

How Costly Are Borrowing Costs?: An Analysis of Fiscal Policy Changes During Crises

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Abstract

Financial crises lead to substantial declines in output and consumption in emerging market economies. The fact that fiscal policy is procyclical in these countries shows that the effects of a crisis are exacerbated by spending cuts and tax increases, which are usually attributed to borrowing constraints that they face in bad times. This paper quantitatively analyzes the costs of reduced borrowing in crisis episodes, by studying the effects of expansionary fiscal policies that would have been possible to implement, had the government been able to borrow more. For additional borrowing that keeps the debt-to-GDP ratio of the government at its pre-crisis level, the model with a proportional reduction of taxes on labor income, capital income and consumption reduces output and consumption decline almost by half during the 1997 Korean crisis. When the effects of each tax rate are analyzed separately, labor income tax reduction turns out to be more effective than the other policies, including the proportional tax reduction.

JEL Classification: E32; E62; F32; F41

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1 Introduction

Financial crises have drastic effects on an economy and these effects are especially severe in emerging market economies, where output and consumption decline substantially during crises. A large empirical literature has found that fiscal policy in developing countries is procyclical.¹ Along with the contraction in economic activity during a crisis, governments resort to spending cuts and tax increases, exacerbating the effects of the crisis. This fact has been explained by many papers as being due to credit constraints that these countries face in bad times.² In crisis episodes, these countries experience capital outflows with interest rates increasing to very high levels. The cost of borrowing therefore increases substantially during crises, leading to reduced borrowing, and this reduction entails some costs of its own. Since engaging in expansionary fiscal policy requires additional borrowing, the government's inability to borrow reduces its capability of using expansionary fiscal policy to stimulate the economy. Hence, the costs of reduced borrowing can be measured in terms of foregone increases in output and consumption that could have been attained through a fiscal stimulus. This paper quantitatively analyzes the costs of reduced borrowing in crisis episodes in terms of the effects of expansionary fiscal policy that would have been possible, had the government been able to borrow more.

The paper uses a small open economy version of the neoclassical growth model to quantitatively analyze the effects of expansionary fiscal policy during a financial crisis if the government had access to additional borrowing. The question is analyzed in the context of the 1997 financial crisis in Korea. First, the standard open economy neoclassical model, extended to incorporate distortionary taxes on consumption, labor income and capital income, is used to generate the cyclical fluctuations around the 1997 crisis in Korea. In this benchmark model, the actual tax rates that come from the data are used. Then,

¹See, among others, Gavin and Perotti (1997), Lane (2003), Talvi and Vegh (2005), Kaminsky, Reinhart and Vegh (2004), Ilzetzki and Vegh (2008).

²See Gavin and Perotti (1997), Aizenman, Gavin and Hausmann (1996), and Mendoza and Oviedo (2006).

tax rates are lowered so that the government borrowing increases. The decline in the net foreign debt of the Korean government is about 4.7% of GDP in 1998. By reducing the tax rates and consequently increasing the foreign borrowing of the government by this amount, it is possible to see the effects that the borrowing decline has imposed on the economy. The results of the analysis shows how much of an expansion could have been achieved if the government borrowing had not declined by the amount observed in the data and an expansionary fiscal policy had been implemented instead. In the analysis, all tax rates are reduced proportionally first, and the implications of the model in terms of output, consumption and factors of production are analyzed. Then, the tax rates are reduced one by one and the results are compared in order to see which one of these tax declines is more effective on output and consumption.

The paper compares the implications of the model in which the actually implemented tax rates are used with the one where expansionary fiscal policy is used. In this comparison, the government outlays are held the same. This way, the model does not incorporate a borrowing constraint but the debt level of the government is counterfactually increased by setting the exogenous tax rates lower.

The benchmark model, which uses the actual tax rates, generates the output and consumption patterns observed in the data reasonably well. Then, tax rates are adjusted down proportionally so that the government borrowing increases by 4.7% of output. This model generates higher output, consumption, labor and capital due to lower taxes. However, the cost of lower taxes during the crisis is higher steady-state taxes, which reduce the steady-state variables. The increase in output with the proportional tax cut is 5.5 percentage points from a reduction of 11.6% to 6.1% during the crisis year and the increase in consumption is 6.6 percentage points. Steady-state output and consumption, on the other hand, decline by 2.3% and 2.27%, respectively. In order to analyze the effects of each tax rate separately, tax rates are reduced one at a time as an additional policy experiment. Among these policies, the most effective is a reduction in the labor income tax rate, which

reduces output decline by about 8.6 percentage points and almost completely eliminates the consumption decline. Reducing the capital tax alone has almost no effect, whereas the consumption tax reduction has an intermediate effect, being more effective than the proportional tax cut but less effective compared to the labor tax cut. While these results are valid for additional borrowing equal to 4.7% of output, it has also been shown that completely eliminating the output reduction during the crisis episode requires an additional borrowing of about 10% of output for a proportional tax cut.

