2846835 | 0.00002384 |

Table 4.1 continued

| year | 2011: Model1: lnw = yerschol + s2 + pexp + pexp2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad +gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.58 | 0.02014 | 4.58 | 0.0002021 | 4.592 | 0.02009 | 4.592 | 0.0002016 | 4.662 | 0.02096 | 4.662 | 0.0002103 | 4.614 | 0.02105 | 4.614 | 0.0002112 |
| S | -0.009721 | 0.003361 | -0.009807 | 0.0000337 | -0.009514 | 0.003347 | -0.009599 | 0.00003357 | -0.01674 | 0.003439 | -0.01682 | 0.00003449 | -0.01225 | 0.003487 | -0.01233 | 0.00003497 |
| S2 | 0.0007136 | 0.0001764 | 0.0007181 | 0.000001771 | 0.0007486 | 0.0001759 | 0.000753 | 0.000001766 | 0.001129 | 0.0001766 | 0.001133 | 0.000001773 | 0.0008735 | 0.0001804 | 0.000878 | 0.000001811 |
| Pexp | -0.0008386 | 0.0005297 | -0.0008267 | 0.000005277 | -0.001045 | 0.0005329 | -0.001033 | 0.000005309 | -0.001003 | 0.0005132 | -0.0009918 | 0.000005114 | -0.001157 | 0.0005304 | -0.001145 | 0.000005285 |
| Pexp2 | -0.0000293 | 0.000009685 | -0.00002953 | 0.00000009638 | -0.00002099 | 0.000009751 | -0.00002122 | 0.00000009703 | -0.0000318 | 0.000009515 | -0.00003203 | 0.00000009467 | -0.0000343 | 0.000009839 | -0.00003367 | 0.0000000979 |
| sex | 0.04593 | 0.007074 | 0.04588 | 0.00007116 | 0.0353 | 0.007107 | 0.03524 | 0.00007149 | 0.02955 | 0.007058 | 0.0295 | 0.000071 | 0.04426 | 0.007156 | 0.04421 | 0.00007198 |
| ld | 0.1015 | 0.02869 | 0.101 | 0.0002846 | 0.04917 | 0.02858 | 0.04869 | 0.0002835 | 0.02599 | 0.02715 | 0.02553 | 0.0002692 | 0.05036 | 0.02806 | 0.04988 | 0.0002784 |
| td | 0.09142 | 0.01697 | 0.09133 | 0.00017 | 0.04991 | 0.017 | 0.04981 | 0.0001702 | 0.04095 | 0.01677 | 0.04087 | 0.000168 | 0.05337 | 0.01704 | 0.05328 | 0.0001707 |
| rd | 0.1387 | 0.01561 | 0.1386 | 0.0001547 | 0.1288 | 0.01509 | 0.1287 | 0.0001495 | 0.1316 | 0.01471 | 0.1315 | 0.0001457 | 0.106 | 0.0149 | 0.1059 | 0.0001476 |
| vd | 0.1839 | 0.01604 | 0.1841 | 0.0001599 | 0.203 | 0.01528 | 0.2032 | 0.0001524 | 0.1768 | 0.0155 | 0.177 | 0.0001545 | 0.01697 | 0.01629 | 0.1699 | 0.0001624 |
| ad | -0.1542 | 0.01789 | -0.154 | 0.0001806 | -0.129 | 0.01658 | -0.1288 | 0.0001674 | -0.1739 | 0.01634 | -0.1737 | 0.000165 | -0.1026 | 0.01493 | -0.1024 | 0.0001509 |
| md | 0.15 | 0.02241 | 0.1499 | 0.0002225 | 0.1604 | 0.02198 | 0.1603 | 0.0002183 | 0.09973 | 0.02213 | 0.0996 | 0.0002198 | 0.09091 | 0.02212 | 0.09078 | 0.0002196 |
| wbgd | -0.1591 | 0.006933 | -0.1591 | 0.00006935 | -0.145 | 0.006934 | -0.145 | 0.00006936 | -0.115 | 0.006912 | -0.115 | 0.00006914 | -0.09682 | 0.007019 | -0.09679 | 0.00007022 |
| isd | -0.02826 | 0.01892 | -0.02837 | 0.0001915 | -0.08042 | 0.01862 | -0.08052 | 0.0001885 | -0.06372 | 0.01816 | -0.06383 | 0.0001839 | -0.04292 | 0.01901 | -0.04303 | 0.0001924 |
| cad | -0.4772 | 0.009174 | -0.4771 | 0.00009126 | -0.4649 | 0.0092 | -0.4648 | 0.00009147 | -0.4559 | 0.009251 | -0.4558 | 0.00009195 | -0.4328 | 0.009374 | -0.4327 | 0.0000932 |
| gd | -0.1257 | 0.01621 | -0.1255 | 0.0001631 | -0.05387 | 0.01613 | -0.05374 | 0.0001623 | -0.06076 | 0.01576 | -0.06064 | 0.0001586 | -0.05838 | 0.01605 | -0.05826 | 0.0001616 |
| | | sigma2 | 0.3111 | 0.00002541 | | sigma2 | 0.3101 | 0.00002541 | | sigma2 | 0.2978 | 0.00002481 | | sigma2 | 0.3076 | 0.00002558 |

**Table 4.2**: Estimation results for daily wages for model 2 using OLS and Bayes

| Table 4.2: Estimation Results for Daily Wages Equation Using OLS and Bayes | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| year | 2006 Model2: lnw=yerschol + s2 + age + age2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.232 | 0.01656 | 4.233 | 0.0001662 | 4.263 | 0.01646 | 4.2632681 | 0.0001652 | 4.236 | 0.01689 | 0.02947 | 0.0001694 | 4.232 | 0.01693 | 4.232 | 0.0001699 |
| S | 0.01555 | 0.002611 | 0.01548 | 0.00002618 | 0.01886 | 0.002582 | 0.0187958 | 0.00002589 | 0.01248 | 0.002625 | 0.01241 | 0.00002632 | 0.007845 | 0.002665 | 0.007774 | 0.00002672 |
| S2 | -0.000117 | 0.0001468 | -0.0001133 | 0.000001474 | -0.0003238 | 0.0001457 | -0.0003201 | 0.000001463 | -0.00006729 | 0.0001461 | -0.00006357 | 0.000001467 | 0.00001772 | 0.0001484 | 0.0000215 | 0.00000149 |
| age | 0.004084 | 0.0007267 | 0.004098 | 0.000007253 | 0.001952 | 0.0007277 | 0.0019658 | 0.000007263 | 0.003025 | 0.0007156 | 0.003039 | 0.000007141 | 0.004773 | 0.000735 | 0.004788 | 0.000007336 |
| age2 | 0.004084 | 0.000009339 | -0.00005646 | 0.00000009321 | -0.00002361 | 0.000009388 | -0.0000238 | 0.0000000937 | -0.0000278 | 0.000009273 | -0.000028 | 0.00000009254 | -0.00005378 | 0.000009528 | -0.00005398 | 0.00000009509 |
| sex | 0.029 | 0.005877 | 0.02887 | 0.00005895 | 0.03577 | 0.005846 | 0.0356436 | 0.00005863 | 0.04736 | 0.005875 | 0.04723 | 0.00005893 | 0.0447 | 0.005898 | 0.04457 | 0.00005915 |
| ld | -0.08475 | 0.0279 | -0.08523 | 0.0002768 | 0.02214 | 0.03004 | 0.021627 | 0.000298 | 0.02736 | 0.03078 | 0.02685 | 0.0003052 | 0.1568 | 0.03076 | 0.1563 | 0.000305 |
| td | 0.004334 | 0.01392 | 0.004237 | 0.0001392 | 0.02949 | 0.01374 | 0.0293931 | 0.0001374 | 0.01488 | 0.01384 | 0.01478 | 0.0001385 | 0.03004 | 0.01403 | 0.02994 | 0.0001403 |
| rd | 0.07215 | 0.01315 | 0.07205 | 0.0001303 | 0.07948 | 0.01295 | 0.079386 | 0.0001282 | 0.09766 | 0.01257 | 0.09757 | 0.0001245 | 0.08764 | 0.01276 | 0.08755 | 0.0001264 |
| vd | 0.101 | 0.01361 | 0.1011 | 0.0001356 | 0.1118 | 0.01355 | 0.1119919 | 0.000135 | 0.1082 | 0.01325 | 0.1083 | 0.0001321 | 0.1038 | 0.01368 | 0.104 | 0.0001364 |
| ad | -0.04712 | 0.01389 | -0.04699 | 0.0001402 | -0.03635 | 0.01287 | -0.0362221 | 0.0001299 | -0.0658 | 0.01305 | -0.06567 | 0.0001317 | -0.09456 | 0.01059 | -0.09444 | 0.000107 |
| md | 0.0716 | 0.01806 | 0.07145 | 0.0001789 | 0.05575 | 0.01753 | 0.0556007 | 0.0001737 | 0.07043 | 0.01777 | 0.07028 | 0.000176 | 0.09332 | 0.01854 | 0.09318 | 0.0001837 |
| wbgd | -0.119 | 0.005922 | -0.119 | 0.00005927 | -0.1255 | 0.005898 | -0.1255346 | 0.00005905 | -0.07121 | 0.00589 | -0.0712 | 0.00005897 | -0.0529 | 0.005948 | -0.0529 | 0.00005955 |
| isd | -0.02333 | 0.01703 | -0.02346 | 0.000172 | -0.0558 | 0.01712 | -0.0559202 | 0.000173 | -0.04604 | 0.01638 | -0.04616 | 0.0001655 | -0.01586 | 0.01726 | -0.01597 | 0.0001743 |
| cad | -0.3063 | 0.01703 | -0.3062 | 0.00007044 | -0.3155 | 0.007089 | -0.3154656 | 0.00007056 | -0.334 | 0.007016 | -0.334 | 0.00006984 | -0.3228 | 0.007041 | -0.3227 | 0.00007012 |
| gd | -0.1118 | 0.03356 | -0.1116 | 0.0003376 | -0.0942 | 0.03202 | -0.0939775 | 0.0003222 | -0.04271 | 0.02947 | -0.04249 | 0.0002965 | -0.04926 | 0.02952 | -0.04905 | 0.000297 |
| | | | | | | sigma2 | 0.2071546 | 0.00001712 | | sigma2 | 0.2068 | 0.00001718 | | sigma2 | 0.2148 | 0.00001771 |
| Cells shaded in blue have a statistically significant at a confidence level of 5% in each of the two methods of estimation (OLS and Bayes) | | | | | | | | | | | | | | | | |

Table 4.2 continued

| year | 2007 Model2: lnw=yerschol + s2 + age + age2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.271 | 0.01636 | 4.27095 | 0.0001641 | 4.309 | 0.01662 | 4.309 | 0.0001667 | 4.28 | 0.01774 | 4.28 | 0.000178 | 4.597 | 0.01817 | 4.5976051 | 0.0001823 |
| S | 0.003988 | 0.002588 | 0.0039193 | 0.00002595 | 0.002764 | 0.002622 | 0.002694 | 0.00002629 | -0.00159 | 0.002778 | -0.001664 | 0.00002785 | -0.005213 | 0.002823 | -0.0052885 | 0.00002831 |
| S2 | 0.0002555 | 0.0001447 | 0.0002591 | 0.000001453 | 0.0002876 | 0.0001466 | 0.0002913 | 0.000001472 | 0.0004418 | 0.000154 | 0.0004457 | 0.000001546 | 0.0006836 | 0.0001565 | 0.0006876 | 0.000001571 |
| age | 0.007254 | 0.0007307 | 0.0072679 | 0.000007293 | 0.005086 | 0.0007452 | 0.0051 | 0.000007438 | 0.006457 | 0.0007511 | 0.006471 | 0.000007496 | 0.01029 | 0.0007732 | 0.0103072 | 0.000007716 |
| age2 | -0.000102 | 0.00000938 | -0.0001022 | 0.00000009362 | -0.00007428 | 0.000009592 | -0.00007448 | 0.00000009573 | -0.00008588 | 0.000009672 | -0.00008609 | 0.00000009653 | -0.0001489 | 0.000009923 | -0.0001491 | 0.00000009903 |
| sex | 0.05017 | 0.005785 | 0.0500397 | 0.00005803 | 0.05819 | 0.005901 | 0.05806 | 0.00005918 | 0.05458 | 0.006153 | 0.05445 | 0.00006171 | 0.0452 | 0.006281 | 0.0450657 | 0.00006302 |
| ld | 0.07355 | 0.02917 | 0.0730406 | 0.0002893 | 0.06861 | 0.02887 | 0.06811 | 0.0002864 | 0.07425 | 0.02778 | 0.07377 | 0.0002756 | 0.05848 | 0.0272 | 0.0580024 | 0.0002699 |
| td | -0.001855 | 0.01351 | -0.0019612 | 0.0001351 | 0.05241 | 0.01376 | 0.0523 | 0.0001377 | 0.04354 | 0.01434 | 0.04344 | 0.0001434 | 0.02081 | 0.01476 | 0.0206935 | 0.0001477 |
| rd | 0.09132 | 0.01244 | 0.0912236 | 0.0001232 | 0.1028 | 0.01224 | 0.1027 | 0.0001213 | 0.08243 | 0.01271 | 0.08234 | 0.0001259 | 0.07275 | 0.01331 | 0.0726561 | 0.0001318 |
| vd | 0.1421 | 0.0135 | 0.1422904 | 0.0001346 | 0.1281 | 0.01302 | 0.1283 | 0.0001297 | 0.09028 | 0.01384 | 0.09044 | 0.0001379 | 0.08863 | 0.01433 | 0.088799 | 0.0001428 |
| ad | -0.1672 | 0.01151 | -0.1671202 | 0.0001163 | -0.1339 | 0.01302 | -0.1338 | 0.0001089 | -0.1797 | 0.01159 | -0.1795 | 0.0001172 | -0.2027 | 0.01226 | -0.2025232 | 0.0001239 |
| md | 0.0689 | 0.01667 | 0.0687624 | 0.0001652 | 0.06265 | 0.01302 | 0.0001089 | 0.0001695 | 0.0516 | 0.01769 | 0.05146 | 0.0001752 | 0.04985 | 0.01855 | 0.0496994 | 0.0001837 |
| wbgd | -0.09856 | 0.005815 | -0.0985609 | 0.00005821 | -0.09373 | 0.01302 | -0.09373 | 0.00005933 | -0.0421 | 0.006107 | -0.0421 | 0.00006115 | -0.37 | 0.006609 | -0.3699868 | 0.00006615 |
| isd | -0.03966 | 0.01656 | -0.0397847 | 0.0001673 | -0.05402 | 0.01302 | -0.05414 | 0.0001669 | 0.01095 | 0.01692 | 0.01083 | 0.0001708 | 0.008894 | 0.01652 | 0.0087708 | 0.0001668 |
| cad | -0.3299 | 0.006905 | -0.3297963 | 0.00006876 | -0.3273 | 0.01302 | -0.3272 | 0.00007021 | -0.2606 | 0.007363 | -0.2606 | 0.00007331 | -0.3449 | 0.007752 | -0.3448293 | 0.00007722 |
| gd | -0.0723 | 0.02854 | -0.0720936 | 0.0002871 | -0.09879 | 0.01302 | -0.0986 | 0.0002826 | -0.1268 | 0.02975 | -0.1266 | 0.0002993 | -0.1014 | 0.03487 | -0.1011548 | 0.0003508 |
| | | sigma2 | 0.2040181 | 0.00001685 | | 0.01302 | 0.2086 | 0.00001733 | | sigma2 | 0.2242 | 0.0000187 | | sigma2 | 0.2160039 | 0.00001882 |

Table 4.2 continued

| year | 2008 Model2: lnw=yerschol + s2 + age + age2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.691 | 0.01732 | 4.6907781 | 0.01738 | 4.8 | 0.01934 | 4.8 | 0.0001941 | 4.323 | 0.01763 | 4.324 | 0.0001769 | 4.673 | 0.01854 | 4.674 | 0.000186 |
| S | -0.005313 | 0.002696 | -0.0053852 | 0.002703 | 0.005487 | 0.002963 | 0.005408 | 0.00002971 | -0.00246 | 0.002753 | -0.002533 | 0.0000276 | -0.004196 | 0.002899 | -0.004274 | 0.00002907 |
| S2 | 0.0007235 | 0.0001496 | 0.0007273 | 0.0001502 | 0.00004267 | 0.0001637 | 0.00004684 | 0.000001644 | 0.000486 | 0.0001503 | 0.0004898 | 0.00000151 | 0.0007556 | 0.0001603 | 0.0007597 | 0.00000161 |
| age | 0.007242 | 0.0007577 | 0.0072569 | 0.0007563 | 0.005863 | 0.000811 | 0.005879 | 0.000008095 | 0.00603 | 0.0007369 | 0.006045 | 0.000007355 | 0.005447 | 0.0007734 | 0.005462 | 0.000007719 |
| age2 | -0.0001125 | 9.705E-06 | -0.0001127 | 0.000009687 | -0.00008733 | 0.00001043 | -0.00008755 | 0.0000001041 | -0.00008923 | 0.000009553 | -0.00008944 | 0.00000009533 | -0.00008564 | 0.000009997 | -0.00008586 | 0.00000009976 |
| sex | 0.04362 | 0.005998 | 0.043485 | 0.006017 | 0.05059 | 0.006523 | 0.05044 | 0.00006546 | 0.04603 | 0.00596 | 0.0459 | 0.00005979 | 0.04206 | 0.006272 | 0.04193 | 0.00006293 |
| ld | -0.007206 | 0.02644 | -0.0076765 | 0.0002623 | 0.1111 | 0.02958 | 0.1106 | 0.0002934 | 0.09994 | 0.02694 | 0.09948 | 0.0002673 | 0.08207 | 0.02941 | 0.08157 | 0.0002916 |
| td | 0.01113 | 0.01386 | 0.0110185 | 0.0001387 | 0.06368 | 0.01524 | 0.06357 | 0.0001526 | 0.05475 | 0.01411 | 0.05466 | 0.0001412 | 0.04089 | 0.01472 | 0.04078 | 0.0001473 |
| rd | 0.07819 | 0.01259 | 0.0780906 | 0.0001247 | 0.09145 | 0.0139 | 0.09135 | 0.0001376 | 0.1216 | 0.01244 | 0.1215 | 0.0001232 | 0.1031 | 0.01383 | 0.103 | 0.000137 |
| vd | 0.08802 | 0.0136 | 0.0881728 | 0.0001355 | 0.09434 | 0.01489 | 0.09451 | 0.0001483 | 0.08241 | 0.01383 | 0.08257 | 0.0001378 | 0.1202 | 0.01526 | 0.1204 | 0.0001521 |
| ad | -0.2171 | 0.01247 | -0.2169444 | 0.000126 | -0.1239 | 0.01281 | -0.1238 | 0.0001293 | -0.08376 | 0.01258 | -0.08362 | 0.000127 | -0.0839 | 0.01445 | -0.08375 | 0.0001459 |
| md | 0.05437 | 0.01833 | 0.0542197 | 0.0001817 | 0.05367 | 0.02053 | 0.05351 | 0.0002035 | 0.09097 | 0.01942 | 0.09082 | 0.0001924 | 0.08547 | 0.02051 | 0.08531 | 0.0002034 |
| wbgd | -0.4172 | 0.006382 | -0.4172051 | 0.00006388 | -0.5692 | 0.007299 | -0.5692 | 0.00007305 | -0.06454 | 0.006064 | -0.06453 | 0.00006071 | -0.3933 | 0.006716 | -0.3933 | 0.00006723 |
| isd | 0.02384 | 0.01595 | 0.0237161 | 0.000161 | -0.0292 | 0.01699 | -0.02932 | 0.0001717 | 0.03947 | 0.0162 | 0.03935 | 0.0001637 | 0.04321 | 0.01643 | 0.04309 | 0.000166 |
| cad | -0.3002 | 0.007353 | -0.3000936 | 0.00007322 | -0.338 | 0.008208 | -0.338 | 0.00008172 | -0.227 | 0.007187 | -0.2269 | 0.00007154 | -0.2618 | 0.007763 | -0.2617 | 0.00007731 |
| gd | -0.06837 | 0.03248 | -0.0681264 | 0.0003267 | -0.1037 | 0.03581 | -0.1035 | 0.0003602 | -0.1319 | 0.03123 | -0.1317 | 0.0003143 | -0.1375 | 0.03489 | -0.1372 | 0.0003509 |
| | | sigma2 | 0.1982138 | 0.00001726 | | sigma2 | 0.2282 | 0.0000203 | | sigma2 | 0.2192 | 0.00001811 | | sigma2 | 0.2208 | 0.00001918 |