Alternative tax policies are also compared in terms of their welfare implications. Relative to the benchmark model, they all lead to a decline in welfare. Therefore, while reduced borrowing of the magnitude observed in the data entails some costs in terms of lower output and consumption in the crisis episode, it is welfare-improving when the long-run effects are taken into account. Among the tax policies considered, the least costly one in terms of welfare is the labor tax reduction. The steady-state values of the model variables are about the same for all policies and labor income tax is the most effective in terms of increasing consumption and output during the crisis. Therefore, it leads to the highest welfare level.

In terms of the model used, this paper follows the literature that aims at explaining large contractions in output using growth accounting and the neoclassical growth model as in Conesa, Kehoe and Ruhl (2007), Bergoeing et al. (2002) and small open economy application of the same methodology in Meza and Quintin (2007). They account for output dynamics using shocks to total factor productivity, interest rates and taxes. Given that the model can account for the dynamics of the macroeconomic variables reasonably well, it can be used to analyze the effects of expansionary fiscal policy quantitatively as in this paper. Using a similar model, Meza (2008) analyzes the effect of fiscal policy changes during the 1995 Mexican crisis. He uses the business cycle accounting methodology to quantify the effects of increased consumption tax and reduced government spending during the crisis. He shows that fiscal policy changes account for 20.7% of the contraction of output, and the increase in the consumption tax rate accounts for most of this contraction. While this

paper also conducts a counterfactual experiment in which the changes in fiscal policy are eliminated to analyze their effects, the link between external borrowing and fiscal policy changes has not been explored. In this sense, the current paper makes a contribution by quantifying the costs of borrowing difficulties experienced in crisis episodes through fiscal policy changes.

Another paper close to the current paper is Ohanian (1997), which evaluates quantitatively the economic effects of the different policies used by the U.S. government to finance World War II and the Korean War. During World War II, government expenditures were financed primarily by issuing debt, whereas during the Korean War, expenditures were financed almost exclusively by higher taxes. The paper studies the implications of financing World War II like the Korean War, and financing the Korean War like World War II. The method used in the current paper is close to Ohanian (1997). However, instead of analyzing the effects of financing war expenditures through borrowing versus taxes, this paper compares these two options in the context of a financial crisis.

The remainder of the paper is organized as follows. Section 2 presents the macroeconomic performance of the Korean economy around the 1997 crisis. Section 3 describes the model. Section 4 explains the data and calibration. Section 5 describes the quantitative method and presents the results. The paper is concluded in Section 6.

2 The Korean Economy

This section documents the behavior of different macroeconomic variables during the crisis at the end of 1997 in Korea. Figure 1 presents GDP, consumption, investment and the ratio of the current account balance to GDP for the period 1994-2007. All series, except the current account-to-GDP ratio, are in logs, and all of them are seasonally adjusted and detrended with the Hodrick-Prescott (HP) filter.