Table 4.2 continued

| year | 2009 Model2: lnw=yerschol + s2 + age + age2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.462 | 0.01681 | 4.4623855 | 0.0001687 | 4.723 | 0.01989 | 4.723 | 0.0001995 | 4.462 | 0.01889 | 4.462 | 0.0001896 | 4.486 | 0.01844 | 4.486 | 0.000185 |
| S | -0.009929 | 0.002658 | -0.0099995 | 0.00002665 | -0.0008402 | 0.003165 | -0.0009245 | 0.00003174 | -0.002316 | 0.002929 | -0.002394 | 0.00002937 | -0.01486 | 0.002908 | -0.01494 | 0.00002916 |
| S2 | 0.0007814 | 0.0001449 | 0.0007851 | 0.000001455 | 0.0004479 | 0.0001696 | 0.0004522 | 0.000001703 | 0.0005281 | 0.0001579 | 0.0005321 | 0.000001586 | 0.001054 | 0.0001577 | 0.001058 | 0.000001583 |
| age | 0.005933 | 0.0007396 | 0.0059477 | 0.000007383 | 0.001622 | 0.0008903 | 0.00164 | 0.000008887 | 0.002467 | 0.0008058 | 0.002483 | 0.000008044 | 0.004784 | 0.0008049 | 0.0048 | 0.000008035 |
| age2 | -0.0001005 | 0.000009476 | -0.0001007 | 0.00000009457 | -3.927E-05 | 0.00001151 | -0.00003952 | 0.0000001149 | -0.00005576 | 0.00001038 | -0.00005598 | 0.0000001036 | -8.664E-05 | 0.00001039 | -0.00008687 | 0.0000001037 |
| sex | 0.04606 | 0.00587 | 0.0459354 | 0.00005887 | 0.03563 | 0.006842 | 0.03548 | 0.00006861 | 0.03905 | 0.006449 | 0.03891 | 0.00006468 | 0.04051 | 0.006351 | 0.04038 | 0.00006369 |
| ld | 0.07857 | 0.02571 | 0.0781261 | 0.0002551 | 0.07606 | 0.02649 | 0.07559 | 0.0002629 | 0.1196 | 0.02444 | 0.1191 | 0.0002426 | 0.1189 | 0.02756 | 0.1184 | 0.0002734 |
| td | 0.04318 | 0.01418 | 0.0430967 | 0.000142 | 0.09514 | 0.01618 | 0.09503 | 0.0001619 | 0.1042 | 0.01558 | 0.1041 | 0.0001559 | 0.06189 | 0.01567 | 0.06179 | 0.0001568 |
| rd | 0.1071 | 0.01287 | 0.1070371 | 0.0001276 | 0.1078 | 0.01466 | 0.1077 | 0.0001452 | 0.1453 | 0.01417 | 0.1452 | 0.0001404 | 0.1166 | 0.01406 | 0.1165 | 0.0001393 |
| vd | 0.126 | 0.01319 | 0.1261641 | 0.0001314 | 0.1376 | 0.0149 | 0.1377 | 0.0001485 | 0.1522 | 0.015 | 0.1524 | 0.0001494 | 0.1641 | 0.01488 | 0.1643 | 0.0001483 |
| ad | -0.1206 | 0.01364 | -0.1204785 | 0.0001377 | -0.1989 | 0.01476 | -0.1988 | 0.0001489 | -0.1457 | 0.01538 | -0.1455 | 0.0001552 | -0.147 | 0.015 | -0.1468 | 0.0001514 |
| md | 0.1011 | 0.01792 | 0.1009445 | 0.0001776 | 0.1286 | 0.02109 | 0.1284 | 0.0002089 | 0.113 | 0.01979 | 0.1128 | 0.0001961 | 0.1048 | 0.01908 | 0.1046 | 0.0001891 |
| wbgd | -0.1201 | 0.005843 | -0.1200537 | 0.00005849 | -0.3712 | 0.007099 | -0.3712 | 0.00007101 | -0.1077 | 0.006464 | -0.1077 | 0.0000647 | -0.1027 | 0.00629 | -0.1027 | 0.00006296 |
| isd | -0.01516 | 0.01529 | -0.0152765 | 0.0001546 | -0.06358 | 0.01694 | -0.06371 | 0.0001711 | -0.05925 | 0.01673 | -0.05937 | 0.000169 | -0.04642 | 0.01681 | -0.04654 | 0.0001699 |
| cad | -0.5302 | 0.007372 | -0.5301217 | 0.00007332 | -0.4517 | 0.008978 | -0.4516 | 0.00008933 | -0.4818 | 0.008243 | -0.4817 | 0.00008203 | -0.5698 | 0.00802 | -0.5697 | 0.00007978 |
| gd | -0.02215 | 0.01325 | -0.0220551 | 0.0001334 | -0.08351 | 0.01523 | -0.0834 | 0.0001533 | -0.1007 | 0.01475 | -0.1006 | 0.0001485 | -0.06262 | 0.0147 | -0.06252 | 0.0001479 |
| | | sigma2 | 0.2101389 | 0.00001727 | | sigma2 | 0.2574 | 0.00002221 | | sigma2 | 0.2533 | 0.00002086 | | sigma2 | 0.252 | 0.00002055 |

Table 4.2 continued

| year | 2010 Model2: lnw=yerschol + s2 + age + age2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.535 | 0.01907 | 4.536 | 0.0001913 | 4.552 | 0.02035 | 4.552 | 0.0002042 | 4.577 | 0.02077 | 4.578 | 0.0002084 | 4.656 | 0.02021 | 4.657 | 0.0002028 |
| S | -0.00695 | 0.003019 | -0.00703 | 0.00003027 | 0.002382 | 0.003207 | 0.002296 | 0.00003215 | -0.002466 | 0.003251 | -0.002552 | 0.0000326 | -0.01196 | 0.003182 | -0.01205 | 0.00003191 |
| S2 | 0.0005256 | 0.0001626 | 0.0005297 | 0.000001633 | 0.0001738 | 0.000172 | 0.0001782 | 0.000001727 | 0.0005053 | 0.0001726 | 0.0005096 | 0.000001734 | 0.0008737 | 0.0001693 | 0.000878 | 0.0000017 |
| age | 0.004589 | 0.0008503 | 0.004606 | 0.000008489 | 0.0007029 | 0.000913 | 0.0007214 | 0.000009115 | 0.001698 | 0.0008917 | 0.001716 | 0.000008902 | 0.003821 | 0.0008768 | 0.003839 | 0.000008754 |
| age2 | -0.00007867 | 0.00001094 | -0.00007891 | 0.0000001092 | -0.00002592 | 0.00001176 | -0.00002618 | 0.0000001174 | -0.00004884 | 0.00001151 | -0.00004909 | 0.0000001149 | -0.00007784 | 0.00001128 | -0.00007809 | 0.0000001125 |
| sex | 0.02228 | 0.006687 | 0.02214 | 0.00006705 | 0.0185 | 0.007113 | 0.01835 | 0.00007132 | 0.03906 | 0.007127 | 0.03891 | 0.00007146 | 0.04625 | 0.006928 | 0.0461 | 0.00006947 |
| ld | 0.07474 | 0.02548 | 0.07428 | 0.0002529 | 0.03521 | 0.02922 | 0.0347 | 0.0002899 | 0.09855 | 0.03071 | 0.09801 | 0.0003047 | 0.07205 | 0.02999 | 0.07151 | 0.0002976 |
| td | 0.06928 | 0.01641 | 0.06917 | 0.0001643 | 0.0489 | 0.01711 | 0.04878 | 0.0001713 | 0.03794 | 0.01748 | 0.03782 | 0.0001749 | 0.09434 | 0.0168 | 0.09423 | 0.0001682 |
| rd | 0.08221 | 0.01493 | 0.08211 | 0.0001479 | 0.1051 | 0.01566 | 0.105 | 0.0001552 | 0.1358 | 0.01568 | 0.1357 | 0.0001553 | 0.1276 | 0.01523 | 0.1275 | 0.0001509 |
| vd | 0.1375 | 0.01503 | 0.1377 | 0.0001497 | 0.1691 | 0.01642 | 0.1693 | 0.0001636 | 0.1557 | 0.01643 | 0.1559 | 0.0001637 | 0.1684 | 0.01595 | 0.1686 | 0.0001589 |
| ad | -0.1214 | 0.01692 | -0.1213 | 0.0001707 | -0.09093 | 0.01686 | -0.09075 | 0.0001701 | -0.08946 | 0.01842 | -0.08928 | 0.0001858 | -0.1789 | 0.01631 | -0.1787 | 0.0001646 |
| md | 0.1012 | 0.02054 | 0.101 | 0.0002035 | 0.1069 | 0.02223 | 0.1067 | 0.0002203 | 0.115 | 0.02414 | 0.1148 | 0.0002393 | 0.119 | 0.02312 | 0.1189 | 0.0002291 |
| wbgd | -0.1578 | 0.006544 | -0.1578 | 0.00006549 | -0.1708 | 0.00704 | -0.1708 | 0.00007049 | -0.1827 | 0.007083 | -0.1827 | 0.00007094 | -0.2568 | 0.006953 | -0.2568 | 0.00006962 |
| isd | -0.02881 | 0.01746 | 0.02895 | 0.0001764 | -0.08281 | 0.01905 | -0.08295 | 0.0001924 | -0.05619 | 0.01904 | -0.05634 | 0.0001922 | -0.0348 | 0.01833 | -0.03494 | 0.000185 |
| cad | -0.588 | 0.008273 | -0.5879 | 0.00008228 | -0.4759 | 0.009192 | -0.4759 | 0.0000914 | -0.4647 | 0.009366 | -0.4646 | 0.00009318 | -0.5104 | 0.009101 | -0.5103 | 0.00009053 |
| gd | -0.05486 | 0.01526 | -0.05476 | 0.0001536 | -0.05694 | 0.01612 | -0.05682 | 0.0001622 | -0.06912 | 0.01635 | -0.06899 | 0.0001645 | -0.1114 | 0.0157 | -0.1112 | 0.0001581 |
| | | sigma2 | 0.2744 | 0.00002239 | | sigma2 | 0.3079 | 0.00002534 | | sigma2 | 0.3008 | 0.00002519 | | sigma2 | 0.2845 | 0.00002382 |

Table 4.2 continued

| year | 2011 Model2: lnw=yerschol + s2 + age + age2 + sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.556 | 0.02033 | 4.556 | 0.000204 | 4.576 | 0.02021 | 4.576 | 0.0002028 | 4.636 | 0.02078 | 4.636 | 0.0002085 | 4.585 | 0.02091 | 4.585 | 0.0002098 |
| S | -0.008436 | 0.0032 | -0.008521 | 0.00003209 | -0.008773 | 0.003191 | -0.008858 | 0.000032 | -0.01504 | 0.003238 | -0.01512 | 0.00003246 | -0.01114 | 0.003288 | -0.01123 | 0.00003296 |
| S2 | 0.0007046 | 0.0001707 | 0.0007089 | 0.000001714 | 0.0007645 | 0.0001702 | 0.0007688 | 0.000001709 | 0.001112 | 0.0001694 | 0.001116 | 0.000001701 | 0.0008822 | 0.0001729 | 0.0008866 | 0.000001736 |
| age | 0.001858 | 0.0009111 | 0.001877 | 0.000009096 | 0.001367 | 0.0009229 | 0.001386 | 0.000009213 | 0.001891 | 0.0008951 | 0.001909 | 0.000008935 | 0.002462 | 0.00092 | 0.002481 | 0.000009185 |
| age2 | -5.477E-05 | 0.00001165 | -5.502E-05 | 0.0000001163 | -4.562E-05 | 0.00001183 | -0.00004587 | 0.000000118 | -5.888E-05 | 0.00001149 | -5.914E-05 | 0.0000001147 | -0.00006953 | 0.00001181 | -6.979E-05 | 0.0000001179 |
| sex | 0.04299 | 0.007119 | 0.04284 | 0.00007138 | 0.03231 | 0.007165 | 0.03216 | 0.00007184 | 0.02606 | 0.007113 | 0.02591 | 0.00007132 | 0.03999 | 0.007206 | 0.03984 | 0.00007225 |
| ld | 0.1014 | 0.02856 | 0.1009 | 0.0002834 | 0.04813 | 0.02846 | 0.04764 | 0.0002823 | 0.0245 | 0.02705 | 0.02403 | 0.0002684 | 0.04712 | 0.02795 | 0.04662 | 0.0002773 |
| td | 0.0915 | 0.01688 | 0.09139 | 0.0001689 | 0.04885 | 0.01691 | 0.04874 | 0.0001692 | 0.04094 | 0.01668 | 0.04084 | 0.0001669 | 0.05204 | 0.01694 | 0.05194 | 0.0001695 |
| rd | 0.1338 | 0.01566 | 0.1337 | 0.0001551 | 0.124 | 0.01514 | 0.1239 | 0.00015 | 0.1265 | 0.01476 | 0.1264 | 0.0001462 | 0.09942 | 0.01495 | 0.09932 | 0.000148 |
| vd | 0.1784 | 0.01609 | 0.1786 | 0.0001603 | 0.1976 | 0.01534 | 0.1978 | 0.0001528 | 0.1708 | 0.01555 | 0.1709 | 0.0001549 | 0.1618 | 0.01633 | 0.162 | 0.0001628 |
| ad | -0.1585 | 0.01792 | -0.1584 | 0.0001808 | -0.133 | 0.01661 | -0.1328 | 0.0001677 | -0.1781 | 0.01636 | -0.178 | 0.0001652 | -0.1084 | 0.01496 | -0.1083 | 0.0001511 |
| md | 0.144 | 0.02244 | 0.1438 | 0.0002224 | 0.1542 | 0.02202 | 0.154 | 0.0002182 | 0.09264 | 0.02218 | 0.09245 | 0.0002197 | 0.08169 | 0.02216 | 0.0815 | 0.0002195 |
| wbgd | -0.1593 | 0.006929 | -0.1593 | 0.00006937 | -0.1452 | 0.00693 | -0.1452 | 0.0000694 | -0.1152 | 0.006907 | -0.1152 | 0.00006917 | -0.09677 | 0.007012 | -0.09677 | 0.00007022 |
| isd | -0.03314 | 0.01895 | -0.03328 | 0.0001914 | -0.08516 | 0.01866 | -0.08529 | 0.0001885 | -0.06866 | 0.01819 | -0.0688 | 0.0001838 | -0.0498 | 0.01904 | -0.04994 | 0.0001923 |
| cad | -0.4773 | 0.009172 | -0.4772 | 0.00009125 | -0.4649 | 0.009198 | -0.4648 | 0.00009145 | -0.456 | 0.009248 | -0.456 | 0.00009193 | -0.4331 | 0.00937 | -0.433 | 0.00009318 |
| gd | -0.1273 | 0.0162 | -0.1272 | 0.0001631 | -0.05547 | 0.01611 | -0.05535 | 0.0001622 | -0.06233 | 0.01574 | -0.06222 | 0.0001585 | -0.06068 | 0.01603 | -0.06057 | 0.0001615 |
| | | sigma2 | 0.311 | 0.0000254 | | sigma2 | 0.31 | 0.0000254 | | sigma2 | 0.2977 | 0.00002479 | | sigma2 | 0.3074 | 0.00002556 |

**Table 4.3:** Estimation results for daily wages for model 3 using OLS and Bayes

| Table 4.3: Estimation Results for Daily Wages Equation Using OLS and Bayes | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| year | 2006 Model3: lnw=ltd+crd+ed+sd+add+bad+hdd+mad+phd + pexp + pexp2+ sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.42 | 0.01139 | 4.42 | 0.0001131 | 4.437 | 0.01126 | 4.437 | 0.0001118 | 4.389 | 0.01127 | 4.389 | 0.000112 | 4.37 | 0.01139 | 4.37 | 0.0001132 |
| ltd | -0.1822 | 0.01612 | -0.1822 | 0.0001632 | -0.2046 | 0.01594 | -0.2046 | 0.0001614 | -0.1641 | 0.01621 | -0.164 | 0.0001642 | -0.129 | 0.01662 | -0.129 | 0.0001683 |
| crd | -0.0759 | 0.008714 | -0.07597 | 0.00008657 | -0.07024 | 0.008677 | -0.07031 | 0.00008621 | -0.05564 | 0.009056 | -0.05571 | 0.00008998 | -0.05205 | 0.008945 | -0.05212 | 0.0000889 |
| ed | -0.04555 | 0.007312 | -0.04566 | 0.00007277 | -0.03946 | 0.007233 | -0.03958 | 0.00007199 | -0.03826 | 0.007252 | -0.03837 | 0.00007219 | -0.02823 | 0.007366 | -0.02834 | 0.00007332 |
| sd | 0.0259 | 0.008596 | 0.02575 | 0.00008547 | 0.02951 | 0.008592 | 0.02935 | 0.00008545 | 0.03289 | 0.008332 | 0.03275 | 0.00008285 | 0.01884 | 0.00846 | 0.01869 | 0.00008411 |
| add | 0.02365 | 0.0159 | 0.02353 | 0.0001608 | 0.02846 | 0.01565 | 0.02833 | 0.0001583 | 0.03216 | 0.01579 | 0.03203 | 0.0001597 | 0.01508 | 0.01626 | 0.01495 | 0.0001644 |
| bad | 0.1156 | 0.01533 | 0.1155 | 0.0001528 | 0.0853 | 0.01513 | 0.08517 | 0.0001509 | 0.1037 | 0.01494 | 0.1036 | 0.0001489 | 0.08582 | 0.01551 | 0.08569 | 0.0001546 |
| hdd | 0.1461 | 0.1195 | 0.1459 | 0.001202 | 0.02234 | 0.1181 | 0.0222 | 0.001188 | -0.07136 | 0.1078 | -0.07147 | 0.001084 | 0.03425 | 0.1164 | 0.03411 | 0.001171 |
| mad | 0.199 | 0.04439 | 0.1992 | 0.0004444 | 0.1054 | 0.04614 | 0.1056 | 0.0004619 | 0.09182 | 0.04973 | 0.09194 | 0.0004978 | 0.113 | 0.04492 | 0.1131 | 0.0004498 |
| phd | 0.1547 | 0.08966 | 0.1542 | 0.0008971 | 0.2115 | 0.09788 | 0.2109 | 0.0009793 | 0.1099 | 0.09195 | 0.1093 | 0.0009199 | 0.07415 | 0.09975 | 0.07357 | 0.000998 |
| pexp | 0.001757 | 0.0004364 | 0.00175 | 0.000004326 | 0.0005343 | 0.0004365 | 0.0005275 | 0.000004326 | 0.001514 | 0.0004248 | 0.001507 | 0.000004211 | 0.002174 | 0.0004369 | 0.002168 | 0.000004329 |
| pexp2 | -0.00003433 | 0.0000079 | -0.00003422 | 0.00000007869 | -0.000003426 | 0.000007951 | -0.000003317 | 0.00000007919 | -0.000008987 | 0.000007824 | -0.000008879 | 0.00000007795 | -0.00002569 | 0.000008034 | -0.00002558 | 0.00000008001 |
| sex | 0.03314 | 0.005881 | 0.03317 | 0.0000589 | 0.04001 | 0.005845 | 0.04004 | 0.00005853 | 0.05071 | 0.00588 | 0.05074 | 0.0000589 | 0.04863 | 0.005903 | 0.04866 | 0.00005914 |
| ld | -0.1016 | 0.02829 | -0.1015 | 0.0002783 | 0.01879 | 0.03042 | 0.01892 | 0.0002991 | 0.02303 | 0.03113 | 0.02317 | 0.0003063 | 0.1514 | 0.0312 | 0.1515 | 0.0003068 |
| td | -0.00643 | 0.01492 | -0.006175 | 0.0001491 | 0.02917 | 0.01485 | 0.02942 | 0.0001485 | 0.01103 | 0.0149 | 0.01128 | 0.0001489 | 0.02596 | 0.01527 | 0.02622 | 0.0001526 |
| rd | 0.07573 | 0.01315 | 0.07594 | 0.0001288 | 0.08364 | 0.01295 | 0.08384 | 0.0001269 | 0.1013 | 0.01257 | 0.1015 | 0.0001231 | 0.09261 | 0.01275 | 0.09281 | 0.0001249 |
| vd | 0.1054 | 0.01358 | 0.1056 | 0.0001369 | 0.1161 | 0.01352 | 0.1163 | 0.0001363 | 0.1116 | 0.01323 | 0.1118 | 0.0001334 | 0.1094 | 0.01367 | 0.1096 | 0.0001378 |
| ad | -0.04434 | 0.01386 | -0.04408 | 0.0001388 | -0.03367 | 0.01284 | -0.03343 | 0.0001286 | -0.06404 | 0.01303 | -0.0638 | 0.0001304 | -0.09217 | 0.01058 | -0.09197 | 0.0001059 |
| md | 0.07534 | 0.01805 | 0.07569 | 0.0001796 | 0.06086 | 0.01752 | 0.06121 | 0.0001744 | 0.07414 | 0.01776 | 0.07449 | 0.0001766 | 0.09961 | 0.01853 | 0.09997 | 0.0001843 |
| wbgd | -0.1181 | 0.005938 | -0.1182 | 0.00006055 | -0.1255 | 0.005912 | -0.1256 | 0.00006028 | -0.07103 | 0.005905 | -0.07112 | 0.00006023 | -0.05305 | 0.005966 | -0.05315 | 0.00006085 |
| isd | -0.02049 | 0.01702 | -0.02029 | 0.0001706 | -0.05291 | 0.0171 | -0.0527 | 0.0001714 | -0.04244 | 0.01638 | -0.04225 | 0.0001642 | -0.01263 | 0.01726 | -0.01243 | 0.0001731 |
| cad | -0.3054 | 0.007079 | -0.3053 | 0.00007012 | -0.3154 | 0.007092 | -0.3154 | 0.00007026 | -0.334 | 0.00702 | -0.334 | 0.00006956 | -0.3228 | 0.007043 | -0.3228 | 0.00006981 |
| gd | -0.1136 | 0.03363 | -0.1136 | 0.0003332 | -0.09509 | 0.03209 | -0.09512 | 0.0003179 | -0.0442 | 0.02953 | -0.04424 | 0.0002926 | -0.04906 | 0.02956 | -0.04909 | 0.0002929 |
| | | sigma2 | 0.2122 | 0.0000174 | | sigma2 | 0.2071 | 0.00001708 | | sigma2 | 0.2068 | 0.00001714 | | sigma2 | 0.2148 | 0.00001768 |
| | Cells shaded in blue have a statistically significant at a confidence level of 5% in each of the two methods of estimation (OLS and Bayes) | | | | | | | | | | | | | | | |

Table 4.3 continued

| year | 2007 Model3: lnw=ltd+crd+ed+sd+add+bad+hdd+mad+phd + pexp + pexp2+ sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.418 | 0.01125 | 4.418 | 0.0001118 | 4.419 | 0.01144 | 4.418994 | 0.0001137 | 4.383 | 0.01173 | 4.383 | 0.0001165 | 4.731 | 0.01234 | 4.7306807 | 0.0001225 |
| ltd | -0.1015 | 0.01623 | -0.1014 | 0.0001644 | -0.09046 | 0.01652 | -0.090437 | 0.0001674 | -0.0547 | 0.01719 | -0.05468 | 0.0001741 | -0.003877 | 0.01762 | -0.003867 | 0.0001784 |
| crd | -0.04981 | 0.008534 | -0.04988 | 0.00008478 | -0.03261 | 0.00871 | -0.032677 | 0.00008649 | -0.03329 | 0.009607 | -0.03336 | 0.00009548 | -0.04211 | 0.009593 | -0.0421839 | 0.0000954 |
| ed | -0.03079 | 0.007245 | -0.0309 | 0.0000721 | -0.02495 | 0.007337 | -0.025061 | 0.00007303 | -0.02055 | 0.007545 | -0.02066 | 0.00007514 | -0.02079 | 0.007801 | -0.020907 | 0.0000777 |
| sd | 0.02224 | 0.008432 | 0.02209 | 0.00008383 | 0.02333 | 0.008583 | 0.023182 | 0.00008535 | 0.02207 | 0.008676 | 0.02191 | 0.00008629 | 0.03412 | 0.009001 | 0.0339716 | 0.0000895 |
| add | 0.005955 | 0.01606 | 0.005827 | 0.0001624 | 0.00739 | 0.01587 | 0.007261 | 0.0001605 | 0.02016 | 0.01601 | 0.02003 | 0.0001619 | 0.01361 | 0.01711 | 0.0134756 | 0.000173 |
| bad | 0.08353 | 0.01496 | 0.0834 | 0.0001492 | 0.06454 | 0.01495 | 0.064406 | 0.000149 | 0.08086 | 0.01534 | 0.08072 | 0.000153 | 0.1033 | 0.01611 | 0.1031613 | 0.0001604 |
| hdd | 0.07605 | 0.08795 | 0.07592 | 0.0008848 | 0.2225 | 0.08716 | 0.222406 | 0.0008768 | 0.1786 | 0.09728 | 0.1785 | 0.0009785 | -0.055 | 0.1209 | -0.055156 | 0.001216 |
| mad | 0.1254 | 0.04194 | 0.1255 | 0.0004201 | 0.08633 | 0.04437 | 0.086426 | 0.0004444 | 0.1696 | 0.05193 | 0.1697 | 0.0005198 | 0.1736 | 0.04746 | 0.1737448 | 0.0004755 |
| phd | 0.2714 | 0.09955 | 0.2708 | 0.0009959 | 0.257 | 0.103 | 0.256377 | 0.00103 | 0.0404 | 0.09978 | 0.03982 | 0.0009983 | 0.1768 | 0.09054 | 0.1763315 | 0.0009056 |
| pexp | 0.002694 | 0.0004365 | 0.002687 | 0.000004325 | 0.001413 | 0.0004439 | 0.001407 | 0.000004399 | 0.002566 | 0.0004455 | 0.002559 | 0.000004415 | 0.00448 | 0.000461 | 0.0044725 | 0.000004569 |
| pexp2 | -0.00005966 | 0.000007949 | -0.00005956 | 0.00000007916 | -0.00003611 | 0.000008156 | -0.000036 | 0.00000008125 | -0.0000504 | 0.000008188 | -0.00005028 | 0.00000008156 | -0.0001092 | 0.000008401 | -0.0001091 | 0.00000008367 |
| sex | 0.05637 | 0.005791 | 0.0564 | 0.00005802 | 0.06412 | 0.005903 | 0.064149 | 0.00005913 | 0.05921 | 0.006156 | 0.05924 | 0.00006165 | 0.04951 | 0.006286 | 0.0495468 | 0.00006298 |
| ld | 0.07028 | 0.02974 | 0.07039 | 0.0002925 | 0.07324 | 0.02929 | 0.073369 | 0.0002882 | 0.07063 | 0.0281 | 0.07076 | 0.0002765 | 0.05498 | 0.02759 | 0.0550992 | 0.0002717 |
| td | 0.002053 | 0.01462 | 0.002297 | 0.0001461 | 0.06528 | 0.01475 | 0.065532 | 0.0001474 | 0.04509 | 0.01543 | 0.04535 | 0.0001542 | 0.01992 | 0.0161 | 0.0201917 | 0.0001608 |
| rd | 0.1007 | 0.01243 | 0.1009 | 0.0001217 | 0.1124 | 0.01222 | 0.112614 | 0.0001197 | 0.08874 | 0.01271 | 0.08894 | 0.0001244 | 0.07909 | 0.01332 | 0.079314 | 0.0001303 |
| vd | 0.1513 | 0.01349 | 0.1515 | 0.0001359 | 0.1377 | 0.01299 | 0.137977 | 0.0001309 | 0.09715 | 0.01382 | 0.09739 | 0.0001394 | 0.09538 | 0.01432 | 0.0956277 | 0.0001445 |
| ad | -0.1597 | 0.01149 | -0.1595 | 0.000115 | -0.1272 | 0.01076 | -0.126977 | 0.0001077 | -0.1749 | 0.01158 | -0.1746 | 0.0001159 | -0.1975 | 0.01226 | -0.1972419 | 0.0001227 |
| md | 0.07879 | 0.01667 | 0.07912 | 0.0001658 | 0.07314 | 0.01711 | 0.073481 | 0.0001701 | 0.05999 | 0.01768 | 0.06035 | 0.0001758 | 0.0559 | 0.01856 | 0.0562591 | 0.0001845 |
| wbgd | -0.0983 | 0.005835 | -0.09839 | 0.0000595 | -0.09386 | 0.005945 | -0.093959 | 0.00006064 | -0.04189 | 0.006124 | -0.042 | 0.00006249 | -0.3688 | 0.006631 | -0.3689388 | 0.00006758 |
| isd | -0.03311 | 0.01656 | -0.03291 | 0.0001661 | -0.04775 | 0.01653 | -0.047546 | 0.0001658 | 0.01631 | 0.01692 | 0.01652 | 0.0001696 | 0.0146 | 0.01652 | 0.0148012 | 0.0001656 |
| cad | -0.3296 | 0.006914 | -0.3296 | 0.00006852 | -0.3273 | 0.007063 | -0.327218 | 0.00006998 | -0.2607 | 0.007372 | -0.2607 | 0.00007299 | -0.3448 | 0.007764 | -0.344689 | 0.00007687 |
| gd | -0.07113 | 0.02864 | -0.07115 | 0.000284 | -0.09601 | 0.02815 | -0.096047 | 0.0002789 | -0.1262 | 0.0298 | -0.1263 | 0.0002954 | -0.09949 | 0.03494 | -0.0995481 | 0.0003467 |
| | | sigma2 | 0.2044 | 0.00001685 | | sigma2 | 0.209028 | 0.00001733 | | sigma2 | 0.2246 | 0.00001869 | | sigma2 | 0.2165216 | 0.00001882 |

Table 4.3 continued

| year | 2008 Model3: lnw=ltd+crd+ed+sd+add+bad+hdd+mad+phd + pexp + pexp2+ sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.781 | 0.01187 | 4.781 | 0.0001179 | 4.915 | 0.01289 | 4.915 | 0.000128 | 4.4 | 0.01131 | 4.4 | 0.0001124 | 4.757 | 0.01219 | 4.757 | 0.000121 |
| ltd | -0.02554 | 0.01692 | -0.02553 | 0.0001713 | -0.07398 | 0.01869 | -0.07396 | 0.0001892 | -0.0457 | 0.01739 | -0.04568 | 0.0001761 | -0.05568 | 0.0181 | -0.05567 | 0.0001833 |
| crd | -0.02193 | 0.009049 | -0.022 | 0.00008996 | -0.02166 | 0.01014 | -0.02174 | 0.0001008 | -0.01071 | 0.009523 | -0.01078 | 0.00009468 | -0.03129 | 0.009754 | -0.03136 | 0.00009704 |
| ed | -0.01209 | 0.007513 | -0.0122 | 0.00007483 | -0.007501 | 0.008182 | -0.007626 | 0.00008151 | 0.005038 | 0.007442 | 0.004924 | 0.00007413 | -0.01053 | 0.007868 | -0.01065 | 0.00007839 |
| sd | 0.04027 | 0.008695 | 0.04012 | 0.00008647 | 0.02402 | 0.009377 | 0.02386 | 0.00009329 | 0.04232 | 0.008279 | 0.04217 | 0.00008234 | 0.05201 | 0.008954 | 0.05186 | 0.00008906 |
| add | 0.04027 | 0.01618 | 0.04014 | 0.0001636 | 0.02923 | 0.01752 | 0.02909 | 0.0001772 | 0.05749 | 0.01575 | 0.05736 | 0.0001593 | 0.05708 | 0.01717 | 0.05694 | 0.0001736 |
| bad | 0.1007 | 0.01504 | 0.1006 | 0.0001498 | 0.08178 | 0.01615 | 0.08164 | 0.0001608 | 0.11 | 0.01422 | 0.1099 | 0.0001418 | 0.1282 | 0.01586 | 0.1281 | 0.0001579 |
| hdd | -0.006082 | 0.1156 | -0.006217 | 0.001163 | -0.2016 | 0.1131 | -0.2018 | 0.001138 | 0.06034 | 0.1006 | 0.06021 | 0.001012 | 0.04735 | 0.1059 | 0.0472 | 0.001065 |
| mad | 0.1641 | 0.03937 | 0.1641 | 0.0003946 | 0.1783 | 0.04488 | 0.1784 | 0.0004499 | 0.2004 | 0.0491 | 0.2006 | 0.0004913 | 0.26 | 0.05096 | 0.2602 | 0.0005102 |
| phd | 0.2168 | 0.09176 | 0.2163 | 0.0009179 | 0.0672 | 0.1134 | 0.06666 | 0.001134 | 0.01895 | 0.1112 | 0.01832 | 0.001112 | 0.1225 | 0.1035 | 0.1219 | 0.001035 |
| pexp | 0.002352 | 0.0004508 | 0.002345 | 0.000004469 | 0.002354 | 0.0004825 | 0.002346 | 0.000004784 | 0.001883 | 0.0004309 | 0.001876 | 0.00000427 | 0.001274 | 0.0004553 | 0.001267 | 0.000004515 |
| pexp2 | -0.00007113 | 0.000008224 | -0.00007102 | 0.00000008192 | -0.00005921 | 0.000008897 | -0.00005909 | 0.00000008863 | -0.00004923 | 0.000008102 | -0.00004912 | 0.00000008072 | -0.00004317 | 0.000008455 | -0.00004306 | 0.00000008424 |
| sex | 0.04941 | 0.006001 | 0.04944 | 0.00006012 | 0.05499 | 0.006523 | 0.05502 | 0.00006538 | 0.05096 | 0.005956 | 0.051 | 0.00005967 | 0.04689 | 0.00627 | 0.04692 | 0.0000628 |
| ld | -0.005889 | 0.02676 | -0.00578 | 0.0002634 | 0.0984 | 0.02985 | 0.09852 | 0.0002938 | 0.09083 | 0.02725 | 0.09094 | 0.000268 | 0.07562 | 0.02969 | 0.07573 | 0.0002923 |
| td | 0.01344 | 0.01493 | 0.01369 | 0.0001493 | 0.04791 | 0.01649 | 0.04818 | 0.0001649 | 0.04143 | 0.01509 | 0.04169 | 0.0001507 | 0.03315 | 0.01606 | 0.03341 | 0.0001602 |
| rd | 0.08676 | 0.01259 | 0.08697 | 0.0001232 | 0.09618 | 0.01389 | 0.0964 | 0.000136 | 0.1273 | 0.01244 | 0.1275 | 0.0001218 | 0.1092 | 0.01383 | 0.1094 | 0.0001354 |
| vd | 0.09688 | 0.0136 | 0.09711 | 0.0001372 | 0.09936 | 0.01486 | 0.09963 | 0.0001501 | 0.09013 | 0.01381 | 0.09037 | 0.0001393 | 0.1286 | 0.01524 | 0.1289 | 0.0001539 |
| ad | -0.2098 | 0.01247 | -0.2096 | 0.0001248 | -0.1205 | 0.01279 | -0.1202 | 0.000128 | -0.07796 | 0.01257 | -0.07773 | 0.0001258 | -0.07782 | 0.01444 | -0.07754 | 0.0001446 |
| md | 0.06386 | 0.01835 | 0.06421 | 0.0001824 | 0.05965 | 0.02052 | 0.06004 | 0.0002041 | 0.09932 | 0.0194 | 0.09971 | 0.0001931 | 0.09514 | 0.02052 | 0.09553 | 0.0002042 |
| wbgd | -0.4166 | 0.006405 | -0.4167 | 0.00006526 | -0.5696 | 0.007318 | -0.5697 | 0.00007448 | -0.06388 | 0.00608 | -0.06398 | 0.00006202 | -0.3927 | 0.006732 | -0.3928 | 0.00006858 |
| isd | 0.03068 | 0.01595 | 0.03088 | 0.0001598 | -0.02372 | 0.01697 | -0.0235 | 0.00017 | 0.04698 | 0.01619 | 0.04718 | 0.0001623 | 0.05002 | 0.01642 | 0.05023 | 0.0001645 |
| cad | -0.2999 | 0.007365 | -0.2998 | 0.00007295 | -0.3371 | 0.008214 | -0.3371 | 0.0000813 | -0.2265 | 0.007192 | -0.2264 | 0.00007126 | -0.2618 | 0.007769 | -0.2617 | 0.00007693 |
| gd | -0.06455 | 0.03257 | -0.06461 | 0.0003231 | -0.1031 | 0.03587 | -0.1031 | 0.0003558 | -0.1325 | 0.03128 | -0.1325 | 0.0003099 | -0.1386 | 0.03496 | -0.1386 | 0.0003469 |
| | | sigma2 | 0.1988 | 0.00001726 | | sigma2 | 0.2282 | 0.00002025 | | sigma2 | 0.2194 | 0.00001808 | | sigma2 | 0.221 | 0.00001915 |

Table 4.3 continued

| year | 2009 Model3: lnw=ltd+crd+ed+sd+add+bad+hdd+mad+phd + pexp + pexp2+ sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.491 | 0.01125 | 4.491 | 0.0001118 | 4.764 | 0.01321 | 4.764 | 0.0001312 | 4.497 | 0.01213 | 4.4974911 | 0.0001205 | 4.472 | 0.01195 | 4.472 | 0.0001188 |
| ltd | 0.0166 | 0.01716 | 0.01663 | 0.0001738 | -0.04367 | 0.02112 | -0.04365 | 0.0002138 | -0.02764 | 0.01882 | -0.0276147 | 0.0001906 | 0.02774 | 0.01878 | 0.02777 | 0.0001902 |
| crd | 0.009133 | 0.008939 | 0.009065 | 0.00008881 | -0.006849 | 0.01032 | -0.006928 | 0.0001026 | -0.007756 | 0.0102 | -0.0078335 | 0.0001014 | 0.01989 | 0.009863 | 0.01981 | 0.00009801 |
| ed | 0.00455 | 0.007338 | 0.004436 | 0.00007307 | -0.008783 | 0.008499 | -0.008912 | 0.00008469 | 0.01489 | 0.008099 | 0.0147642 | 0.00008069 | 0.02469 | 0.007991 | 0.02457 | 0.00007959 |
| sd | 0.0398 | 0.00829 | 0.03965 | 0.00008244 | 0.03818 | 0.009567 | 0.03802 | 0.00009514 | 0.04583 | 0.008878 | 0.0456754 | 0.0000883 | 0.05828 | 0.008845 | 0.05813 | 0.00008796 |
| add | 0.03481 | 0.01556 | 0.03468 | 0.0001573 | 0.06547 | 0.01764 | 0.06533 | 0.0001784 | 0.06168 | 0.01678 | 0.0615416 | 0.0001697 | 0.03808 | 0.01699 | 0.03794 | 0.0001718 |
| bad | 0.08398 | 0.01409 | 0.08385 | 0.0001406 | 0.07681 | 0.01583 | 0.07667 | 0.0001577 | 0.09303 | 0.01463 | 0.0928906 | 0.0001459 | 0.1055 | 0.01493 | 0.1054 | 0.0001489 |
| hdd | -0.05064 | 0.08585 | -0.05077 | 0.0008635 | 0.02736 | 0.09671 | 0.0272 | 0.000973 | 0.09972 | 0.09421 | 0.0995767 | 0.0009477 | 0.01234 | 0.1011 | 0.0122 | 0.001017 |
| mad | 0.1277 | 0.04136 | 0.1278 | 0.0004142 | 0.1778 | 0.04588 | 0.1779 | 0.0004597 | 0.1139 | 0.04577 | 0.1140068 | 0.0004583 | 0.1293 | 0.04651 | 0.1294 | 0.0004657 |
| phd | 0.1366 | 0.08588 | 0.1361 | 0.0008593 | 0.1117 | 0.08127 | 0.1112 | 0.0008129 | 0.09405 | 0.085 | 0.0935396 | 0.0008505 | 0.1296 | 0.0806 | 0.1291 | 0.0008066 |
| pexp | 0.001432 | 0.0004378 | 0.001425 | 0.000004339 | 0.0002542 | 0.0005245 | -0.0002622 | 0.000005199 | -0.0004438 | 0.00047 | -0.0004512 | 0.000004657 | 0.0003564 | 0.0004713 | 0.000349 | 0.00000467 |
| pexp2 | -0.00006035 | 0.000008077 | -0.00006024 | 0.00000008047 | -0.00002122 | 0.000009909 | -0.00002108 | 0.00000009873 | -0.00002543 | 0.000008829 | -0.0000253 | 0.00000008794 | -0.00003889 | 0.000008872 | -0.00003877 | 0.00000008838 |
| sex | 0.0517 | 0.00587 | 0.05173 | 0.00005878 | 0.03821 | 0.006834 | 0.03825 | 0.00006841 | 0.04264 | 0.006443 | 0.042676 | 0.00006453 | 0.04574 | 0.006351 | 0.04578 | 0.00006359 |
| ld | 0.0762 | 0.02609 | 0.07631 | 0.0002566 | 0.07015 | 0.02686 | 0.07027 | 0.0002642 | 0.1216 | 0.02476 | 0.1217055 | 0.0002435 | 0.1187 | 0.028 | 0.1188 | 0.0002754 |
| td | 0.04355 | 0.01512 | 0.04379 | 0.0001507 | 0.08859 | 0.01718 | 0.08886 | 0.0001712 | 0.1007 | 0.01656 | 0.1010123 | 0.0001651 | 0.06583 | 0.01669 | 0.0661 | 0.0001664 |
| rd | 0.1146 | 0.01288 | 0.1149 | 0.0001261 | 0.1116 | 0.01464 | 0.1119 | 0.0001433 | 0.1516 | 0.01415 | 0.1518553 | 0.0001386 | 0.1255 | 0.01406 | 0.1258 | 0.0001377 |
| vd | 1.351e-01* | 0.01318 | 0.1354 | 0.0001328 | 0.1419 | 0.01487 | 0.1422 | 0.00015 | 0.1603 | 0.01497 | 0.1605769 | 0.0001509 | 0.1758 | 0.01487 | 0.1761 | 0.0001498 |
| ad | -0.1131 | 0.01364 | -0.1128 | 0.0001365 | -0.1953 | 0.01472 | -0.1951 | 0.0001473 | -0.1414 | 0.01536 | -0.141118 | 0.0001537 | -0.138 | 0.01499 | -0.1378 | 0.00015 |
| md | 1.114E-18 | 0.01793 | 0.1117 | 0.0001784 | 0.1349 | 0.02106 | 0.1353 | 0.0002094 | 0.1213 | 0.01977 | 0.1217295 | 0.0001968 | 0.1165 | 0.01908 | 0.1168 | 0.0001898 |
| wbgd | -0.1194 | 0.005862 | -0.1195 | 0.00005978 | -0.3717 | 0.007121 | -0.3718 | 0.00007259 | -0.1077 | 0.006477 | -0.10783 | 0.00006607 | -0.1027 | 0.006301 | -0.1028 | 0.00006428 |
| isd | -0.007698 | 0.01529 | -0.007498 | 0.0001532 | -0.0605 | 0.01692 | -0.0603 | 0.0001695 | -0.05389 | 0.01671 | -0.053683 | 0.0001676 | -0.03845 | 0.0168 | -0.03824 | 0.0001684 |
| cad | -0.5292 | 0.007383 | -0.5292 | 0.0000731 | -0.4519 | 0.008981 | -0.4518 | 0.00008889 | -0.4815 | 0.008247 | -0.4814361 | 0.00008169 | -0.5688 | 0.008027 | -0.5687 | 0.00007944 |
| gd | -0.02022 | 0.01327 | -0.02029 | 0.0001316 | -0.0839 | 0.01525 | -0.08399 | 0.0001512 | -0.09998 | 0.01478 | -0.1000661 | 0.0001466 | -0.06109 | 0.01472 | -0.06117 | 0.000146 |
| | | sigma2 | 0.2105 | 0.00001727 | | sigma2 | 0.2574 | 0.00002215 | | sigma2 | 0.2533764 | 0.00002082 | | sigma2 | 0.2523 | 0.00002053 |

Table 4.3 continued

| year | 2010 Model3: lnw=ltd+crd+ed+sd+add+bad+hdd+mad+phd + pexp + pexp2+ sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.55 | 0.01267 | 4.55 | 0.0001259 | 4.587 | 0.01341 | 4.587 | 0.0001332 | 4.606 | 0.01328 | 4.606 | 0.0001319 | 4.645 | 0.01311 | 4.645 | 0.0001302 |
| ltd | -0.005865 | 0.01985 | 0.005894 | 0.000201 | -0.05192 | 0.02137 | -0.05189 | 0.0002165 | -0.008434 | 0.0215 | -0.00841 | 0.0002177 | 0.02937 | 0.02095 | 0.0294 | 0.0002122 |
| crd | 0.009439 | 0.01014 | 0.009361 | 0.0001008 | -0.01933 | 0.01086 | -0.01941 | 0.0001079 | -0.01573 | 0.01141 | -0.01582 | 0.0001134 | 0.02376 | 0.0109 | 0.02368 | 0.0001082 |
| ed | 0.0222 | 0.008342 | 0.02207 | 0.00008309 | 0.003049 | 0.008908 | 0.002911 | 0.00008873 | 0.0006936 | 0.00895 | 0.0005579 | 0.0000892 | 0.01522 | 0.008784 | 0.01508 | 0.00008751 |
| sd | 0.04718 | 0.009302 | 0.04701 | 0.0000925 | 0.03709 | 0.01002 | 0.03691 | 0.00009961 | 0.05309 | 0.009859 | 0.05291 | 0.00009808 | 0.05336 | 0.009534 | 0.05318 | 0.0000948 |
| add | 0.02084 | 0.01782 | 0.0207 | 0.0001802 | 0.005502 | 0.01866 | 0.005353 | 0.0001886 | 0.02071 | 0.01881 | 0.02056 | 0.0001902 | 0.02636 | 0.01822 | 0.02621 | 0.0001843 |
| bad | 0.05806 | 0.01565 | 0.05791 | 0.0001561 | 0.03699 | 0.01622 | 0.03684 | 0.0001618 | 0.06305 | 0.0161 | 0.0629 | 0.0001606 | 0.06538 | 0.01561 | 0.06523 | 0.0001557 |
| hdd | -0.07263 | 0.08108 | -0.07278 | 0.0008158 | 0.05397 | 0.08882 | 0.05382 | 0.0008936 | -0.0868 | 0.09633 | -0.08694 | 0.0009691 | -0.06442 | 0.09505 | -0.06455 | 0.0009562 |
| mad | 0.03588 | 0.04563 | 0.03597 | 0.0004569 | 0.01618 | 0.04401 | 0.01626 | 0.0004409 | 0.1088 | 0.04415 | 0.1089 | 0.0004425 | 0.1452 | 0.04132 | 0.1453 | 0.0004142 |
| phd | 0.245 | 0.08844 | 0.2445 | 0.0008849 | 0.185 | 0.08593 | 0.1845 | 0.0008598 | 0.01289 | 0.08807 | 0.01236 | 0.0008812 | 0.007876 | 0.0889 | 0.007354 | 0.0008896 |
| pexp | 0.0003452 | 0.0004991 | 0.0003374 | 0.000004946 | -0.001185 | 0.0005356 | -0.001194 | 0.000005308 | -0.0008304 | 0.0005207 | -0.0008386 | 0.00000516 | 0.0001585 | 0.0005137 | 0.0001504 | 0.000005092 |
| pexp2 | -0.0000324 | 0.000009294 | -0.00003228 | 0.00000009262 | -0.00000008059 | 0.00001002 | 0.00000005855 | 0.00000009984 | -0.00002358 | 0.000009828 | -0.00002345 | 0.00000009793 | -0.00004238 | 0.000009633 | -0.00004225 | 0.00000009602 |
| sex | 0.02791 | 0.006684 | 0.02795 | 0.00006691 | 0.0218 | 0.007109 | 0.02184 | 0.00007116 | 0.04135 | 0.007124 | 0.04139 | 0.0000713 | 0.05078 | 0.006927 | 0.05082 | 0.00006936 |
| ld | 0.08352 | 0.02594 | 0.08364 | 0.0002554 | 0.044 | 0.02956 | 0.04413 | 0.0002908 | 0.1054 | 0.03119 | 0.1055 | 0.000307 | 0.08013 | 0.03045 | 0.08027 | 0.0002997 |
| td | 0.07834 | 0.01748 | 0.07862 | 0.0001743 | 6.181e-02* | 0.01818 | 0.0621 | 0.0001813 | 0.05033 | 0.0185 | 0.05063 | 0.0001845 | 0.1076 | 0.01775 | 0.1079 | 0.0001769 |
| rd | 0.09172 | 0.01491 | 0.09197 | 0.0001461 | 0.111 | 0.01563 | 0.1113 | 0.0001532 | 0.1401 | 0.01566 | 0.1404 | 0.0001535 | 0.1353 | 0.01522 | 0.1356 | 0.0001491 |
| vd | 0.1486 | 0.015 | 0.1489 | 0.0001512 | 0.1748 | 0.01639 | 0.1751 | 0.0001653 | 0.1612 | 0.0164 | 0.1615 | 0.0001655 | 0.1758 | 0.01592 | 0.1761 | 0.0001606 |
| ad | -0.1115 | 0.0169 | -0.1112 | 0.0001692 | -0.08745 | 0.01685 | -0.08714 | 0.0001686 | -0.08481 | 0.0184 | -0.08448 | 0.0001841 | -0.1726 | 0.01629 | -0.1723 | 0.000163 |
| md | 0.1144 | 0.02053 | 0.1148 | 0.0002042 | 0.1152 | 0.02222 | 0.1156 | 0.000221 | 0.1222 | 0.02414 | 0.1227 | 0.0002401 | 0.1275 | 0.0231 | 0.128 | 0.0002298 |
| wbgd | -0.1574 | 0.006557 | -0.1575 | 0.0000669 | -0.1706 | 0.007054 | -0.1707 | 0.00007196 | -0.1825 | 0.007097 | -0.05098 | 0.0001907 | -0.2567 | 0.006966 | -0.2568 | 0.00007102 |
| isd | -0.01953 | 0.01745 | -0.01931 | 0.0001749 | -0.07813 | 0.01903 | -0.07789 | 0.0001908 | -0.05121 | 0.01902 | -0.05098 | 0.0001907 | -0.02858 | 0.01832 | -0.02837 | 0.0001837 |
| cad | -0.5868 | 0.00828 | -0.5867 | 0.00008188 | -0.4752 | 0.009197 | -0.4751 | 0.00009094 | -0.4642 | 0.009371 | -0.4641 | 0.00009268 | -0.5094 | 0.009109 | -0.5093 | 0.0000901 |
| gd | -0.05092 | 0.0153 | -0.051 | 0.0001518 | -0.05364 | 0.01615 | -0.05373 | 0.0001603 | -0.06765 | 0.01639 | -0.06774 | 0.0001627 | -0.1097 | 0.01574 | -0.1098 | 0.0001561 |
| | | sigma2 | 0.2746 | 0.00002236 | | sigma2 | 0.3079 | 0.00002529 | | sigma2 | 0.3008 | 0.00002514 | | sigma2 | 0.2846 | 0.00002379 |