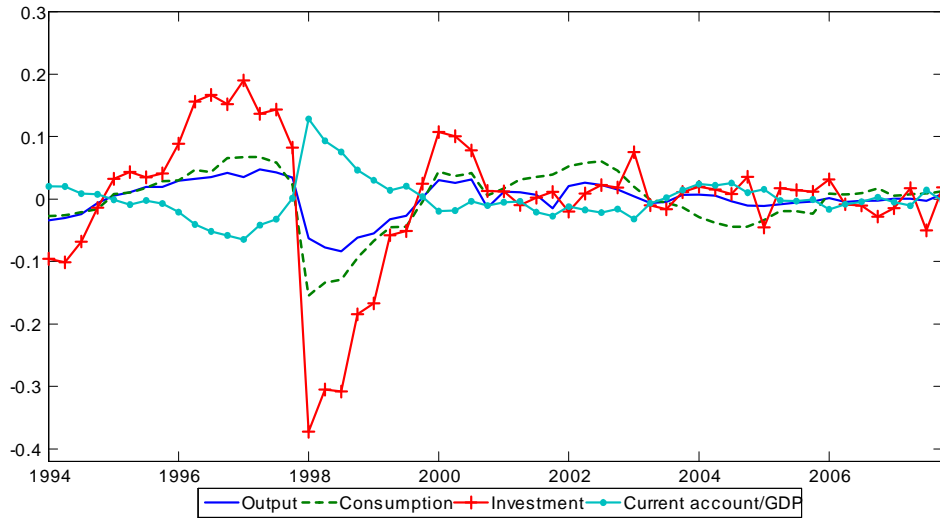


Figure 1. Korean data between 1994-2007

Consumption and investment are both procyclical, and the current account is strongly countercyclical. During the crisis in 1998, the declines in output and consumption are quite large, and consumption falls more than output. The fact that consumption declines more than output shows the inability of consumers to smooth their consumption. This observation is consistent with the fact documented by Neumeyer and Perri (2005) and Aguiar and Gopinath (2007) that consumption volatility is greater than output volatility in emerging market economies. Investment, being the most volatile of all the series, falls more than 30% below the trend in the crisis episode. The current account balance goes up to 11.3% of GDP in annual terms in 1998, whereas it has been negative in the years before that. This is again in line with capital flows being procyclical in emerging market economies. Economic downturns are associated with current account surpluses, which shows that the foreign borrowing of the economy decreases in these episodes.

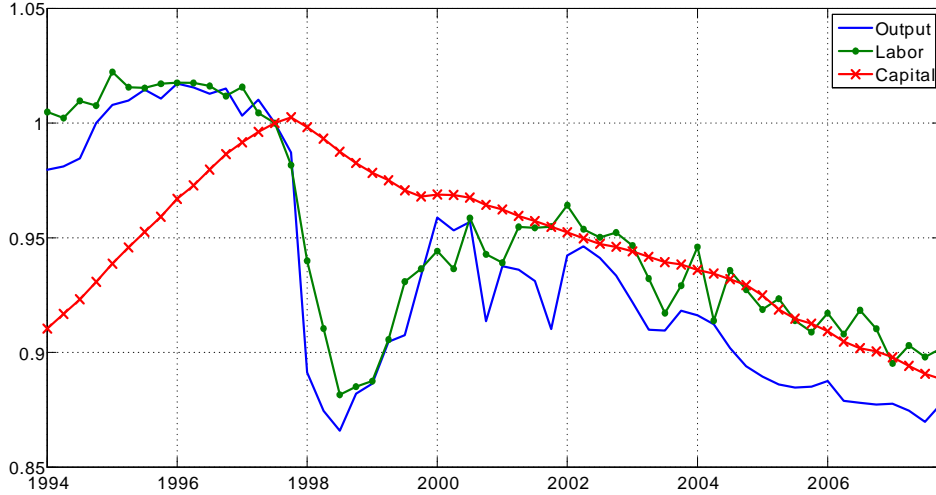


Figure 2: Detrended output and inputs

Figure 2 presents per capita output, labor and capital. Output and capital are linearly detrended by the average annual growth rate of output between 1980-2007. All the series are normalized such that the values for the third quarter of 1997, which is the last quarter before the crisis, equal one. The figure shows that output and labor decline by similar magnitudes in the crisis episode. In particular, the annual decline in output from the end of 1997 to the end of 1998 is 12.2% and the decline in labor is 9.6%. While both output and labor start to recover one year after the crisis, they do not reach their pre-crisis levels, and both of them have declining trends starting roughly in 2002. The capital stock starts to decline with the crisis and has a downward trend since then.

3 The Model

Consider a small open economy model with an infinitely lived representative household. The household maximizes the utility function

$$\sum_{t=0}^{\infty} \beta^t \frac{(c_t - \psi l_t^\nu)^{1-\sigma}}{1-\sigma} \quad (1)$$

where c_t denotes consumption, l_t denotes labor supply, $0 < \beta < 1$ is the discount factor, $\nu > 1$ determines the labor supply elasticity and $\psi > 0$ measures the disutility from working. This preference specification, introduced by Greenwood et al. (1988), has been commonly used in small open economy business cycle models.³

Households supply labor, rent out capital and borrow/lend in international financial markets. They trade a one-period risk-free asset with an exogenous time- t return r_t in international markets.

Households pay three types of taxes. In period t , consumption is taxed at rate τ_t^c , labor income is taxed at rate τ_t^l , and capital income is taxed at rate τ_t^k . They also receive a transfer T_t from the government.

The budget constraint of the household in period t is given by

$$(1 + \tau_t^c) c_t + k_{t+1} + a_{t+1} = (1 - \tau_t^l) w_t l_t + [1 + (1 - \tau_t^k) (q_t - \delta)] k_t + (1 + r_t) a_t + T_t - \Phi_k(k_{t+1}, k_t) - \Phi_a(a_{t+1}) \quad (2)$$

where k_t is the quantity of capital and a_t is net foreign assets held by the household, w_t is the wage rate, q_t is the return to capital and δ is the depreciation rate. The function Φ_k represents the cost of adjusting the capital stock. Capital adjustment costs are commonly used in small open economy business cycle models in order to prevent excessive volatility of investment. The function Φ_a represents the adjustment costs for international assets. Adjustment costs on holdings of assets are used in order to induce stationarity in small open economy business cycle models.