Table 4.3 continued

| year | 2011 Model3: lnw=ltd+crd+ed+sd+add+bad+hdd+mad+phd + pexp + pexp2+ sex + ld + td + rd + vd + ad + md + wbgd + isd + cad + gd | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | | Q2 | | | | Q3 | | | | Q4 | | | |
| | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error | OLS | OLS st.error | Bayes | Bayes st.error |
| intercept | 4.53 | 0.01347 | 4.53 | 0.0001339 | 4.553 | 0.0136 | 4.553 | 0.0001351 | 4.596 | 0.01341 | 4.597 | 0.0001333 | 4.564 | 0.01359 | 4.564 | 0.000135 |
| ltd | -0.003522 | 0.02122 | -0.003492 | 0.0002149 | 0.01342 | 0.0214 | 0.01345 | 0.0002167 | 0.03261 | 0.02175 | 0.03263 | 0.0002203 | 0.01626 | 0.02184 | 0.01628 | 0.0002212 |
| crd | 0.02868 | 0.01087 | 0.0286 | 0.0001079 | 0.01748 | 0.01083 | 0.0174 | 0.0001075 | 0.01895 | 0.01141 | 0.01886 | 0.0001133 | 0.02583 | 0.01136 | 0.02575 | 0.0001128 |
| ed | 0.02742 | 0.009009 | 0.02728 | 0.00008974 | 0.02264 | 0.008995 | 0.0225 | 0.00008961 | 0.01517 | 0.008932 | 0.01504 | 0.00008904 | 0.01506 | 0.009125 | 0.01492 | 0.00009093 |
| sd | 0.05493 | 0.009815 | 0.05475 | 0.00009759 | 0.04954 | 0.009946 | 0.04936 | 0.00009891 | 0.04469 | 0.009642 | 0.04452 | 0.0000959 | 0.04157 | 0.009819 | 0.0414 | 0.00009764 |
| add | 0.01804 | 0.01845 | 0.01789 | 0.0001866 | 0.03069 | 0.01819 | 0.03054 | 0.0001839 | 0.02239 | 0.01818 | 0.02224 | 0.0001838 | 0.04 | 0.01832 | 0.03985 | 0.0001852 |
| bad | 0.08302 | 0.01567 | 0.08287 | 0.0001563 | 0.07199 | 0.0159 | 0.07184 | 0.0001587 | 0.08881 | 0.01539 | 0.08866 | 0.0001535 | 0.08555 | 0.01569 | 0.08541 | 0.0001565 |
| hdd | -0.1491 | 0.09951 | -0.1492 | 0.001001 | 0.1284 | 0.09251 | 0.1282 | 0.0009307 | 0.06843 | 0.1171 | 0.06829 | 0.001178 | 0.09731 | 0.0974 | 0.09717 | 0.0009799 |
| mad | 0.09923 | 0.0414 | 0.09929 | 0.0004149 | 0.08853 | 0.04207 | 0.0886 | 0.0004216 | 0.0908 | 0.04465 | 0.09087 | 0.0004474 | 0.09254 | 0.04287 | 0.09261 | 0.0004297 |
| phd | 0.1705 | 0.08343 | 0.17 | 0.0008349 | 0.1063 | 0.08834 | 0.1058 | 0.0008839 | 0.1129 | 0.07314 | 0.1124 | 0.0007318 | 0.09635 | 0.08692 | 0.09583 | 0.0008698 |
| pexp | -0.0009845 | 0.0005355 | -0.000993 | 0.000005307 | -0.001178 | 0.0005393 | -0.001186 | 0.000005343 | -0.001202 | 0.0005207 | -0.00121 | 0.000005158 | -0.001327 | 0.0005361 | -0.001336 | 0.000005313 |
| pexp2 | -0.00002159 | 0.000009944 | -0.00002145 | 0.00000009909 | -0.00001696 | 0.00001006 | -0.00001682 | 0.0000001002 | -0.00002516 | 0.000009849 | -0.00002502 | 0.00000009814 | -0.00002763 | 0.0000101 | -0.00002749 | 0.0000001007 |
| sex | 0.04775 | 0.007111 | 0.04779 | 0.0000712 | 0.03656 | 0.007153 | 0.0366 | 0.0000716 | 0.03047 | 0.007107 | 0.03051 | 0.00007114 | 0.04506 | 0.0072 | 0.0451 | 0.00007209 |
| ld | 0.1053 | 0.02885 | 0.1055 | 0.0002839 | 0.05585 | 0.0288 | 0.05597 | 0.0002834 | 0.03446 | 0.02727 | 0.03458 | 0.0002684 | 0.05395 | 0.02825 | 0.05409 | 0.000278 |
| td | 0.09707 | 0.0178 | 0.09736 | 0.0001775 | 0.06184 | 0.01785 | 0.06212 | 0.000178 | 0.05435 | 0.01765 | 0.05464 | 0.000176 | 0.05685 | 0.01787 | 0.05714 | 0.0001782 |
| rd | 0.1417 | 0.01562 | 0.1419 | 0.000153 | 0.1314 | 0.01511 | 0.1317 | 0.000148 | 0.1339 | 0.01474 | 0.1341 | 0.0001443 | 0.1087 | 0.01492 | 0.1089 | 0.0001462 |
| vd | 0.1861 | 0.01604 | 0.1864 | 0.0001618 | 0.2053 | 0.0153 | 0.2055 | 0.0001542 | 0.1783 | 0.01552 | 0.1786 | 0.0001565 | 0.1717 | 0.0163 | 0.172 | 0.0001644 |
| ad | -0.1535 | 0.01789 | -0.1532 | 0.000179 | -0.1286 | 0.01659 | -0.1283 | 0.000166 | -0.1736 | 0.01634 | -0.1733 | 0.0001636 | -0.102 | 0.01494 | -0.1017 | 0.0001496 |
| md | 0.1528 | 0.02241 | 0.1532 | 0.0002228 | 0.1639 | 0.022 | 0.1643 | 0.0002188 | 0.1014 | 0.02215 | 0.1018 | 0.0002202 | 0.09261 | 0.02213 | 0.09305 | 0.00022 |
| wbgd | -0.1586 | 0.006938 | -0.1587 | 0.00007076 | -0.1448 | 0.006944 | -0.1449 | 0.00007085 | -0.1147 | 0.006922 | -0.1148 | 0.00007063 | -0.09666 | 0.007026 | -0.09678 | 0.00007167 |
| isd | -0.02559 | 0.01892 | -0.02535 | 0.0001896 | -0.07896 | 0.01864 | -0.07871 | 0.0001869 | -0.06383 | 0.01818 | -0.06359 | 0.0001823 | -0.04179 | 0.01902 | -0.04155 | 0.0001907 |
| cad | -0.4763 | 0.009173 | -0.4762 | 0.00009076 | -0.4649 | 0.009203 | -0.4648 | 0.000091 | -0.4556 | 0.009259 | -0.4555 | 0.00009157 | -0.4322 | 0.009381 | -0.4321 | 0.00009282 |
| gd | -0.1265 | 0.01624 | -0.1266 | 0.0001611 | -0.05373 | 0.01615 | -0.05381 | 0.0001602 | -0.06096 | 0.0158 | -0.06105 | 0.0001569 | -0.05885 | 0.0161 | -0.05895 | 0.0001597 |
| | | sigma2 | 0.3108 | 0.00002533 | | sigma2 | 0.3101 | 0.00002536 | | sigma2 | 0.298 | 0.00002477 | | sigma2 | 0.3076 | 0.00002553 |

**Table 4.4:** Model Comparison between three models using R-squared and Bayes Factor

| year | 2006: Model Comarison | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | Q2 | | | Q3 | | | Q4 | | |
| | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 |
| Model1 | 1.00E+00 | 3.17E-02 | 2.10E+07 | 1.00E+00 | 1.19E-01 | 2.87E+09 | 1.00E+00 | 7.56E-02 | 3.38E+09 | 1.00E+00 | 4.89E-04 | 2.85E+10 |
| Model2 | 3.16E+01 | 1.00E+00 | 6.62E+08 | 8.38E+00 | 1.00E+00 | 2.40E+10 | 1.32E+01 | 1.00E+00 | 4.46E+10 | 2.04E+03 | 1.00E+00 | 5.82E+13 |
| Model3 | 4.77E-08 | 1.51E-09 | 1.00E+00 | 3.49E-10 | 4.16E-11 | 1.00E+00 | 2.96E-10 | 2.24E-11 | 1.00E+00 | 3.51E-11 | 1.72E-14 | 1.00E+00 |
| | R-Squared | | | R-Squared | | | R-Squared | | | R-Squared | | |
| Model1 | 0.08538 | | | 0.08682 | | | 0.0892 | | | 0.084111 | | |
| Model2 | 0.08558 | | | 0.08694 | | | 0.08935 | | | 0.08457 | | |
| Model3 | 0.08602 | | | 0.08715 | | | 0.08953 | | | 0.08429 | | |
| | | | | | | | | | | | | |
| year | 2007: Model Comarison | | | | | | | | | | | |
| Quarter | Q1 | | | Q2 | | | Q3 | | | Q4 | | |
| | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 |
| Model1 | 1.00E+00 | 3.34E-11 | 2.14E+14 | 1.00E+00 | 5.94E-08 | 1.69E+16 | 1.00E+00 | 5.37E-08 | 8.18E+13 | 1.00E+00 | 2.42E-12 | 1.43E+13 |
| Model2 | 2.99E+10 | 1.00E+00 | 6.39E+24 | 1.68E+07 | 1.00E+00 | 2.84E+23 | 1.86E+07 | 1.00E+00 | 1.52E+21 | 4.13E+11 | 1.00E+00 | 5.89E+24 |
| Model3 | 4.68E-15 | 1.56E-25 | 1.00E+00 | 5.93E-17 | 3.52E-24 | 1.00E+00 | 1.22E-14 | 6.56E-22 | 1.00E+00 | 7.00E-14 | 1.70E-25 | 1.00E+00 |
| | | | | | | | | | | | | |
| | R-Squared | | | R-Squared | | | R-Squared | | | R-Squared | | |
| Model1 | 0.1009 | | | 0.09385 | | | 0.06413 | | | 0.1667 | | |
| Model2 | 0.1024 | | | 0.09488 | | | 0.06521 | | | 0.1684 | | |
| Model3 | 0.1006 | | | 0.09322 | | | 0.06379 | | | 0.1665 | | |
| | | | | | | | | | | | | |
| year | 2008: Model Comarison | | | | | | | | | | | |
| Quarter | Q1 | | | Q2 | | | Q3 | | | Q4 | | |
| | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 |
| Model1 | 1.00E+00 | 4.01E-11 | 2.90E+16 | 1.00E+00 | 8.63E-04 | 1.38E+08 | 1.00E+00 | 3.60E-08 | 1.94E+07 | 1.00E+00 | 1.17E-08 | 3.21E+09 |
| Model2 | 2.50E+10 | 1.00E+00 | 7.24E+26 | 1.16E+03 | 1.00E+00 | 1.60E+11 | 2.78E+07 | 1.00E+00 | 5.41E+14 | 8.52E+07 | 1.00E+00 | 2.73E+17 |
| Model3 | 3.45E-17 | 1.38E-27 | 1.00E+00 | 7.25E-09 | 6.26E-12 | 1.00E+00 | 5.14E-08 | 1.85E-15 | 1.00E+00 | 3.12E-10 | 3.66E-18 | 1.00E+00 |
| | R-Squared | | | R-Squared | | | R-Squared | | | R-Squared | | |
| Model1 | 0.1871 | | | 0.229 | | | 0.05309 | | | 0.1478 | | |
| Model2 | 0.1886 | | | 0.2294 | | | 0.05419 | | | 0.149 | | |
| Model3 | 0.1865 | | | 0.2295 | | | 0.0537 | | | 0.1481 | | |

Table 4.4 continued

| year | 2009: Model Comarison | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | Q2 | | | Q3 | | | Q4 | | |
| | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 |
| Model1 | 1.00E+00 | 1.52E-10 | 3.77E+12 | 1.00E+00 | 1.30E-01 | 5.19E+09 | 1.00E+00 | 3.85E-04 | 1.24E+10 | 1.00E+00 | 1.41E-09 | 7.58E+08 |
| Model2 | 6.56E+09 | 1.00E+00 | 2.47E+22 | 7.71E+00 | 1.00E+00 | 4.00E+10 | 2.60E+03 | 1.00E+00 | 3.22E+13 | 7.11E+08 | 1.00E+00 | 5.39E+17 |
| Model3 | 2.66E-13 | 4.05E-23 | 1.00E+00 | 1.93E-10 | 2.50E-11 | 1.00E+00 | 8.06E-11 | 3.10E-14 | 1.00E+00 | 1.32E-09 | 1.85E-18 | 1.00E+00 |
| | R-Squared | | | R-Squared | | | R-Squared | | | R-Squared | | |
| Model1 | 0.01679 | | | 0.1651 | | | 0.1236 | | | 0.1603 | | |
| Model2 | 0.1692 | | | 0.1652 | | | 0.1241 | | | 0.1614 | | |
| Model3 | 0.1678 | | | 0.1653 | | | 0.1238 | | | 0.1606 | | |

| year | 2010: Model Comarison | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | Q2 | | | Q3 | | | Q4 | | |
| | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 |
| Model1 | 1.00E+00 | 1.65E-08 | 6.78E+06 | 1.00E+00 | 8.04E-02 | 3.13E+09 | 1.00E+00 | 2.54E-03 | 4.30E+08 | 1.00E+00 | 1.06E-05 | 6.10E+09 |
| Model2 | 6.04E+07 | 1.00E+00 | 4.10E+14 | 1.24E+01 | 1.00E+00 | 3.90E+10 | 3.93E+02 | 1.00E+00 | 1.69E+11 | 9.41E+04 | 1.00E+00 | 5.74E+14 |
| Model3 | 1.47E-07 | 2.44E-15 | 1.00E+00 | 3.19E-10 | 2.56E-11 | 1.00E+00 | 2.33E-09 | 5.92E-12 | 1.00E+00 | 1.64E-10 | 1.74E-15 | 1.00E+00 |
| | R-Squared | | | R-Squared | | | R-Squared | | | R-Squared | | |
| Model1 | 0.161 | | | 0.1055 | | | 0.1082 | | | 0.1498 | | |
| Model2 | 0.162 | | | 0.1056 | | | 0.1085 | | | 0.1505 | | |
| Model3 | 0.1617 | | | 0.1058 | | | 0.1086 | | | 0.1501 | | |

| year | 2011: Model Comarison | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | | Q2 | | | Q3 | | | Q4 | | |
| | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 | Model1 | Model2 | Model3 |
| Model1 | 1.00E+00 | 1.27E-03 | 6.38E+04 | 1.00E+00 | 4.88E-03 | 6.15E+10 | 1.00E+00 | 4.35E-04 | 9.41E+13 | 1.00E+00 | 7.94E-06 | 1.24E+11 |
| Model2 | 7.86E+02 | 1.00E+00 | 5.01E+07 | 2.05E+02 | 1.00E+00 | 1.26E+13 | 2.30E+03 | 1.00E+00 | 2.16E+17 | 1.26E+05 | 1.00E+00 | 1.57E+16 |
| Model3 | 1.57E-05 | 2.00E-08 | 1.00E+00 | 1.63E-11 | 7.94E-14 | 1.00E+00 | 1.06E-14 | 4.62E-18 | 1.00E+00 | 8.04E-12 | 6.38E-17 | 1.00E+00 |
| | R-Squared | | | R-Squared | | | R-Squared | | | R-Squared | | |
| Model1 | 0.1103 | | | 0.104 | | | 0.1017 | | | 0.08793 | | |
| Model2 | 0.1106 | | | 0.1043 | | | 0.1022 | | | 0.08866 | | |
| Model3 | 0.1112 | | | 0.10411 | | | 0.1014 | | | 0.8799 | | |

**Table 4.5:** HPDI for each variable in Model 1.

| Table 4.5: HPDI for each variable for Model 1 | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| year | 2006 | | | | | | | | 2007 | | | | | | | |
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper |
| intercept | 4.24E+00 | 4.31E+00 | 4.25E+00 | 4.31E+00 | 4.23E+00 | 4.29E+00 | 4.24E+00 | 4.31E+00 | 4.31E+00 | 4.37E+00 | 4.32E+00 | 4.39E+00 | 4.31E+00 | 4.38E+00 | 4.68E+00 | 4.75E+00 |
| S | 9.27E-03 | 2.03E-02 | 1.41E-02 | 2.50E-02 | 8.16E-03 | 1.92E-02 | 3.36E-03 | 1.45E-02 | -1.59E-03 | 9.28E-03 | -2.20E-03 | 8.81E-03 | -7.46E-03 | 4.25E-03 | -1.40E-02 | -2.05E-03 |
| S2 | -3.15E-04 | 2.86E-04 | -6.15E-04 | -1.93E-05 | -3.46E-04 | 2.52E-04 | -2.36E-04 | 3.71E-04 | 6.67E-05 | 6.59E-04 | 2.58E-05 | 6.26E-04 | 2.24E-04 | 8.54E-04 | 6.20E-04 | 1.26E-03 |
| pexp | 1.18E-03 | 2.86E-03 | -2.47E-05 | 1.66E-03 | 9.29E-04 | 2.57E-03 | 1.55E-03 | 3.23E-03 | 2.02E-03 | 3.70E-03 | 7.21E-04 | 2.43E-03 | 1.86E-03 | 3.58E-03 | 3.58E-03 | 5.36E-03 |
| pexp2 | -5.71E-05 | -2.68E-05 | -2.72E-05 | 3.32E-06 | -3.09E-05 | -7.47E-07 | -4.70E-05 | -1.62E-05 | -8.00E-05 | -4.96E-05 | -5.62E-05 | -2.51E-05 | -6.98E-05 | -3.84E-05 | -1.24E-04 | -9.13E-05 |
| sex | 1.93E-02 | 4.22E-02 | 2.56E-02 | 4.84E-02 | 3.70E-02 | 5.99E-02 | 3.52E-02 | 5.82E-02 | 4.33E-02 | 6.59E-02 | 5.04E-02 | 7.35E-02 | 4.61E-02 | 7.01E-02 | 3.83E-02 | 6.28E-02 |
| ld | -1.44E-01 | -3.58E-02 | -3.83E-02 | 7.84E-02 | -3.35E-02 | 8.58E-02 | 9.26E-02 | 2.12E-01 | 1.10E-02 | 1.24E-01 | 9.51E-03 | 1.22E-01 | 1.74E-02 | 1.25E-01 | -6.52E-04 | 1.05E-01 |
| td | -2.66E-02 | 2.85E-02 | 3.29E-03 | 5.75E-02 | -1.23E-02 | 4.25E-02 | 1.29E-03 | 5.69E-02 | -3.18E-02 | 2.17E-02 | 2.60E-02 | 8.04E-02 | 1.23E-02 | 6.91E-02 | -1.90E-02 | 3.95E-02 |
| rd | 4.82E-02 | 9.88E-02 | 5.61E-02 | 1.06E-01 | 7.49E-02 | 1.23E-01 | 6.68E-02 | 1.16E-01 | 7.35E-02 | 1.21E-01 | 8.59E-02 | 1.33E-01 | 6.32E-02 | 1.12E-01 | 5.28E-02 | 1.04E-01 |
| vd | 7.62E-02 | 1.30E-01 | 8.75E-02 | 1.41E-01 | 8.45E-02 | 1.37E-01 | 8.11E-02 | 1.35E-01 | 1.24E-01 | 1.77E-01 | 1.10E-01 | 1.61E-01 | 6.93E-02 | 1.24E-01 | 6.70E-02 | 1.24E-01 |
| ad | -7.18E-02 | -1.73E-02 | -5.93E-02 | -8.77E-03 | -9.01E-02 | -3.88E-02 | -1.13E-01 | -7.09E-02 | -1.83E-01 | -1.38E-01 | -1.49E-01 | -1.07E-01 | -1.98E-01 | -1.52E-01 | -2.21E-01 | -1.73E-01 |
| md | 3.82E-02 | 1.08E-01 | 2.42E-02 | 9.18E-02 | 3.80E-02 | 1.07E-01 | 6.10E-02 | 1.32E-01 | 4.53E-02 | 1.10E-01 | 3.72E-02 | 1.03E-01 | 2.48E-02 | 9.30E-02 | 2.06E-02 | 9.22E-02 |
| wbgd | -1.30E-01 | -1.07E-01 | -1.37E-01 | -1.14E-01 | -8.29E-02 | -5.99E-02 | -6.45E-02 | -4.13E-02 | -1.09E-01 | -8.67E-02 | -1.05E-01 | -8.21E-02 | -5.38E-02 | -3.00E-02 | -3.82E-01 | -3.56E-01 |
| isd | -5.54E-02 | 1.25E-02 | -8.78E-02 | -1.94E-02 | -7.72E-02 | -1.20E-02 | -4.82E-02 | 2.05E-02 | -6.62E-02 | -2.04E-04 | -8.21E-02 | -1.63E-02 | -1.74E-02 | 5.01E-02 | -1.67E-02 | 4.91E-02 |
| cad | -3.20E-01 | -2.92E-01 | -3.29E-01 | -3.02E-01 | -3.47E-01 | -3.20E-01 | -3.36E-01 | -3.09E-01 | -3.42E-01 | -3.15E-01 | -3.40E-01 | -3.13E-01 | -2.74E-01 | -2.46E-01 | -3.59E-01 | -3.29E-01 |
| gd | -1.78E-01 | -4.53E-02 | -1.56E-01 | -2.93E-02 | -1.02E-01 | 1.40E-02 | -1.06E-01 | 1.02E-02 | -1.27E-01 | -1.47E-02 | -1.50E-01 | -3.89E-02 | -1.84E-01 | -6.61E-02 | -1.68E-01 | -3.02E-02 |
| sigma2 | 2.09E-01 | 2.16E-01 | 2.04E-01 | 2.11E-01 | 2.03E-01 | 2.10E-01 | 2.11E-01 | 2.18E-01 | 2.01E-01 | 2.08E-01 | 2.05E-01 | 2.12E-01 | 2.21E-01 | 2.28E-01 | 2.13E-01 | 2.20E-01 |

Table 4.5 continued

| year | 2008 | | | | | | | | 2009 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper |
| intercept | 4.74E+00 | 4.80E+00 | 4.83E+00 | 4.91E+00 | 4.35E+00 | 4.42E+00 | 4.69E+00 | 4.77E+00 | 4.50E+00 | 4.56E+00 | 4.50E+00 | 4.56E+00 | 4.46E+00 | 4.53E+00 | 4.50E+00 | 4.57E+00 |
| S | -1.24E-02 | -1.08E-03 | -2.74E-03 | 9.76E-03 | -9.23E-03 | 2.41E-03 | -1.06E-02 | 1.61E-03 | -1.71E-02 | -5.89E-03 | -1.71E-02 | -5.89E-03 | -9.72E-03 | 2.63E-03 | -2.14E-02 | -9.18E-03 |
| S2 | 5.56E-04 | 1.17E-03 | -1.35E-04 | 5.37E-04 | 2.83E-04 | 9.01E-04 | 4.89E-04 | 1.15E-03 | 5.88E-04 | 1.18E-03 | 5.88E-04 | 1.18E-03 | 2.37E-04 | 8.86E-04 | 7.59E-04 | 1.41E-03 |
| pexp | 1.65E-03 | 3.39E-03 | 1.61E-03 | 3.47E-03 | 1.35E-03 | 3.01E-03 | 6.32E-04 | 2.39E-03 | 7.24E-04 | 2.41E-03 | 7.24E-04 | 2.41E-03 | -1.10E-03 | 7.05E-04 | -3.52E-04 | 1.46E-03 |
| pexp2 | -8.98E-05 | -5.83E-05 | -8.15E-05 | -4.75E-05 | -7.27E-05 | -4.17E-05 | -6.62E-05 | -3.39E-05 | -7.94E-05 | -4.86E-05 | -7.94E-05 | -4.86E-05 | -4.75E-05 | -1.39E-05 | -6.31E-05 | -2.95E-05 |
| sex | 3.67E-02 | 6.01E-02 | 4.06E-02 | 6.60E-02 | 3.78E-02 | 6.10E-02 | 3.37E-02 | 5.82E-02 | 3.92E-02 | 6.21E-02 | 3.92E-02 | 6.21E-02 | 2.91E-02 | 5.42E-02 | 3.24E-02 | 5.71E-02 |
| ld | -6.26E-02 | 4.01E-02 | 4.87E-02 | 1.63E-01 | 4.48E-02 | 1.50E-01 | 2.34E-02 | 1.37E-01 | 2.31E-02 | 1.23E-01 | 2.31E-02 | 1.23E-01 | 7.12E-02 | 1.66E-01 | 6.37E-02 | 1.71E-01 |
| td | -2.07E-02 | 3.41E-02 | 2.80E-02 | 8.82E-02 | 2.37E-02 | 7.95E-02 | 1.05E-02 | 6.86E-02 | 1.35E-02 | 6.95E-02 | 1.35E-02 | 6.95E-02 | 7.47E-02 | 1.36E-01 | 3.13E-02 | 9.31E-02 |
| rd | 6.06E-02 | 1.09E-01 | 6.77E-02 | 1.21E-01 | 1.02E-01 | 1.50E-01 | 8.25E-02 | 1.36E-01 | 8.81E-02 | 1.38E-01 | 8.81E-02 | 1.38E-01 | 1.23E-01 | 1.78E-01 | 9.60E-02 | 1.51E-01 |
| vd | 6.90E-02 | 1.23E-01 | 7.01E-02 | 1.29E-01 | 6.27E-02 | 1.17E-01 | 9.89E-02 | 1.59E-01 | 1.07E-01 | 1.59E-01 | 1.07E-01 | 1.59E-01 | 1.29E-01 | 1.89E-01 | 1.43E-01 | 2.02E-01 |
| ad | -2.35E-01 | -1.86E-01 | -1.46E-01 | -9.54E-02 | -1.04E-01 | -5.45E-02 | -1.07E-01 | -5.04E-02 | -1.41E-01 | -8.75E-02 | -1.41E-01 | -8.75E-02 | -1.72E-01 | -1.12E-01 | -1.69E-01 | -1.10E-01 |
| md | 2.70E-02 | 9.78E-02 | 1.75E-02 | 9.67E-02 | 5.99E-02 | 1.35E-01 | 5.26E-02 | 1.32E-01 | 7.42E-02 | 1.43E-01 | 7.42E-02 | 1.43E-01 | 8.05E-02 | 1.57E-01 | 7.64E-02 | 1.50E-01 |
| wbgd | -4.30E-01 | -4.05E-01 | -5.84E-01 | -5.55E-01 | -7.62E-02 | -5.25E-02 | -4.06E-01 | -3.80E-01 | -1.31E-01 | -1.08E-01 | -1.31E-01 | -1.08E-01 | -1.21E-01 | -9.55E-02 | -1.15E-01 | -9.07E-02 |
| isd | -1.80E-03 | 6.15E-02 | -6.03E-02 | 7.40E-03 | 1.14E-02 | 7.59E-02 | 1.54E-02 | 8.10E-02 | -4.02E-02 | 2.09E-02 | -4.02E-02 | 2.09E-02 | -8.89E-02 | -2.25E-02 | -7.37E-02 | -6.76E-03 |
| cad | -3.14E-01 | -2.85E-01 | -3.53E-01 | -3.21E-01 | -2.41E-01 | -2.13E-01 | -2.76E-01 | -2.46E-01 | -5.44E-01 | -5.16E-01 | -5.44E-01 | -5.16E-01 | -4.97E-01 | -4.65E-01 | -5.85E-01 | -5.54E-01 |
| gd | -1.28E-01 | -2.20E-04 | -1.74E-01 | -3.28E-02 | -1.94E-01 | -7.04E-02 | -2.02E-01 | -6.47E-02 | -4.64E-02 | 5.72E-03 | -4.64E-02 | 5.72E-03 | -1.29E-01 | -7.10E-02 | -8.95E-02 | -3.17E-02 |
| sigma2 | 1.95E-01 | 2.02E-01 | 2.24E-01 | 2.32E-01 | 2.16E-01 | 2.23E-01 | 2.17E-01 | 2.25E-01 | 2.07E-01 | 2.14E-01 | 2.07E-01 | 2.14E-01 | 2.49E-01 | 2.58E-01 | 2.48E-01 | 2.56E-01 |

Table 4.5 continued

| year | 2010 | | | | | | | | 2011 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper |
| intercept | 4.54E+00 | 4.61E+00 | 4.52E+00 | 4.60E+00 | 4.56E+00 | 4.64E+00 | 4.66E+00 | 4.74E+00 | 4.54E+00 | 4.61E+00 | 4.52E+00 | 4.60E+00 | 4.56E+00 | 4.64E+00 | 4.66E+00 | 4.74E+00 |
| S | -1.22E-02 | 4.33E-04 | -3.61E-03 | 9.78E-03 | -1.01E-02 | 3.59E-03 | -1.99E-02 | -6.60E-03 | -1.22E-02 | 4.33E-04 | -3.61E-03 | 9.78E-03 | -1.01E-02 | 3.59E-03 | -1.99E-02 | -6.60E-03 |
| S2 | 1.68E-04 | 8.34E-04 | -2.36E-04 | 4.68E-04 | 1.47E-04 | 8.57E-04 | 5.70E-04 | 1.26E-03 | 1.68E-04 | 8.34E-04 | -2.36E-04 | 4.68E-04 | 1.47E-04 | 8.57E-04 | 5.70E-04 | 1.26E-03 |
| pexp | -4.94E-04 | 1.43E-03 | -2.06E-03 | 1.62E-06 | -1.79E-03 | 2.12E-04 | -7.27E-04 | 1.25E-03 | -4.94E-04 | 1.43E-03 | -2.06E-03 | 1.62E-06 | -1.79E-03 | 2.12E-04 | -7.27E-04 | 1.25E-03 |
| pexp2 | -5.39E-05 | -1.85E-05 | -2.27E-05 | 1.55E-05 | -4.27E-05 | -5.38E-06 | -6.48E-05 | -2.81E-05 | -5.39E-05 | -1.85E-05 | -2.27E-05 | 1.55E-05 | -4.27E-05 | -5.38E-06 | -6.48E-05 | -2.81E-05 |
| sex | 1.37E-02 | 3.98E-02 | 6.49E-03 | 3.42E-02 | 2.78E-02 | 5.56E-02 | 3.61E-02 | 6.31E-02 | 1.37E-02 | 3.98E-02 | 6.49E-03 | 3.42E-02 | 2.78E-02 | 5.56E-02 | 3.61E-02 | 6.31E-02 |
| ld | 2.62E-02 | 1.25E-01 | -1.78E-02 | 9.58E-02 | 3.86E-02 | 1.58E-01 | 1.10E-02 | 1.28E-01 | 2.62E-02 | 1.25E-01 | -1.78E-02 | 9.58E-02 | 3.86E-02 | 1.58E-01 | 1.10E-02 | 1.28E-01 |
| td | 3.95E-02 | 1.04E-01 | 1.93E-02 | 8.67E-02 | 4.60E-03 | 7.36E-02 | 6.08E-02 | 1.27E-01 | 3.95E-02 | 1.04E-01 | 1.93E-02 | 8.67E-02 | 4.60E-03 | 7.36E-02 | 6.08E-02 | 1.27E-01 |
| rd | 6.01E-02 | 1.18E-01 | 7.81E-02 | 1.39E-01 | 1.11E-01 | 1.72E-01 | 1.04E-01 | 1.64E-01 | 6.01E-02 | 1.18E-01 | 7.81E-02 | 1.39E-01 | 1.11E-01 | 1.72E-01 | 1.04E-01 | 1.64E-01 |
| vd | 1.17E-01 | 1.76E-01 | 1.41E-01 | 2.06E-01 | 1.28E-01 | 1.93E-01 | 1.45E-01 | 2.08E-01 | 1.17E-01 | 1.76E-01 | 1.41E-01 | 2.06E-01 | 1.28E-01 | 1.93E-01 | 1.45E-01 | 2.08E-01 |
| ad | -1.47E-01 | -8.05E-02 | -1.20E-01 | -5.44E-02 | -1.21E-01 | -4.89E-02 | -2.05E-01 | -1.41E-01 | -1.47E-01 | -8.05E-02 | -1.20E-01 | -5.44E-02 | -1.21E-01 | -4.89E-02 | -2.05E-01 | -1.41E-01 |
| md | 7.11E-02 | 1.50E-01 | 6.95E-02 | 1.55E-01 | 7.36E-02 | 1.67E-01 | 8.13E-02 | 1.70E-01 | 7.11E-02 | 1.50E-01 | 6.95E-02 | 1.55E-01 | 7.36E-02 | 1.67E-01 | 8.13E-02 | 1.70E-01 |
| wbgd | -1.71E-01 | -1.45E-01 | -1.85E-01 | -1.57E-01 | -1.97E-01 | -1.69E-01 | -2.71E-01 | -2.44E-01 | -1.71E-01 | -1.45E-01 | -1.85E-01 | -1.57E-01 | -1.97E-01 | -1.69E-01 | -2.71E-01 | -2.44E-01 |
| isd | -5.68E-02 | 1.27E-02 | -1.18E-01 | -4.20E-02 | -9.06E-02 | -1.49E-02 | -6.53E-02 | 7.68E-03 | -5.68E-02 | 1.27E-02 | -1.18E-01 | -4.20E-02 | -9.06E-02 | -1.49E-02 | -6.53E-02 | 7.68E-03 |
| cad | -6.04E-01 | -5.72E-01 | -4.94E-01 | -4.58E-01 | -4.83E-01 | -4.46E-01 | -5.27E-01 | -4.92E-01 | -6.04E-01 | -5.72E-01 | -4.94E-01 | -4.58E-01 | -4.83E-01 | -4.46E-01 | -5.27E-01 | -4.92E-01 |
| gd | -8.21E-02 | -2.21E-02 | -8.69E-02 | -2.36E-02 | -1.00E-01 | -3.58E-02 | -1.41E-01 | -7.97E-02 | -8.21E-02 | -2.21E-02 | -8.69E-02 | -2.36E-02 | -1.00E-01 | -3.58E-02 | -1.41E-01 | -7.97E-02 |
| sigma2 | 2.70E-01 | 2.79E-01 | 3.03E-01 | 3.13E-01 | 2.96E-01 | 3.06E-01 | 2.80E-01 | 2.89E-01 | 2.70E-01 | 2.79E-01 | 3.03E-01 | 3.13E-01 | 2.96E-01 | 3.06E-01 | 2.80E-01 | 2.89E-01 |

**Table 4.6:** HPDI for each variable in Model 2.

| Table 4.6:HPDI for each variable for Model2 | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| year | 2006 | | | | | | | | 2007 | | | | | | | |
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper |
| intercept | 4.20E+00 | 4.26E+00 | 4.23E+00 | 4.30E+00 | 4.20E+00 | 4.27E+00 | 4.20E+00 | 4.27E+00 | 4.24E+00 | 4.30E+00 | 4.28E+00 | 4.34E+00 | 4.24E+00 | 4.31E+00 | 4.56E+00 | 4.63E+00 |
| S | 1.05E-02 | 2.08E-02 | 1.38E-02 | 2.40E-02 | 7.37E-03 | 1.78E-02 | 2.70E-03 | 1.32E-02 | -1.07E-03 | 9.18E-03 | -2.35E-03 | 8.03E-03 | -7.01E-03 | 3.99E-03 | -1.07E-02 | 5.00E-04 |
| S2 | -4.20E-04 | 1.64E-04 | -6.24E-04 | -4.41E-05 | -3.65E-04 | 2.15E-04 | -2.90E-04 | 3.00E-04 | -3.30E-05 | 5.43E-04 | -3.46E-06 | 5.81E-04 | 1.27E-04 | 7.39E-04 | 3.71E-04 | 9.94E-04 |
| age | 2.72E-03 | 5.53E-03 | 5.84E-04 | 3.40E-03 | 1.71E-03 | 4.48E-03 | 3.40E-03 | 6.24E-03 | 5.88E-03 | 8.71E-03 | 3.69E-03 | 6.57E-03 | 5.08E-03 | 7.98E-03 | 8.88E-03 | 1.19E-02 |
| age2 | -7.43E-05 | -3.82E-05 | -4.11E-05 | -4.69E-06 | -4.58E-05 | -9.88E-06 | -7.22E-05 | -3.53E-05 | -1.20E-04 | -8.37E-05 | -9.23E-05 | -5.51E-05 | -1.04E-04 | -6.68E-05 | -1.68E-04 | -1.29E-04 |
| sex | 1.74E-02 | 4.03E-02 | 2.42E-02 | 4.70E-02 | 3.57E-02 | 5.86E-02 | 3.30E-02 | 5.59E-02 | 3.88E-02 | 6.13E-02 | 4.65E-02 | 6.95E-02 | 4.24E-02 | 6.63E-02 | 3.28E-02 | 5.73E-02 |
| ld | -1.37E-01 | -2.92E-02 | -3.62E-02 | 8.04E-02 | -3.30E-02 | 8.61E-02 | 9.79E-02 | 2.17E-01 | 1.63E-02 | 1.29E-01 | 1.26E-02 | 1.25E-01 | 2.21E-02 | 1.30E-01 | 4.15E-03 | 1.10E-01 |
| td | -2.26E-02 | 3.16E-02 | 2.82E-03 | 5.63E-02 | -1.18E-02 | 4.21E-02 | 2.65E-03 | 5.73E-02 | -2.82E-02 | 2.44E-02 | 2.57E-02 | 7.93E-02 | 1.57E-02 | 7.16E-02 | -7.78E-03 | 4.98E-02 |
| rd | 4.74E-02 | 9.85E-02 | 5.38E-02 | 1.04E-01 | 7.39E-02 | 1.23E-01 | 6.37E-02 | 1.13E-01 | 6.78E-02 | 1.16E-01 | 7.92E-02 | 1.27E-01 | 5.85E-02 | 1.08E-01 | 4.78E-02 | 9.94E-02 |
| vd | 7.40E-02 | 1.28E-01 | 8.56E-02 | 1.39E-01 | 8.22E-02 | 1.35E-01 | 7.71E-02 | 1.31E-01 | 1.15E-01 | 1.69E-01 | 1.02E-01 | 1.54E-01 | 6.29E-02 | 1.18E-01 | 6.02E-02 | 1.17E-01 |
| ad | -7.36E-02 | -1.92E-02 | -6.12E-02 | -1.06E-02 | -9.07E-02 | -3.94E-02 | -1.15E-01 | -7.34E-02 | -1.89E-01 | -1.44E-01 | -1.54E-01 | -1.12E-01 | -2.02E-01 | -1.56E-01 | -2.26E-01 | -1.78E-01 |
| md | 3.74E-02 | 1.07E-01 | 2.24E-02 | 8.99E-02 | 3.68E-02 | 1.05E-01 | 5.87E-02 | 1.30E-01 | 3.79E-02 | 1.02E-01 | 3.09E-02 | 9.68E-02 | 1.84E-02 | 8.65E-02 | 1.46E-02 | 8.62E-02 |
| wbgd | -1.31E-01 | -1.07E-01 | -1.37E-01 | -1.14E-01 | -8.30E-02 | -5.99E-02 | -6.45E-02 | -4.12E-02 | -1.10E-01 | -8.71E-02 | -1.05E-01 | -8.22E-02 | -5.41E-02 | -3.02E-02 | -3.83E-01 | -3.57E-01 |
| isd | -5.84E-02 | 9.28E-03 | -9.15E-02 | -2.35E-02 | -7.85E-02 | -1.34E-02 | -5.06E-02 | 1.80E-02 | -7.26E-02 | -6.74E-03 | -8.71E-02 | -2.15E-02 | -2.32E-02 | 4.39E-02 | -2.42E-02 | 4.13E-02 |
| cad | -3.20E-01 | -2.93E-01 | -3.29E-01 | -3.02E-01 | -3.48E-01 | -3.20E-01 | -3.36E-01 | -3.09E-01 | -3.43E-01 | -3.16E-01 | -3.41E-01 | -3.13E-01 | -2.75E-01 | -2.46E-01 | -3.60E-01 | -3.30E-01 |
| gd | -1.75E-01 | -4.26E-02 | -1.58E-01 | -3.16E-02 | -9.94E-02 | 1.66E-02 | -1.06E-01 | 1.03E-02 | -1.27E-01 | -1.55E-02 | -1.52E-01 | -4.12E-02 | -1.83E-01 | -6.56E-02 | -1.69E-01 | -3.23E-02 |
| sigma2 | 2.09E-01 | 2.16E-01 | 2.04E-01 | 2.11E-01 | 2.03E-01 | 2.10E-01 | 2.11E-01 | 2.18E-01 | 2.01E-01 | 2.07E-01 | 2.05E-01 | 2.12E-01 | 2.21E-01 | 2.28E-01 | 2.12E-01 | 2.20E-01 |

Table 4.6 continued

| year | 2008 | | | | | | | | 2009 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper |
| intercept | 4.66E+00 | 4.72E+00 | 4.76E+00 | 4.84E+00 | 4.29E+00 | 4.36E+00 | 4.64E+00 | 4.71E+00 | 4.43E+00 | 4.49E+00 | 4.68E+00 | 4.76E+00 | 4.42E+00 | 4.50E+00 | 4.45E+00 | 4.52E+00 |
| S | -1.06E-02 | 1.06E-04 | -2.68E-04 | 1.15E-02 | -7.83E-03 | 3.05E-03 | -9.78E-03 | 1.69E-03 | -1.51E-02 | -4.55E-03 | -6.99E-03 | 5.55E-03 | -8.01E-03 | 3.58E-03 | -2.05E-02 | -8.95E-03 |
| S2 | 4.26E-04 | 1.02E-03 | -2.83E-04 | 3.68E-04 | 1.70E-04 | 7.67E-04 | 4.23E-04 | 1.06E-03 | 4.81E-04 | 1.06E-03 | 9.63E-05 | 7.70E-04 | 1.95E-04 | 8.23E-04 | 7.40E-04 | 1.37E-03 |
| age | 5.82E-03 | 8.75E-03 | 4.35E-03 | 7.48E-03 | 4.65E-03 | 7.50E-03 | 3.99E-03 | 6.98E-03 | 4.54E-03 | 7.41E-03 | -5.92E-05 | 3.39E-03 | 9.45E-04 | 4.07E-03 | 3.27E-03 | 6.39E-03 |
| age2 | -1.31E-04 | -9.31E-05 | -1.07E-04 | -6.69E-05 | -1.07E-04 | -7.05E-05 | -1.05E-04 | -6.60E-05 | -1.19E-04 | -8.22E-05 | -6.13E-05 | -1.68E-05 | -7.57E-05 | -3.56E-05 | -1.06E-04 | -6.64E-05 |
| sex | 3.15E-02 | 5.49E-02 | 3.73E-02 | 6.28E-02 | 3.41E-02 | 5.73E-02 | 2.96E-02 | 5.40E-02 | 3.45E-02 | 5.74E-02 | 2.23E-02 | 4.91E-02 | 2.61E-02 | 5.12E-02 | 2.78E-02 | 5.26E-02 |
| ld | -5.75E-02 | 4.52E-02 | 5.43E-02 | 1.69E-01 | 4.86E-02 | 1.53E-01 | 2.57E-02 | 1.40E-01 | 2.93E-02 | 1.29E-01 | 2.60E-02 | 1.29E-01 | 7.29E-02 | 1.68E-01 | 6.62E-02 | 1.73E-01 |
| td | -1.53E-02 | 3.88E-02 | 3.39E-02 | 9.34E-02 | 2.76E-02 | 8.27E-02 | 1.27E-02 | 7.01E-02 | 1.44E-02 | 7.01E-02 | 6.25E-02 | 1.26E-01 | 7.22E-02 | 1.33E-01 | 3.12E-02 | 9.25E-02 |
| rd | 5.41E-02 | 1.03E-01 | 6.41E-02 | 1.18E-01 | 9.82E-02 | 1.46E-01 | 7.62E-02 | 1.30E-01 | 8.17E-02 | 1.32E-01 | 7.93E-02 | 1.36E-01 | 1.18E-01 | 1.73E-01 | 8.94E-02 | 1.44E-01 |
| vd | 6.18E-02 | 1.16E-01 | 6.43E-02 | 1.23E-01 | 5.38E-02 | 1.09E-01 | 8.98E-02 | 1.50E-01 | 9.96E-02 | 1.52E-01 | 1.08E-01 | 1.67E-01 | 1.22E-01 | 1.82E-01 | 1.35E-01 | 1.94E-01 |
| ad | -2.41E-01 | -1.92E-01 | -1.49E-01 | -9.88E-02 | -1.08E-01 | -5.82E-02 | -1.12E-01 | -5.56E-02 | -1.46E-01 | -9.27E-02 | -2.28E-01 | -1.70E-01 | -1.75E-01 | -1.15E-01 | -1.76E-01 | -1.18E-01 |
| md | 1.96E-02 | 9.02E-02 | 1.47E-02 | 9.37E-02 | 5.43E-02 | 1.29E-01 | 4.44E-02 | 1.23E-01 | 6.54E-02 | 1.35E-01 | 8.71E-02 | 1.68E-01 | 7.29E-02 | 1.49E-01 | 6.98E-02 | 1.43E-01 |
| wbgd | -4.30E-01 | -4.05E-01 | -5.84E-01 | -5.55E-01 | -7.68E-02 | -5.30E-02 | -4.07E-01 | -3.80E-01 | -1.31E-01 | -1.09E-01 | -3.85E-01 | -3.57E-01 | -1.21E-01 | -9.55E-02 | -1.15E-01 | -9.04E-02 |
| isd | -8.14E-03 | 5.50E-02 | -6.27E-02 | 4.70E-03 | 7.50E-03 | 7.17E-02 | 1.06E-02 | 7.58E-02 | -4.57E-02 | 1.50E-02 | -9.69E-02 | -2.99E-02 | -9.27E-02 | -2.63E-02 | -7.93E-02 | -1.26E-02 |
| cad | -3.15E-01 | -2.86E-01 | -3.54E-01 | -3.22E-01 | -2.41E-01 | -2.13E-01 | -2.77E-01 | -2.47E-01 | -5.44E-01 | -5.16E-01 | -4.69E-01 | -4.34E-01 | -4.97E-01 | -4.65E-01 | -5.85E-01 | -5.54E-01 |
| gd | -1.32E-01 | -4.52E-03 | -1.72E-01 | -3.08E-02 | -1.94E-01 | -7.05E-02 | -2.06E-01 | -6.87E-02 | -4.78E-02 | 4.27E-03 | -1.13E-01 | -5.35E-02 | -1.29E-01 | -7.14E-02 | -9.17E-02 | -3.39E-02 |
| sigma2 | 1.95E-01 | 2.02E-01 | 2.24E-01 | 2.32E-01 | 2.16E-01 | 2.23E-01 | 2.17E-01 | 2.25E-01 | 2.07E-01 | 2.14E-01 | 2.53E-01 | 2.62E-01 | 2.49E-01 | 2.57E-01 | 2.48E-01 | 2.56E-01 |

Table 4.6 continued

| year | 2010 | | | | | | | | 2011 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper |
| intercept | 4.50E+00 | 4.57E+00 | 4.51E+00 | 4.59E+00 | 4.54E+00 | 4.62E+00 | 4.62E+00 | 4.70E+00 | 4.50E+00 | 4.57E+00 | 4.51E+00 | 4.59E+00 | 4.54E+00 | 4.62E+00 | 4.62E+00 | 4.70E+00 |
| S | -1.28E-02 | -8.62E-04 | -3.85E-03 | 8.85E-03 | -8.83E-03 | 4.05E-03 | -1.81E-02 | -5.55E-03 | -1.28E-02 | -8.62E-04 | -3.85E-03 | 8.85E-03 | -8.83E-03 | 4.05E-03 | -1.81E-02 | -5.55E-03 |
| S2 | 1.90E-04 | 8.37E-04 | -1.83E-04 | 5.01E-04 | 1.53E-04 | 8.39E-04 | 5.35E-04 | 1.21E-03 | 1.90E-04 | 8.37E-04 | -1.83E-04 | 5.01E-04 | 1.53E-04 | 8.39E-04 | 5.35E-04 | 1.21E-03 |
| age | 2.98E-03 | 6.27E-03 | -1.02E-03 | 2.52E-03 | -5.44E-06 | 3.45E-03 | 2.16E-03 | 5.55E-03 | 2.98E-03 | 6.27E-03 | -1.02E-03 | 2.52E-03 | -5.44E-06 | 3.45E-03 | 2.16E-03 | 5.55E-03 |
| age2 | -9.98E-05 | -5.76E-05 | -4.85E-05 | -3.13E-06 | -7.07E-05 | -2.63E-05 | -9.96E-05 | -5.61E-05 | -9.98E-05 | -5.76E-05 | -4.85E-05 | -3.13E-06 | -7.07E-05 | -2.63E-05 | -9.96E-05 | -5.61E-05 |
| sex | 9.11E-03 | 3.52E-02 | 4.37E-03 | 3.21E-02 | 2.46E-02 | 5.24E-02 | 3.24E-02 | 5.94E-02 | 9.11E-03 | 3.52E-02 | 4.37E-03 | 3.21E-02 | 2.46E-02 | 5.24E-02 | 3.24E-02 | 5.94E-02 |
| ld | 2.58E-02 | 1.25E-01 | -2.09E-02 | 9.23E-02 | 3.91E-02 | 1.58E-01 | 1.43E-02 | 1.31E-01 | 2.58E-02 | 1.25E-01 | -2.09E-02 | 9.23E-02 | 3.91E-02 | 1.58E-01 | 1.43E-02 | 1.31E-01 |
| td | 3.67E-02 | 1.01E-01 | 1.48E-02 | 8.18E-02 | 3.52E-03 | 7.20E-02 | 6.05E-02 | 1.26E-01 | 3.67E-02 | 1.01E-01 | 1.48E-02 | 8.18E-02 | 3.52E-03 | 7.20E-02 | 6.05E-02 | 1.26E-01 |
| rd | 5.32E-02 | 1.11E-01 | 7.43E-02 | 1.35E-01 | 1.06E-01 | 1.66E-01 | 9.81E-02 | 1.57E-01 | 5.32E-02 | 1.11E-01 | 7.43E-02 | 1.35E-01 | 1.06E-01 | 1.66E-01 | 9.81E-02 | 1.57E-01 |
| vd | 1.07E-01 | 1.67E-01 | 1.36E-01 | 2.01E-01 | 1.23E-01 | 1.88E-01 | 1.37E-01 | 2.00E-01 | 1.07E-01 | 1.67E-01 | 1.36E-01 | 2.01E-01 | 1.23E-01 | 1.88E-01 | 1.37E-01 | 2.00E-01 |
| ad | -1.54E-01 | -8.79E-02 | -1.23E-01 | -5.74E-02 | -1.25E-01 | -5.30E-02 | -2.11E-01 | -1.47E-01 | -1.54E-01 | -8.79E-02 | -1.23E-01 | -5.74E-02 | -1.25E-01 | -5.30E-02 | -2.11E-01 | -1.47E-01 |
| md | 5.97E-02 | 1.39E-01 | 6.27E-02 | 1.48E-01 | 6.96E-02 | 1.63E-01 | 7.29E-02 | 1.62E-01 | 5.97E-02 | 1.39E-01 | 6.27E-02 | 1.48E-01 | 6.96E-02 | 1.63E-01 | 7.29E-02 | 1.62E-01 |
| wbgd | -1.71E-01 | -1.45E-01 | -1.85E-01 | -1.57E-01 | -1.97E-01 | -1.69E-01 | -2.70E-01 | -2.43E-01 | -1.71E-01 | -1.45E-01 | -1.85E-01 | -1.57E-01 | -1.97E-01 | -1.69E-01 | -2.70E-01 | -2.43E-01 |
| isd | -6.33E-02 | 5.94E-03 | -1.22E-01 | -4.66E-02 | -9.55E-02 | -2.01E-02 | -7.36E-02 | -8.22E-04 | -6.33E-02 | 5.94E-03 | -1.22E-01 | -4.66E-02 | -9.55E-02 | -2.01E-02 | -7.36E-02 | -8.22E-04 |
| cad | -6.04E-01 | -5.72E-01 | -4.94E-01 | -4.59E-01 | -4.83E-01 | -4.46E-01 | -5.27E-01 | -4.92E-01 | -6.04E-01 | -5.72E-01 | -4.94E-01 | -4.59E-01 | -4.83E-01 | -4.46E-01 | -5.27E-01 | -4.92E-01 |
| gd | -8.45E-02 | -2.46E-02 | -8.90E-02 | -2.55E-02 | -1.02E-01 | -3.75E-02 | -1.42E-01 | -8.06E-02 | -8.45E-02 | -2.46E-02 | -8.90E-02 | -2.55E-02 | -1.02E-01 | -3.75E-02 | -1.42E-01 | -8.06E-02 |
| sigma2 | 2.70E-01 | 2.79E-01 | 3.03E-01 | 3.13E-01 | 2.96E-01 | 3.06E-01 | 2.80E-01 | 2.89E-01 | 2.70E-01 | 2.79E-01 | 3.03E-01 | 3.13E-01 | 2.96E-01 | 3.06E-01 | 2.80E-01 | 2.89E-01 |

**Table 4.7:** HPDI for each variable in Model 3.

Table 4.7:HPDI for each variable for Model3

| year | 2006 | | | | | | | | 2007 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper |
| intercept | 4.40E+00 | 4.44E+00 | 4.42E+00 | 4.46E+00 | 4.37E+00 | 4.41E+00 | 4.35E+00 | 4.39E+00 | 4.40E+00 | 4.44E+00 | 4.40E+00 | 4.44E+00 | 4.36E+00 | 4.41E+00 | 4.71E+00 | 4.76E+00 |
| ltd | -2.13E-01 | -1.49E-01 | -2.35E-01 | -1.72E-01 | -1.95E-01 | -1.31E-01 | -1.61E-01 | -9.46E-02 | -1.33E-01 | -6.79E-02 | -1.22E-01 | -5.62E-02 | -8.75E-02 | -1.91E-02 | -3.75E-02 | 3.25E-02 |
| crd | -9.36E-02 | -5.96E-02 | -8.80E-02 | -5.41E-02 | -7.43E-02 | -3.89E-02 | -7.05E-02 | -3.56E-02 | -6.72E-02 | -3.38E-02 | -5.03E-02 | -1.62E-02 | -5.31E-02 | -1.56E-02 | -6.19E-02 | -2.44E-02 |
| ed | -6.03E-02 | -3.15E-02 | -5.41E-02 | -2.56E-02 | -5.28E-02 | -2.43E-02 | -4.32E-02 | -1.42E-02 | -4.53E-02 | -1.68E-02 | -3.98E-02 | -1.09E-02 | -3.60E-02 | -6.22E-03 | -3.66E-02 | -5.85E-03 |
| sd | 9.09E-03 | 4.24E-02 | 1.25E-02 | 4.58E-02 | 1.66E-02 | 4.89E-02 | 1.96E-03 | 3.48E-02 | 5.42E-03 | 3.81E-02 | 6.32E-03 | 3.95E-02 | 5.15E-03 | 3.87E-02 | 1.62E-02 | 5.11E-02 |
| add | -8.37E-03 | 5.40E-02 | -2.19E-03 | 5.92E-02 | 1.04E-03 | 6.29E-02 | -1.79E-02 | 4.59E-02 | -2.65E-02 | 3.65E-02 | -2.39E-02 | 3.83E-02 | -1.14E-02 | 5.14E-02 | -2.01E-02 | 4.69E-02 |
| bad | 8.71E-02 | 1.47E-01 | 5.68E-02 | 1.15E-01 | 7.60E-02 | 1.34E-01 | 5.69E-02 | 1.17E-01 | 5.58E-02 | 1.14E-01 | 3.68E-02 | 9.48E-02 | 5.23E-02 | 1.12E-01 | 7.35E-02 | 1.36E-01 |
| hdd | -1.03E-01 | 3.67E-01 | -2.10E-01 | 2.55E-01 | -2.83E-01 | 1.42E-01 | -2.06E-01 | 2.52E-01 | -9.65E-02 | 2.49E-01 | 5.22E-02 | 3.95E-01 | -1.17E-02 | 3.71E-01 | -2.92E-01 | 1.84E-01 |
| mad | 1.16E-01 | 2.88E-01 | 1.86E-02 | 1.98E-01 | -2.53E-05 | 1.93E-01 | 2.84E-02 | 2.03E-01 | 4.65E-02 | 2.09E-01 | 2.48E-03 | 1.75E-01 | 7.39E-02 | 2.76E-01 | 8.48E-02 | 2.69E-01 |
| phd | -2.64E-02 | 3.22E-01 | 1.80E-02 | 3.98E-01 | -7.78E-02 | 2.80E-01 | -1.27E-01 | 2.60E-01 | 7.16E-02 | 4.58E-01 | 4.77E-02 | 4.48E-01 | -1.63E-01 | 2.25E-01 | -4.75E-03 | 3.47E-01 |
| pexp | 9.18E-04 | 2.60E-03 | -2.96E-04 | 1.39E-03 | 7.21E-04 | 2.36E-03 | 1.34E-03 | 3.02E-03 | 1.86E-03 | 3.55E-03 | 5.88E-04 | 2.30E-03 | 1.72E-03 | 3.43E-03 | 3.58E-03 | 5.36E-03 |
| pexp2 | -4.98E-05 | -1.90E-05 | -1.85E-05 | 1.24E-05 | -2.41E-05 | 6.41E-06 | -4.10E-05 | -9.78E-06 | -7.51E-05 | -4.41E-05 | -5.24E-05 | -2.06E-05 | -6.59E-05 | -3.40E-05 | -1.26E-04 | -9.32E-05 |
| sex | 2.18E-02 | 4.47E-02 | 2.86E-02 | 5.15E-02 | 3.95E-02 | 6.24E-02 | 3.73E-02 | 6.04E-02 | 4.49E-02 | 6.75E-02 | 5.23E-02 | 7.54E-02 | 4.75E-02 | 7.15E-02 | 3.68E-02 | 6.14E-02 |
| ld | -1.55E-01 | -4.67E-02 | -3.98E-02 | 7.73E-02 | -3.54E-02 | 8.39E-02 | 9.35E-02 | 2.13E-01 | 1.33E-02 | 1.27E-01 | 1.86E-02 | 1.31E-01 | 1.66E-02 | 1.25E-01 | 2.63E-03 | 1.08E-01 |
| td | -3.54E-02 | 2.29E-02 | 2.81E-04 | 5.83E-02 | -1.79E-02 | 4.02E-02 | -3.50E-03 | 5.62E-02 | -2.56E-02 | 3.16E-02 | 3.58E-02 | 9.36E-02 | 1.51E-02 | 7.55E-02 | -1.11E-02 | 5.17E-02 |
| rd | 5.03E-02 | 1.01E-01 | 5.76E-02 | 1.07E-01 | 7.69E-02 | 1.25E-01 | 6.82E-02 | 1.17E-01 | 7.66E-02 | 1.24E-01 | 8.87E-02 | 1.36E-01 | 6.46E-02 | 1.14E-01 | 5.31E-02 | 1.04E-01 |
| vd | 7.84E-02 | 1.32E-01 | 8.90E-02 | 1.42E-01 | 8.48E-02 | 1.37E-01 | 8.20E-02 | 1.36E-01 | 1.24E-01 | 1.78E-01 | 1.12E-01 | 1.63E-01 | 6.98E-02 | 1.24E-01 | 6.70E-02 | 1.24E-01 |
| ad | -7.10E-02 | -1.69E-02 | -5.97E-02 | -9.46E-03 | -8.98E-02 | -3.89E-02 | -1.12E-01 | -7.12E-02 | -1.82E-01 | -1.37E-01 | -1.48E-01 | -1.06E-01 | -1.97E-01 | -1.52E-01 | -2.21E-01 | -1.73E-01 |
| md | 4.08E-02 | 1.11E-01 | 2.75E-02 | 9.57E-02 | 4.00E-02 | 1.09E-01 | 6.45E-02 | 1.37E-01 | 4.70E-02 | 1.12E-01 | 4.10E-02 | 1.07E-01 | 2.60E-02 | 9.48E-02 | 2.05E-02 | 9.26E-02 |
| wbgd | -1.30E-01 | -1.06E-01 | -1.38E-01 | -1.14E-01 | -8.30E-02 | -5.95E-02 | -6.50E-02 | -4.12E-02 | -1.10E-01 | -8.68E-02 | -1.06E-01 | -8.23E-02 | -5.45E-02 | -3.01E-02 | -3.82E-01 | -3.56E-01 |
| isd | -5.31E-02 | 1.34E-02 | -8.51E-02 | -1.83E-02 | -7.32E-02 | -9.41E-03 | -4.54E-02 | 2.20E-02 | -6.46E-02 | 1.22E-04 | -7.92E-02 | -1.48E-02 | -1.56E-02 | 5.02E-02 | -1.70E-02 | 4.74E-02 |
| cad | -3.19E-01 | -2.92E-01 | -3.29E-01 | -3.02E-01 | -3.48E-01 | -3.20E-01 | -3.36E-01 | -3.09E-01 | -3.43E-01 | -3.16E-01 | -3.41E-01 | -3.14E-01 | -2.75E-01 | -2.47E-01 | -3.60E-01 | -3.30E-01 |
| gd | -1.77E-01 | -4.69E-02 | -1.56E-01 | -3.19E-02 | -9.93E-02 | 1.54E-02 | -1.05E-01 | 9.79E-03 | -1.25E-01 | -1.44E-02 | -1.49E-01 | -3.97E-02 | -1.82E-01 | -6.59E-02 | -1.67E-01 | -3.07E-02 |
| sigma2 | 2.09E-01 | 2.16E-01 | 2.04E-01 | 2.10E-01 | 2.03E-01 | 2.10E-01 | 2.11E-01 | 2.18E-01 | 2.01E-01 | 2.08E-01 | 2.06E-01 | 2.12E-01 | 2.21E-01 | 2.28E-01 | 2.13E-01 | 2.20E-01 |

Table 4.7 continued

| year | 2008 | | | | | | | | 2009 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper |
| intercept | 4.76E+00 | 4.81E+00 | 4.89E+00 | 4.94E+00 | 4.38E+00 | 4.42E+00 | 4.73E+00 | 4.78E+00 | 4.47E+00 | 4.51E+00 | 4.74E+00 | 4.79E+00 | 4.47E+00 | 4.52E+00 | 4.45E+00 | 4.50E+00 |
| ltd | -5.79E-02 | 9.47E-03 | -1.10E-01 | -3.52E-02 | -7.88E-02 | -9.59E-03 | -9.02E-02 | -1.82E-02 | -1.62E-02 | 5.21E-02 | -8.41E-02 | -8.60E-05 | -6.36E-02 | 1.13E-02 | -8.11E-03 | 6.66E-02 |
| crd | -4.06E-02 | -5.21E-03 | -4.19E-02 | -2.30E-03 | -2.97E-02 | 7.45E-03 | -5.05E-02 | -1.24E-02 | -9.23E-03 | 2.57E-02 | -2.77E-02 | 1.26E-02 | -2.82E-02 | 1.16E-02 | 1.75E-04 | 3.86E-02 |
| ed | -2.72E-02 | 2.35E-03 | -2.36E-02 | 8.76E-03 | -9.38E-03 | 2.00E-02 | -2.59E-02 | 5.20E-03 | -1.05E-02 | 1.85E-02 | -2.53E-02 | 8.23E-03 | -1.87E-03 | 3.01E-02 | 8.33E-03 | 3.99E-02 |
| sd | 2.32E-02 | 5.69E-02 | 5.09E-03 | 4.14E-02 | 2.60E-02 | 5.80E-02 | 3.42E-02 | 6.89E-02 | 2.34E-02 | 5.54E-02 | 1.87E-02 | 5.56E-02 | 2.78E-02 | 6.22E-02 | 4.08E-02 | 7.50E-02 |
| add | 8.42E-03 | 7.17E-02 | -4.83E-03 | 6.38E-02 | 2.68E-02 | 8.85E-02 | 2.36E-02 | 9.09E-02 | 4.25E-03 | 6.52E-02 | 3.10E-02 | 1.00E-01 | 2.83E-02 | 9.40E-02 | 4.30E-03 | 7.09E-02 |
| bad | 7.30E-02 | 1.31E-01 | 5.18E-02 | 1.14E-01 | 8.23E-02 | 1.38E-01 | 9.86E-02 | 1.60E-01 | 5.78E-02 | 1.13E-01 | 4.77E-02 | 1.09E-01 | 6.59E-02 | 1.23E-01 | 7.78E-02 | 1.36E-01 |
| hdd | -2.42E-01 | 2.13E-01 | -4.34E-01 | 1.15E-02 | -1.36E-01 | 2.59E-01 | -1.63E-01 | 2.54E-01 | -2.22E-01 | 1.16E-01 | -1.62E-01 | 2.18E-01 | -8.45E-02 | 2.86E-01 | -1.86E-01 | 2.12E-01 |
| mad | 9.04E-02 | 2.44E-01 | 9.37E-02 | 2.69E-01 | 1.09E-01 | 3.00E-01 | 1.63E-01 | 3.61E-01 | 5.05E-02 | 2.11E-01 | 9.27E-02 | 2.71E-01 | 2.86E-02 | 2.06E-01 | 4.29E-02 | 2.24E-01 |
| phd | 3.02E-02 | 3.87E-01 | -1.62E-01 | 2.78E-01 | -2.05E-01 | 2.26E-01 | -8.17E-02 | 3.20E-01 | -3.17E-02 | 3.02E-01 | -5.25E-02 | 2.63E-01 | -7.73E-02 | 2.53E-01 | -3.27E-02 | 2.80E-01 |
| pexp | 1.50E-03 | 3.24E-03 | 1.45E-03 | 3.31E-03 | 1.06E-03 | 2.72E-03 | 4.16E-04 | 2.17E-03 | 6.15E-04 | 2.30E-03 | -1.25E-03 | 7.78E-04 | -1.33E-03 | 4.87E-04 | -5.73E-04 | 1.24E-03 |
| pexp2 | -8.72E-05 | -5.52E-05 | -7.67E-05 | -4.20E-05 | -6.52E-05 | -3.36E-05 | -6.01E-05 | -2.71E-05 | -7.64E-05 | -4.49E-05 | -4.08E-05 | -2.22E-06 | -4.31E-05 | -8.69E-06 | -5.65E-05 | -2.19E-05 |
| sex | 3.75E-02 | 6.09E-02 | 4.19E-02 | 6.73E-02 | 3.91E-02 | 6.24E-02 | 3.43E-02 | 5.87E-02 | 4.06E-02 | 6.36E-02 | 2.47E-02 | 5.14E-02 | 2.98E-02 | 5.49E-02 | 3.37E-02 | 5.85E-02 |
| ld | -5.70E-02 | 4.55E-02 | 4.03E-02 | 1.55E-01 | 3.82E-02 | 1.43E-01 | 1.84E-02 | 1.33E-01 | 2.79E-02 | 1.28E-01 | 1.97E-02 | 1.23E-01 | 7.46E-02 | 1.69E-01 | 6.72E-02 | 1.75E-01 |
| td | -1.60E-02 | 4.26E-02 | 1.71E-02 | 8.20E-02 | 1.18E-02 | 7.08E-02 | 2.46E-03 | 6.51E-02 | 1.40E-02 | 7.33E-02 | 5.51E-02 | 1.23E-01 | 6.78E-02 | 1.33E-01 | 3.34E-02 | 9.88E-02 |
| rd | 6.13E-02 | 1.10E-01 | 6.93E-02 | 1.23E-01 | 1.03E-01 | 1.51E-01 | 8.20E-02 | 1.35E-01 | 9.07E-02 | 1.40E-01 | 8.33E-02 | 1.39E-01 | 1.25E-01 | 1.79E-01 | 9.96E-02 | 1.54E-01 |
| vd | 6.97E-02 | 1.24E-01 | 7.00E-02 | 1.29E-01 | 6.29E-02 | 1.17E-01 | 9.86E-02 | 1.59E-01 | 1.09E-01 | 1.61E-01 | 1.13E-01 | 1.71E-01 | 1.30E-01 | 1.89E-01 | 1.46E-01 | 2.05E-01 |
| ad | -2.34E-01 | -1.85E-01 | -1.45E-01 | -9.50E-02 | -1.02E-01 | -5.27E-02 | -1.05E-01 | -4.86E-02 | -1.40E-01 | -8.69E-02 | -2.23E-01 | -1.66E-01 | -1.70E-01 | -1.10E-01 | -1.67E-01 | -1.08E-01 |
| md | 2.84E-02 | 9.98E-02 | 2.07E-02 | 1.00E-01 | 6.27E-02 | 1.38E-01 | 5.64E-02 | 1.36E-01 | 7.72E-02 | 1.47E-01 | 9.54E-02 | 1.77E-01 | 8.36E-02 | 1.60E-01 | 7.97E-02 | 1.54E-01 |
| wbgd | -4.30E-01 | -4.04E-01 | -5.84E-01 | -5.55E-01 | -7.64E-02 | -5.22E-02 | -4.06E-01 | -3.79E-01 | -1.31E-01 | -1.08E-01 | -3.86E-01 | -3.58E-01 | -1.21E-01 | -9.53E-02 | -1.16E-01 | -9.06E-02 |
| isd | 5.22E-04 | 6.23E-02 | -5.53E-02 | 1.06E-02 | 1.62E-02 | 7.92E-02 | 1.93E-02 | 8.29E-02 | -3.67E-02 | 2.29E-02 | -9.22E-02 | -2.65E-02 | -8.52E-02 | -2.01E-02 | -6.96E-02 | -4.23E-03 |
| cad | -3.14E-01 | -2.86E-01 | -3.53E-01 | -3.22E-01 | -2.40E-01 | -2.12E-01 | -2.77E-01 | -2.47E-01 | -5.43E-01 | -5.15E-01 | -4.69E-01 | -4.34E-01 | -4.97E-01 | -4.65E-01 | -5.84E-01 | -5.53E-01 |
| gd | -1.27E-01 | -9.79E-04 | -1.72E-01 | -3.19E-02 | -1.94E-01 | -7.27E-02 | -2.05E-01 | -6.93E-02 | -4.57E-02 | 5.60E-03 | -1.13E-01 | -5.40E-02 | -1.28E-01 | -7.11E-02 | -8.99E-02 | -3.30E-02 |
| sigma2 | 1.95E-01 | 2.02E-01 | 2.24E-01 | 2.32E-01 | 2.16E-01 | 2.23E-01 | 2.17E-01 | 2.25E-01 | 2.07E-01 | 2.14E-01 | 2.53E-01 | 2.62E-01 | 2.49E-01 | 2.57E-01 | 2.48E-01 | 2.56E-01 |

Table 4.7 continued

| year | 2010 | | | | | | | | 2011 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper | Lower | Upper |
| intercept | 4.53E+00 | 4.58E+00 | 4.56E+00 | 4.61E+00 | 4.58E+00 | 4.63E+00 | 4.62E+00 | 4.67E+00 | 4.53E+00 | 4.58E+00 | 4.56E+00 | 4.61E+00 | 4.58E+00 | 4.63E+00 | 4.62E+00 | 4.67E+00 |
| ltd | -3.22E-02 | 4.68E-02 | -9.27E-02 | -7.73E-03 | -4.95E-02 | 3.60E-02 | -1.06E-02 | 7.27E-02 | -3.22E-02 | 4.68E-02 | -9.27E-02 | -7.73E-03 | -4.95E-02 | 3.60E-02 | -1.06E-02 | 7.27E-02 |
| crd | -1.10E-02 | 2.86E-02 | -4.12E-02 | 1.16E-03 | -3.87E-02 | 5.74E-03 | 2.02E-03 | 4.45E-02 | -1.10E-02 | 2.86E-02 | -4.12E-02 | 1.16E-03 | -3.87E-02 | 5.74E-03 | 2.02E-03 | 4.45E-02 |
| ed | 5.15E-03 | 3.81E-02 | -1.45E-02 | 2.07E-02 | -1.78E-02 | 1.76E-02 | -1.74E-03 | 3.30E-02 | 5.15E-03 | 3.81E-02 | -1.45E-02 | 2.07E-02 | -1.78E-02 | 1.76E-02 | -1.74E-03 | 3.30E-02 |
| sd | 2.87E-02 | 6.47E-02 | 1.69E-02 | 5.56E-02 | 3.32E-02 | 7.13E-02 | 3.39E-02 | 7.07E-02 | 2.87E-02 | 6.47E-02 | 1.69E-02 | 5.56E-02 | 3.32E-02 | 7.13E-02 | 3.39E-02 | 7.07E-02 |
| add | -1.41E-02 | 5.58E-02 | -3.10E-02 | 4.21E-02 | -1.61E-02 | 5.75E-02 | -9.86E-03 | 6.15E-02 | -1.41E-02 | 5.58E-02 | -3.10E-02 | 4.21E-02 | -1.61E-02 | 5.75E-02 | -9.86E-03 | 6.15E-02 |
| bad | 2.90E-02 | 8.98E-02 | 6.97E-03 | 6.99E-02 | 3.30E-02 | 9.57E-02 | 3.57E-02 | 9.64E-02 | 2.90E-02 | 8.98E-02 | 6.97E-03 | 6.99E-02 | 3.30E-02 | 9.57E-02 | 3.57E-02 | 9.64E-02 |
| hdd | -2.35E-01 | 8.38E-02 | -1.25E-01 | 2.24E-01 | -2.78E-01 | 1.01E-01 | -2.52E-01 | 1.23E-01 | -2.35E-01 | 8.38E-02 | -1.25E-01 | 2.24E-01 | -2.78E-01 | 1.01E-01 | -2.52E-01 | 1.23E-01 |
| mad | -4.84E-02 | 1.29E-01 | -6.66E-02 | 1.05E-01 | 2.59E-02 | 1.98E-01 | 6.57E-02 | 2.27E-01 | -4.84E-02 | 1.29E-01 | -6.66E-02 | 1.05E-01 | 2.59E-02 | 1.98E-01 | 6.57E-02 | 2.27E-01 |
| phd | 6.74E-02 | 4.11E-01 | 1.24E-02 | 3.46E-01 | -1.64E-01 | 1.78E-01 | -1.74E-01 | 1.72E-01 | 6.74E-02 | 4.11E-01 | 1.24E-02 | 3.46E-01 | -1.64E-01 | 1.78E-01 | -1.74E-01 | 1.72E-01 |
| pexp | -5.96E-04 | 1.33E-03 | -2.19E-03 | -1.28E-04 | -1.86E-03 | 1.55E-04 | -8.28E-04 | 1.16E-03 | -5.96E-04 | 1.33E-03 | -2.19E-03 | -1.28E-04 | -1.86E-03 | 1.55E-04 | -8.28E-04 | 1.16E-03 |
| pexp2 | -5.10E-05 | -1.48E-05 | -1.96E-05 | 1.95E-05 | -4.21E-05 | -3.73E-06 | -6.18E-05 | -2.42E-05 | -5.10E-05 | -1.48E-05 | -1.96E-05 | 1.95E-05 | -4.21E-05 | -3.73E-06 | -6.18E-05 | -2.42E-05 |
| sex | 1.53E-02 | 4.14E-02 | 7.90E-03 | 3.56E-02 | 2.71E-02 | 5.49E-02 | 3.69E-02 | 6.40E-02 | 1.53E-02 | 4.14E-02 | 7.90E-03 | 3.56E-02 | 2.71E-02 | 5.49E-02 | 3.69E-02 | 6.40E-02 |
| ld | 3.42E-02 | 1.34E-01 | -1.14E-02 | 1.02E-01 | 4.73E-02 | 1.67E-01 | 2.38E-02 | 1.40E-01 | 3.42E-02 | 1.34E-01 | -1.14E-02 | 1.02E-01 | 4.73E-02 | 1.67E-01 | 2.38E-02 | 1.40E-01 |
| td | 4.48E-02 | 1.13E-01 | 2.52E-02 | 9.67E-02 | 1.36E-02 | 8.63E-02 | 7.16E-02 | 1.41E-01 | 4.48E-02 | 1.13E-01 | 2.52E-02 | 9.67E-02 | 1.36E-02 | 8.63E-02 | 7.16E-02 | 1.41E-01 |
| rd | 6.30E-02 | 1.20E-01 | 8.23E-02 | 1.42E-01 | 1.11E-01 | 1.72E-01 | 1.07E-01 | 1.65E-01 | 6.30E-02 | 1.20E-01 | 8.23E-02 | 1.42E-01 | 1.11E-01 | 1.72E-01 | 1.07E-01 | 1.65E-01 |
| vd | 1.19E-01 | 1.78E-01 | 1.43E-01 | 2.07E-01 | 1.29E-01 | 1.93E-01 | 1.44E-01 | 2.07E-01 | 1.19E-01 | 1.78E-01 | 1.43E-01 | 2.07E-01 | 1.29E-01 | 1.93E-01 | 1.44E-01 | 2.07E-01 |
| ad | -1.45E-01 | -7.90E-02 | -1.20E-01 | -5.42E-02 | -1.20E-01 | -4.88E-02 | -2.04E-01 | -1.40E-01 | -1.45E-01 | -7.90E-02 | -1.20E-01 | -5.42E-02 | -1.20E-01 | -4.88E-02 | -2.04E-01 | -1.40E-01 |
| md | 7.53E-02 | 1.55E-01 | 7.31E-02 | 1.60E-01 | 7.54E-02 | 1.69E-01 | 8.37E-02 | 1.74E-01 | 7.53E-02 | 1.55E-01 | 7.31E-02 | 1.60E-01 | 7.54E-02 | 1.69E-01 | 8.37E-02 | 1.74E-01 |
| wbgd | -1.71E-01 | -1.45E-01 | -1.85E-01 | -1.57E-01 | -1.97E-01 | -1.69E-01 | -2.71E-01 | -2.43E-01 | -1.71E-01 | -1.45E-01 | -1.85E-01 | -1.57E-01 | -1.97E-01 | -1.69E-01 | -2.71E-01 | -2.43E-01 |
| isd | -5.20E-02 | 1.59E-02 | -1.14E-01 | -3.96E-02 | -8.82E-02 | -1.40E-02 | -6.39E-02 | 7.44E-03 | -5.20E-02 | 1.59E-02 | -1.14E-01 | -3.96E-02 | -8.82E-02 | -1.40E-02 | -6.39E-02 | 7.44E-03 |
| cad | -6.03E-01 | -5.71E-01 | -4.93E-01 | -4.57E-01 | -4.82E-01 | -4.46E-01 | -5.27E-01 | -4.92E-01 | -6.03E-01 | -5.71E-01 | -4.93E-01 | -4.57E-01 | -4.82E-01 | -4.46E-01 | -5.27E-01 | -4.92E-01 |
| gd | -8.05E-02 | -2.15E-02 | -8.49E-02 | -2.26E-02 | -9.94E-02 | -3.61E-02 | -1.40E-01 | -7.94E-02 | -8.05E-02 | -2.15E-02 | -8.49E-02 | -2.26E-02 | -9.94E-02 | -3.61E-02 | -1.40E-01 | -7.94E-02 |
| sigma2 | 2.70E-01 | 2.79E-01 | 3.03E-01 | 3.13E-01 | 2.96E-01 | 3.06E-01 | 2.80E-01 | 2.89E-01 | 2.70E-01 | 2.79E-01 | 3.03E-01 | 3.13E-01 | 2.96E-01 | 3.06E-01 | 2.80E-01 | 2.89E-01 |

Table 4.8 : Estimates of logit equation and Estimates of Heckman correction

| year | 2006 | | | | | | | | 2007 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit |
| intercept | -3.95851 | 5.3074738 | -3.872 | 5.588599 | -3.42391 | 5.1893893 | -3.112 | 4.941801 | -3.669 | 5.2919459 | -3.089 | 4.7893211 | -3.081 | 4.9896331 | -3.94 | 5.7877003 |
| yerschol | -0.12438 | 0.0438973 | -0.119 | 0.05442 | -0.11166 | 0.0381523 | -0.1333 | 0.032608 | -0.1858 | 0.0501473 | -0.1487 | 0.0220316 | -0.1121 | 0.0199762 | -0.1253 | 0.0290052 |
| S2 | 0.010837 | -0.0026496 | 0.01031 | -0.003463 | 0.009514 | -0.0023133 | 0.01024 | -0.00191 | 0.01357 | -0.0031302 | 0.01072 | -0.0011079 | 0.008689 | -0.0012589 | 0.01037 | -0.0021817 |
| age | 0.32323 | -0.0830847 | 0.3183 | -0.106401 | 0.294401 | -0.077922 | 0.2586 | -0.053552 | 0.325 | -0.0823464 | 0.29 | -0.0391149 | 0.2801 | -0.0570091 | 0.3175 | -0.0852751 |
| age2 | -0.0038 | 0.0009564 | -0.00375 | 0.00124 | -0.00351 | 0.0009246 | -0.00306 | 0.000625 | -0.00382 | 0.0009417 | -0.00343 | 0.0004411 | -0.00331 | 0.0006548 | -0.00374 | 0.0009672 |
| sex | -2.5365 | 0.6675893 | -2.447 | 0.825072 | -2.48765 | 0.6851834 | -1.978 | 0.450106 | -2.258 | 0.6389748 | -2.223 | 0.3694442 | -2.259 | 0.5348703 | -2.132 | 0.662326 |
| ld | | -0.0999725 | | 0.008002 | | 0.0165355 | | 0.144194 | | 0.063576 | | 0.060741 | | 0.065161 | | 0.0496157 |
| td | | -0.0049037 | | 0.021114 | | 0.0063841 | | 0.020871 | | -0.0095737 | | 0.0467005 | | 0.0370929 | | 0.0146583 |
| rd | | 0.0677448 | | 0.076228 | | 0.0942449 | | 0.083904 | | 0.0895684 | | 0.1008049 | | 0.0802126 | | 0.0713756 |
| vd | | 0.0946658 | | 0.105608 | | 0.10365 | | 0.09857 | | 0.1379402 | | 0.1256786 | | 0.0868568 | | 0.0867178 |
| ad | | -0.0507017 | | -0.041024 | | -0.0692111 | | -0.098205 | | -0.1694816 | | -0.1357744 | | -0.1808288 | | -0.204317 |
| md | | 0.0650945 | | 0.049116 | | 0.0650032 | | 0.086497 | | 0.0667563 | | 0.0594811 | | 0.0487952 | | 0.0478977 |
| wbgd | 0.787751 | -0.3159691 | 0.8927 | -0.412078 | 1.004056 | -0.3280732 | 0.8862 | -0.233746 | 0.5432 | -0.2388557 | 0.6639 | -0.1862558 | 0.7188 | -0.1946377 | 0.6326 | -0.5522358 |
| isd | | -0.0250822 | | -0.054879 | | -0.0461786 | | -0.016669 | | -0.0400529 | | -0.0548543 | | 0.0097938 | | 0.0081034 |
| cad | -0.15425 | -0.266496 | -0.1703 | -0.259936 | -0.1771 | -0.2872159 | -0.3464 | -0.24984 | -0.2676 | -0.2583391 | -0.2882 | -0.2858718 | -0.1725 | -0.2227517 | -0.2696 | -0.2654761 |
| gd | | -0.1155801 | | -0.100135 | | -0.0485636 | | -0.054604 | | -0.0762946 | | -0.1009023 | | -0.1291444 | | -0.1033716 |
| msd | 0.332451 | | 0.2521 | | 0.304926 | | 0.3701 | | 0.2662 | | 0.3613 | | 0.2648 | | 0.1845 | |
| logit (λ) | | 0.2526566 | | 0.323431 | | 0.2573597 | | 0.206023 | | 0.2613864 | | 0.1406837 | | 0.2133516 | | 0.2899684 |

Table 4.8 Continued

| year | 2008 | | | | | | | | 2009 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit |
| intercept | -4.042 | 5.857274 | -3.814 | 5.8848511 | -3.524 | 5.483321 | -4.203 | 6.084537 | -4.129 | 5.3153153 | -3.716 | 5.3489501 | -3.954 | 5.288814 | -4.164 | 5.4153073 |
| yerschol | -0.1291 | 0.0280333 | -0.1316 | 0.0383527 | -0.1188 | 0.031622 | -0.1369 | 0.037147 | -0.1444 | 0.0168484 | -0.1807 | 0.0205338 | -0.1207 | 0.0182133 | -0.1455 | 0.0122411 |
| S2 | 0.01099 | -0.0021544 | 0.01036 | -0.0025738 | 0.009981 | -0.002407 | 0.01227 | -0.003015 | 0.01299 | -0.0016674 | 0.01376 | -0.0013079 | 0.01106 | -0.0014205 | 0.01227 | -0.0012767 |
| age | 0.3258 | -0.0864071 | 0.2836 | -0.0747659 | 0.2867 | -0.087996 | 0.3021 | -0.096016 | 0.3198 | -0.0599477 | 0.3182 | -0.0491851 | 0.3101 | -0.0619742 | 0.3321 | -0.068863 |
| age2 | -0.00379 | 0.0009688 | -0.00332 | 0.0008469 | -0.00342 | 0.001019 | -0.00359 | 0.001109 | -0.00376 | 0.0006668 | -0.0038 | 0.0005549 | -0.00374 | 0.0007087 | -0.00402 | 0.0007904 |
| sex | -0.00379 | 0.6610533 | -2.078 | 0.60541 | -2.28 | 0.745182 | -2.111 | 0.718964 | -2.312 | 0.498977 | -2.441 | 0.3967092 | -2.497 | 0.5147213 | -2.486 | 0.546826 |
| ld | | -0.0149075 | | 0.1012491 | | 0.086104 | | 0.072565 | | 0.0737714 | | 0.0763409 | | 0.1099855 | | 0.1071205 |
| td | | 0.0044791 | | 0.056743 | | 0.047208 | | 0.035189 | | 0.0411838 | | 0.0932551 | | 0.097875 | | 0.0533426 |
| rd | | 0.0765987 | | 0.0882279 | | 0.115429 | | 0.10039 | | 0.1064419 | | 0.1092322 | | 0.1432478 | | 0.1144599 |
| vd | | 0.0862683 | | 0.0908827 | | 0.078931 | | 0.119098 | | 0.12507 | | 0.1396331 | | 0.1490348 | | 0.1599013 |
| ad | | -0.2200749 | | -0.1269412 | | -0.087748 | | -0.087323 | | -0.1231391 | | -0.2046945 | | -0.1480092 | | -0.1514714 |
| md | | 0.0532276 | | 0.0497085 | | 0.08503 | | 0.081409 | | 0.098788 | | 0.1303037 | | 0.1090005 | | 0.1010709 |
| wbgd | 0.5462 | -0.5660268 | 1.089 | -0.8589371 | 0.8794 | -0.333266 | 0.9369 | -0.692373 | 0.7637 | -0.2690552 | 1.061 | -0.5323712 | 1.151 | -0.3261751 | 1.081 | -0.3223031 |
| isd | | 0.0231517 | | -0.0300992 | | 0.038842 | | 0.041958 | | -0.016907 | | -0.0678156 | | -0.0618352 | | -0.0492005 |
| cad | -0.1696 | -0.2527431 | -0.1923 | -0.2848346 | -0.1153 | -0.189459 | -0.07253 | -0.23725 | -0.09497 | -0.5106264 | -0.1104 | -0.43365 | -0.1024 | -0.4601333 | -0.1423 | -0.5386093 |
| gd | | -0.072622 | | -0.1084511 | | -0.139299 | | -0.141914 | | -0.0267442 | | -0.0884639 | | -0.1064835 | | -0.0689355 |
| msd | 0.2157 | | 0.263 | | 0.2824 | | 0.2078 | | 0.2357 | | 0.3399 | | 0.3918 | | 0.4095 | |
| logit (λ) | | 0.2752953 | | 0.26798 | | 0.307464 | | 0.321292 | | 0.1964823 | | 0.1498463 | | 0.191529 | | 0.2047853 |

Table 4.8 Continued

| year | 2010 | | | | | | | | 2011 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit | Logit | Heckman Logit |
| intercept | -3.845 | 5.1151235 | -3.959 | 5.182967 | -4.099 | 5.1006312 | -4.026 | 5.2874368 | -3.91523 | 5.356597 | -3.808 | 5.951996 | -3.625 | 5.655347 | -3.63 | 5.651681 |
| yerschol | -0.152 | 0.0114163 | -0.1518 | 0.0225143 | -0.1081 | 0.0083784 | -0.1526 | 0.0073659 | -0.13238 | 0.0141274 | -0.1033 | 0.02482 | -0.1008 | 0.009324 | -0.1369 | 0.024214 |
| S2 | 0.01226 | -0.0009885 | 0.01221 | -0.0014768 | 0.01024 | -0.0005679 | 0.0126 | -0.0007511 | 0.01142 | -0.0012668 | 0.009476 | -0.002361 | 0.009401 | -0.001219 | 0.01076 | -0.001917 |
| age | 0.3362 | -0.0451317 | 0.3278 | -0.0509535 | 0.3247 | -0.0394579 | 0.3189 | -0.0456795 | 0.341045 | -0.0669694 | 0.3495 | -0.123859 | 0.3283 | -0.089276 | 0.3245 | -0.091822 |
| age2 | -0.00406 | 0.0005101 | -0.00398 | 0.0005903 | -0.00395 | 0.0004421 | -0.00385 | 0.0005073 | -0.0041 | 0.0007583 | -0.00415 | 0.001428 | -0.00392 | 0.001018 | -0.00386 | 0.001038 |
| sex | -2.682 | 0.380143 | -2.508 | 0.3796475 | -2.617 | 0.3395251 | -2.461 | 0.3882867 | -2.68804 | 0.5334642 | -2.708 | 0.957517 | -2.585 | 0.702544 | -2.42 | 0.699178 |
| ld | | 0.0642603 | | 0.0276046 | | 0.0914704 | | 0.0613629 | | 0.0882091 | | 0.038535 | | 0.014593 | | 0.034118 |
| td | | 0.0647754 | | 0.0449546 | | 0.0334817 | | 0.0885681 | | 0.0845047 | | 0.044458 | | 0.038656 | | 0.048579 |
| rd | | 0.0796158 | | 0.1025722 | | 0.1334371 | | 0.1246651 | | 0.129954 | | 0.121364 | | 0.124987 | | 0.098937 |
| vd | | 0.1328232 | | 0.1645467 | | 0.1531321 | | 0.1653783 | | 0.1742975 | | 0.19445 | | 0.16744 | | 0.159574 |
| ad | | -0.1256365 | | -0.0936839 | | -0.0907287 | | -0.1807038 | | -0.1634875 | | -0.13581 | | -0.180748 | | -0.110632 |
| md | | 0.0941961 | | 0.1018369 | | 0.1097323 | | 0.1121645 | | 0.1334392 | | 0.145971 | | 0.086318 | | 0.075596 |
| wbgd | 0.9355 | -0.2825325 | 1.15 | -0.3363163 | 1.069 | -0.3053748 | 1.175 | -0.420606 | 0.798852 | -0.3039459 | 0.759 | -0.403088 | 0.7035 | -0.297926 | 0.895 | -0.339095 |
| isd | | -0.0320069 | | -0.0865835 | | -0.0596705 | | -0.0386712 | | -0.0394659 | | -0.09015 | | -0.072436 | | -0.055936 |
| cad | -0.187 | -0.5605654 | -0.2857 | -0.4322422 | -0.2218 | -0.4375293 | -0.2707 | -0.47129 | -0.21107 | -0.4358964 | -0.2859 | -0.364243 | -0.2029 | -0.400607 | -0.2835 | -0.354774 |
| gd | | -0.0630957 | | -0.0640069 | | -0.074102 | | -0.11852 | | -0.1369259 | | -0.063793 | | -0.071132 | | -0.070833 |
| msd | 0.5131 | | 0.4385 | | 0.4772 | | 0.5117 | | 0.501188 | | 0.2447 | | 0.2894 | | 0.3041 | |
| logit (λ) | | 0.1345686 | | 0.1450383 | | 0.1156071 | | 0.1403624 | | 0.1840251 | | 0.342573 | | 0.26267 | | 0.273668 |

Table 4.9 : Estimates of probit equation and Estimates of Heckman correction

| year | 2006 | | | | | | | | 2007 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Logit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit |
| intercept | -2.193 | 4.334 | -2.131 | 4.3588468 | -1.863 | 4.313 | -1.698 | 4.357 | -1.98 | 4.289 | -1.691 | 4.319 | -1.662 | 4.274 | -2.137 | 4.5725743 |
| yerschol | -0.07498 | 0.01835 | -0.06788 | 0.0213535 | -0.06447 | 0.01463 | -0.07775 | 0.01229 | -0.1093 | 0.004802 | -0.08527 | 0.003163 | -0.06753 | -0.001822 | -0.07387 | -0.0060011 |
| S2 | 0.006455 | -0.0003491 | 0.005975 | -0.0005373 | 0.005581 | -0.0002476 | 0.006003 | -0.0003227 | 0.007988 | 0.0001966 | 0.006214 | 0.000259 | 0.0052 | 0.0004584 | 0.006085 | 0.0007447 |
| age | 0.1794 | -0.004754 | 0.1739 | -0.0062751 | 0.1592 | -0.003871 | 0.1397 | -0.005877 | 0.1763 | 0.005563 | 0.1577 | 0.004076 | 0.1524 | 0.007022 | 0.1729 | 0.0124185 |
| age2 | -0.00208 | 0.00004755 | -0.00202 | 0.0000732 | -0.00187 | 0.00005389 | -0.00164 | 0.00007071 | -0.00204 | -0.00008228 | -0.00184 | -0.00006245 | -0.00177 | -0.00009254 | -0.00201 | -0.000174 |
| sex | -1.452 | 0.09023 | -1.394 | 0.0931748 | -1.417 | 0.0996 | -1.122 | 0.1176 | -1.289 | 0.06117 | -1.259 | 0.06514 | -1.289 | 0.05051 | -1.221 | 0.0320097 |
| ld | | -0.07445 | | 0.0311597 | | 0.03387 | | 0.1646 | | 0.07509 | | 0.06919 | | 0.07349 | | 0.0559873 |
| td | | 0.0111 | | 0.0354692 | | 0.02007 | | 0.03486 | | -0.0008393 | | 0.0528 | | 0.04302 | | 0.0192373 |
| rd | | 0.07923 | | 0.0854699 | | 0.1023 | | 0.09244 | | 0.09228 | | 0.1032 | | 0.08207 | | 0.0714516 |
| vd | | 0.1095 | | 0.1193385 | | 0.1141 | | 0.1103 | | 0.1434 | | 0.1287 | | 0.08977 | | 0.0869608 |
| ad | | -0.0454 | | -0.0343879 | | -0.0645 | | -0.09382 | | -0.1671 | | -0.1339 | | -0.1798 | | -0.202962 |
| md | | 0.08153 | | 0.0649959 | | 0.07784 | | 0.101 | | 0.07041 | | 0.06348 | | 0.0511 | | 0.0478813 |
| wbgd | 0.4573 | -0.1388 | 0.5192 | -0.1475719 | 0.5864 | -0.09333 | 0.5274 | -0.08736 | 0.3183 | -0.1013 | 0.3948 | -0.09592 | 0.421 | -0.04069 | 0.3732 | -0.365849 |
| isd | | -0.01656 | | -0.0495659 | | -0.04066 | | -0.009754 | | -0.03858 | | -0.05339 | | 0.01061 | | 0.0076228 |
| cad | -0.09627 | -0.302 | -0.1073 | -0.3110186 | -0.1098 | -0.3296 | -0.2105 | -0.308 | -0.1565 | -0.3284 | -0.1745 | -0.3263 | -0.1065 | -0.261 | -0.1644 | -0.3467882 |
| gd | | -0.1106 | | -0.0931623 | | -0.04285 | | -0.04984 | | -0.07194 | | -0.0986 | | -0.1267 | | -0.1010919 |
| msd | 0.1845 | | 0.1499 | | 0.1787 | | 0.2235 | | 0.1555 | | 0.2067 | | 0.1516 | | 0.1146 | |
| Probit(λ) | | 0.01915 | | 0.0193151 | | 0.01758 | | 0.03297 | | 0.00407 | | 0.00276 | | -0.001568 | | -0.005216 |

Table 4.9 Continued

| year | 2008 | | | | | | | | 2009 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit |
| intercept | -2.195 | 4.5536941 | -2.099 | 4.7605311 | -1.923 | 4.236463 | -2.257 | 4.5739038 | -2.225 | 4.303999 | -2.015 | 4.6403019 | -2.088 | 4.3582661 | -2.219 | 4.4410119 |
| yerschol | -0.07738 | -0.0091097 | -0.07662 | 0.0041973 | -0.07579 | -0.0052651 | -0.08619 | -0.0075132 | -0.08951 | -0.0150516 | -0.1052 | -0.0096279 | -0.07285 | -0.0046815 | -0.09267 | -0.0161942 |
| S2 | 0.006508 | 0.0010491 | 0.006048 | 0.0001394 | 0.006119 | 0.0007062 | 0.007413 | 0.0010291 | 0.00777 | 0.0012265 | 0.00801 | 0.0009903 | 0.006564 | 0.0007576 | 0.007522 | 0.0011637 |
| age | 0.1782 | 0.0187563 | 0.1554 | 0.0089276 | 0.1587 | 0.0135374 | 0.1638 | 0.013216 | 0.1751 | 0.0190394 | 0.1735 | 0.0113435 | 0.1645 | 0.0108869 | 0.1795 | 0.0085253 |
| age2 | -0.00205 | -0.0002461 | -0.0018 | -0.0001233 | -0.00187 | -0.0001788 | -0.00193 | -0.0001786 | -0.00203 | -0.0002547 | -0.00204 | -0.0001601 | -0.00195 | -0.000156 | -0.00214 | -0.0001317 |
| sex | -1.288 | -0.0309843 | -1.18 | 0.0305204 | -1.297 | -0.0061769 | -1.197 | -0.0071222 | -1.319 | -0.0404982 | -1.395 | -0.0315426 | -1.413 | -0.0213037 | -1.401 | 0.0161328 |
| ld | | -0.0197785 | | 0.107923 | | 0.0921676 | | 0.073931 | | 0.0648291 | | 0.0737926 | | 0.1097487 | | 0.1149439 |
| td | | 0.0034211 | | 0.0616742 | | 0.0495643 | | 0.0352778 | | 0.0354414 | | 0.0919569 | | 0.0990706 | | 0.0597039 |
| rd | | 0.0713934 | | 0.089866 | | 0.1169249 | | 0.0981787 | | 0.0996139 | | 0.1056618 | | 0.1396623 | | 0.1139515 |
| vd | | 0.0798227 | | 0.0920435 | | 0.0767071 | | 0.1139146 | | 0.115331 | | 0.1345805 | | 0.1448488 | | 0.1606521 |
| ad | | -0.217858 | | -0.1242964 | | -0.0842069 | | -0.0850166 | | -0.121436 | | -0.2039193 | | -0.1465756 | | -0.1477487 |
| md | | 0.0444239 | | 0.0510922 | | 0.0832984 | | 0.0778087 | | 0.0887755 | | 0.1250846 | | 0.1048806 | | 0.1012054 |
| wbgd | 0.3151 | -0.398552 | 0.6232 | -0.5580299 | 0.5043 | -0.0436249 | 0.5417 | -0.3706001 | 0.4373 | -0.0910761 | 0.6117 | -0.3461449 | 0.665 | -0.078575 | -0.0821 | -0.0916083 |
| isd | | 0.0168433 | | -0.031086 | | 0.0338385 | | 0.037634 | | -0.0250565 | | -0.0723962 | | -0.0661023 | | -0.0494798 |
| cad | -0.09942 | -0.3064732 | -0.1179 | -0.3401918 | -0.07035 | -0.2299902 | -0.051 | -0.2641154 | -0.06131 | -0.5344321 | -0.07447 | -0.4549758 | -0.0632 | -0.4848067 | 0.6234 | -0.5714356 |
| gd | | -0.0682449 | | -0.1033999 | | -0.1314815 | | -0.1361097 | | -0.0260706 | | -0.086014 | | -0.1021766 | | -0.0634192 |
| msd | 0.1286 | | 0.1522 | | 0.1431 | | 0.1204 | | 0.1294 | | 0.1901 | | 0.2116 | | 0.2161 | |
| Probit (λ) | | -0.0276914 | | -0.0084097 | | -0.0194494 | | -0.0194974 | | -0.0307527 | | -0.0221351 | | -0.020165 | | -0.0080703 |

Table 4.9 Continued

| year | 2010 | | | | | | | | 2011 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | Q1 | | Q2 | | Q3 | | Q4 | |
| | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit | Probit | Heckman Probit |
| intercept | -2.068 | 4.608 | -2.117 | 4.501 | 0.115607 | 4.4601999 | -2.162 | 4.704 | -2.07 | 4.534 | -2.023 | 4.4489362 | -1.934 | 4.5869502 | -1.955 | 4.553093 |
| yerschol | -0.09593 | -0.004739 | -0.09005 | 0.0009528 | -0.067 | -0.0045043 | -0.09117 | -0.01071 | -0.08369 | -0.009008 | -0.06546 | -0.0115483 | -0.06855 | -0.0161955 | -0.08446 | -0.0121323 |
| S2 | 0.007464 | 0.0003496 | 0.007126 | 0.0002908 | 0.006079 | 0.0007102 | 0.007405 | 0.0007665 | 0.00693 | 0.000754 | 0.005774 | 0.0010257 | 0.005912 | 0.0012169 | 0.006489 | 0.0009602 |
| age | 0.1841 | -0.00193 | 0.1766 | 0.00499 | 0.1753 | 0.011325 | 0.1719 | -0.00001592 | 0.1847 | 0.003776 | 0.1896 | 0.0131797 | 0.1812 | 0.0064671 | 0.1779 | 0.005326 |
| age2 | -0.00219 | -0.000000684 | -0.00212 | -0.00007759 | -0.00211 | -0.0001652 | -0.00205 | -0.00003207 | -0.00219 | -0.00007762 | -0.00222 | -0.0001855 | -0.00214 | -0.0001136 | -0.00209 | -0.0001035 |
| sex | -1.516 | 0.06637 | -1.416 | -0.009869 | -1.484 | -0.0268564 | -1.396 | 0.07166 | -1.529 | 0.03003 | -1.55 | -0.0508325 | -1.489 | -0.0055905 | -1.39 | 0.020858 |
| ld | | 0.08158 | | 0.03092 | | 0.0885224 | | 0.07553 | | 0.09934 | | 0.0363167 | | 0.0199787 | | 0.0443062 |
| td | | 0.07263 | | 0.04647 | | 0.0327498 | | 0.09631 | | 0.09024 | | 0.0421839 | | 0.0385694 | | 0.0505244 |
| rd | | 0.0866 | | 0.1021 | | 0.1287735 | | 0.1301 | | 0.1324 | | 0.116108 | | 0.1236439 | | 0.0978317 |
| vd | | 0.1433 | | 0.1653 | | 0.1467086 | | 0.1714 | | 0.1767 | | 0.1879792 | | 0.1671409 | | 0.1597294 |
| ad | | -0.1205 | | -0.09155 | | -0.0913371 | | -0.1783 | | -0.1589 | | -0.1344916 | | -0.178586 | | -0.1088193 |
| md | | 0.1081 | | 0.1024 | | 0.1040407 | | 0.1228 | | 0.1421 | | 0.1421544 | | 0.0878047 | | 0.0792051 |
| wbgd | 0.5353 | -0.1738 | 0.6683 | -0.1569 | 0.6244 | -0.1538935 | 0.687 | -0.2696 | 0.4634 | -0.1552 | 0.4431 | -0.1205323 | 0.4106 | -0.106151 | 0.5265 | -0.0893355 |
| isd | | -0.02318 | | -0.08622 | | -0.0642546 | | -0.03192 | | -0.03462 | | -0.0946704 | | -0.072074 | | -0.0516909 |
| cad | -0.1076 | -0.5845 | -0.1737 | -0.4798 | -0.1331 | -0.4711708 | -0.1599 | -0.5072 | -0.1301 | -0.4785 | -0.1672 | -0.4744994 | -0.1195 | -0.4587013 | -0.1696 | -0.4355521 |
| gd | | -0.05304 | | -0.05764 | | -0.0711601 | | -0.1107 | | -0.1276 | | -0.0588325 | | -0.0635941 | | -0.0612356 |
| msd | 0.2699 | | 0.2401 | | 0.2601 | | 0.288 | | 0.2748 | | 0.1423 | | 0.1607 | | 0.178 | |
| Probit (λ) | | 0.01343 | | -0.00947 | | -0.0205898 | | 0.008624 | | -0.003953 | | -0.0255866 | | -0.0102404 | | -0.0067441 |

| Table 4.10: Comparison between Logit Heckman Correction and Probit Heckman Correction | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| year | 2006: Model Comarison | | | | | | | | | |
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | | |
| | HL | HP | HL | HP | HL | HP | HL | HP | | |
| HL | 1.00E+00 | 5.94E+20 | 1.00E+00 | 1.09E+20 | 1.00E+00 | 3.83E+18 | 1.00E+00 | 7.03E+15 | | |
| HP | 1.68E-21 | 1.00E+00 | 9.14E-21 | 1.00E+00 | 2.61E-19 | 1.00E+00 | 1.42E-16 | 1.00E+00 | | |
| | | | | | | | | | | |
| 2007: Model Comarison | | | | | | | | | | |
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | | |
| | HL | HP | HL | HP | HL | HP | HL | HP | | |
| HL | 1.00E+00 | 2.83E+16 | 1.00E+00 | 3.07E+08 | 1.00E+00 | 5.07E+09 | 1.00E+00 | 3.91E+08 | | |
| HP | 3.53E-17 | 1.00E+00 | 3.26E-09 | 1.00E+00 | 1.97E-10 | 1.00E+00 | 2.56E-09 | 1.00E+00 | | |
| | | | | | | | | | | |
| 2008: Model Comparison | | | | | | | | | | |
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | | |
| | HL | HP | HL | HP | HL | HP | HL | HP | | |
| HL | 1.00E+00 | 1.71E+08 | 1.00E+00 | 1.03E+13 | 1.00E+00 | 4.28E+21 | 1.00E+00 | 1.60E+11 | | |
| HP | 5.84E-09 | 1.00E+00 | 9.75E-14 | 1.00E+00 | 2.34E-22 | 1.00E+00 | 6.25E-12 | 1.00E+00 | | |
| | | | | | | | | | | |
| 2009: Model Comparison | | | | | | | | | | |
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | | |
| | HL | HP | HL | HP | HL | HP | HL | HP | | |
| HL | 1.00E+00 | 175.714 | 1.00E+00 | 71153.2 | 1.00E+00 | 3.06E+13 | 1.00E+00 | 1.57E+19 | | |
| HP | 5.69E-03 | 1.00E+00 | 1.41E-05 | 1.00E+00 | 3.26E-14 | 1.00E+00 | 6.37E-20 | 1.00E+00 | | |
| | | | | | | | | | | |
| 2010: Model Comparison | | | | | | | | | | |
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | | |
| | HL | HP | HL | HP | HL | HP | HL | HP | | |
| HL | 1.00E+00 | 2.88E+11 | 1.00E+00 | 1.95E+09 | 1.00E+00 | 46601.6 | 1.00E+00 | 8.03E+11 | | |
| HP | 3.48E-12 | 1.00E+00 | 5.13E-10 | 1.00E+00 | 2.15E-05 | 1.00E+00 | 1.25E-12 | 1.00E+00 | | |
| | | | | | | | | | | |
| 2011: Model Comparison | | | | | | | | | | |
| Quarter | Q1 | | Q2 | | Q3 | | Q4 | | | |
| | HL | HP | HL | HP | HL | HP | HL | HP | | |
| HL | 1.00E+00 | 2.47E+19 | 1.00E+00 | 3.83E+13 | 1.00E+00 | 1.42E+13 | 1.00E+00 | 1.59E+15 | | |
| HP | 4.05E-20 | 1.00E+00 | 2.61E-14 | 1.00E+00 | 7.05E-14 | 1.00E+00 | 6.30E-16 | 1.00E+00 | | |

# Appendix B

## R Codes and Commands

- **Libraries used in our analysis,**

MCMCpack, MASS and LearnBayes.

- **Import Data**

```
dat=read.table("C:\\Users\\Mohsen\\Dropbox\\Photos\\mystudy\\thesis\\LFSD\\excellfsda
ta\\lfsdata2006Q1.csv", header=T, sep=",")
```

- **OLS regression**

```
ols= lm(lnw ~ yerschol + s2 + pexp + pexp2 + sex + ld + td + rd + vd + ad + md + wbgd
+ isd + cad + gd, data = dat).
```

- **Bayesian linear regression**

```
> Posterior= MCMCrgress(lnw ~ yerschol + s2 + pexp + pexp2 + sex + ld + td + rd + vd
+ ad + md + wbgd + isd + cad + gd, data = dat)
```

- **Bayes Factor**

```
> m1<-MCMCregress(formula = lnw ~ yerschol + s2 + pexp + pexp2 + sex + ld + td + rd
+ vd + ad + md + wbgd + isd + cad + gd, data = dat, mcmc = 10000, b0 = 0, B0 = 0.1, c0
= 2, d0 = 0.11, marginal.likelihood = "Chib95")

> m2<-MCMCregress(formula = lnw ~ yerschol + s2 + age + age2 + sex + ld + td + rd +
vd + ad + md + wbgd + isd + cad + gd, data = dat, mcmc = 10000, b0 = 0, B0 = 0.1, c0 =
2, d0 = 0.11, marginal.likelihood = "Chib95")
```

```
> m3<-MCMCregress(lnw~ltd+crd+ed+sd+add+bad+hdd+mad+phd  + pexp + pexp2 + sex + ld +td + rd + vd + ad + md + wbgd + isd + cad + gd, data=dat, mcmc=10000, b0=0, B0=0.1, c0=2,d0=0.11, marginal.likelihood="Chib95")

> BF<-BayesFactor(m1,m2,m3)

> summary(BF)
```

- **HPDI**

```
> HPDIQ1m2<-HPDinterval(m2,  prob=0.95)

> HPDIQ1m2
```

- **Heckman Logit Correction**

```
> logistic<-glm(emd~  yerschol + s2 + age + age2 + sex + msd+ wbgd + cad, family=binomial(  link  = "logit"  ), data=dat)

> p= fitted(logistic)

> logit=log(p/(1-p))

> summary(logistic)

> HLQ16<-MCMCregress(lnw  ~ yerschol  + s2 + age + age2 + sex + ld +  td + rd + vd + ad + md + wbgd + isd + cad + gd+logit,  marginal.likelihood="Chib95",data=dat)

> summary(HLQ16)
```

- **Heckman Probit Correction**

```
> logistic<-glm(emd~  yerschol + s2 + age + age2 + sex + msd+ wbgd + cad, family=binomial(  link  = " probit " ), data=dat)

> p= fitted(logistic)

> probit =log(p/(1-p))

> summary(logistic)

> HLQ16<-MCMCregress(lnw  ~ yerschol  + s2 + age + age2 + sex + ld +  td + rd + vd + ad + md + wbgd + isd + cad + gd+probit,  marginal.likelihood="Chib95",data=dat)

> summary(HPQ16)
```