Firms operate in a perfectly competitive market, using a constant returns to scale technology. The production function is assumed to be Cobb-Douglas, which is given by

$$y_t = z_t k_t^\alpha l_t^{1-\alpha}$$

where z_t is total factor productivity (TFP), and $0 < \alpha < 1$. Firms hire labor and rent capital from households so as to maximize their profits.

³See Mendoza (1991), Correia et al. (1995), Kose (2002), Neumeyer and Perri (2005).

The government finances sequences of expenditures $\{g_t\}_{t=0}^{\infty}$ and transfers $\{T_t\}_{t=0}^{\infty}$ through tax revenues and borrowing in international financial markets. It issues one-period, non-contingent debt, b_t , with return r_t in period t . Tax revenues are collected through taxes on consumption, labor income and capital income. The flow budget constraint of the government is

$$g_t + T_t + (1 + r_t) b_t = \tau_t^c c_t + \tau_t^l w_t l_t + \tau_t^k (q_t - \delta) k_t + b_{t+1}. \quad (3)$$

This budget constraint, imposing a No-Ponzi scheme condition, implies the following intertemporal budget constraint

$$\sum_{t=0}^{\infty} p_t [g_t + T_t] + p_0 (1 + r_0) b_0 = \sum_{t=0}^{\infty} p_t [\tau_t^c c_t + \tau_t^l w_t l_t + \tau_t^k (q_t - \delta) k_t] \quad (4)$$

where p_t , defined as follows, is the discount factor

$$p_t = \prod_{i=0}^t \frac{1}{1 + r_i}.$$

An equilibrium can be defined under the simplifying assumption that agents perfectly foresee the path of TFP, taxes and the exogenous interest rate.

Given an initial stock of capital and initial international assets (k_0, a_0, b_0) and a sequence of government purchases $\{g_t\}_{t=0}^{\infty}$, a competitive equilibrium for this economy consists of sequences for factor prices $\{w_t, q_t\}_{t=0}^{\infty}$, allocations $\{c_t, l_t, k_{t+1}, a_{t+1}\}_{t=0}^{\infty}$ and transfers $\{T_t\}_{t=0}^{\infty}$ such that, 1) given prices and transfers, the sequence of allocations solves the household's problem, 2) given prices, the sequence of labor and capital allocations solves the firm's problem and 3) transfers satisfy the government's intertemporal budget constraint (4).

4 Data and Calibration

In order to solve the model, the paths of exogenous shocks $\{z_t, r_t, \tau_t^c, \tau_t^l, \tau_t^k\}_{t=0}^{\infty}$ have to be computed. These shocks are computed using quarterly data from Korea for the period 1994 to 2007. The series for TFP is computed as

$$z_t = \frac{y_t}{k_t^\alpha l_t^{1-\alpha}}$$

which requires data on y_t , l_t and k_t . The details of the way these variables are constructed are explained in the appendix. The exponent of capital in the production function, α , is set to 0.3, which is the standard value in RBC studies. Otsu (2008), following Young (1995), uses 0.297 for the capital share parameter in a study of the Korean crisis.

The real interest rate is computed by subtracting expected inflation rate from the nominal interest rate. The nominal interest rate is the minimum annual lending rate of deposit money banks. Expected inflation is computed as the average of GDP deflator inflation in the current period and in the three preceding periods following Neumeyer and Perri (2005).

Tax rates on consumption, labor income and capital income are calculated using the method described by Mendoza, Razin and Tesar (1994). The calculated tax rates are average effective tax rates, defined as the ratio of tax revenue to the tax base. The details of the computation are given in the appendix. Since the data used in these computations are available on an annual basis, taxes are measured annually and they are assumed to remain constant throughout each year.

Figure 1 plots the paths of exogenous shocks for the period 1994-2007. The first panel shows the path of TFP, where the value for the third quarter of 1997 is normalized to one. In annual terms, the fall in TFP is 4.9% from 1997Q3 to 1998Q3. For the same time period, output falls by 10.2%, labor falls by 7.9% and capital falls by 0.2%. Since the capital stock changes very slowly and labor falls less than output, the decline in TFP accounts for the remaining decline in output.

The real interest rate starts to increase in 1997 before the crisis erupts. In annual terms, it increases from 3.8% on average during 1996 to 7.9% in 1997 and 8% in 1998. It reaches its highest level of 10.4% in the first quarter of 1998.

The capital and labor income tax rates have increasing trends, starting roughly in 1998. The labor income tax rate increases from 10.8% to 12.7% in 1998, while capital tax rate slightly increases from 18.8% to 19.4%. The consumption tax rate does not change much throughout this period and remains around 15%. In 1998 it decreases from 15.2% to 13.7%.

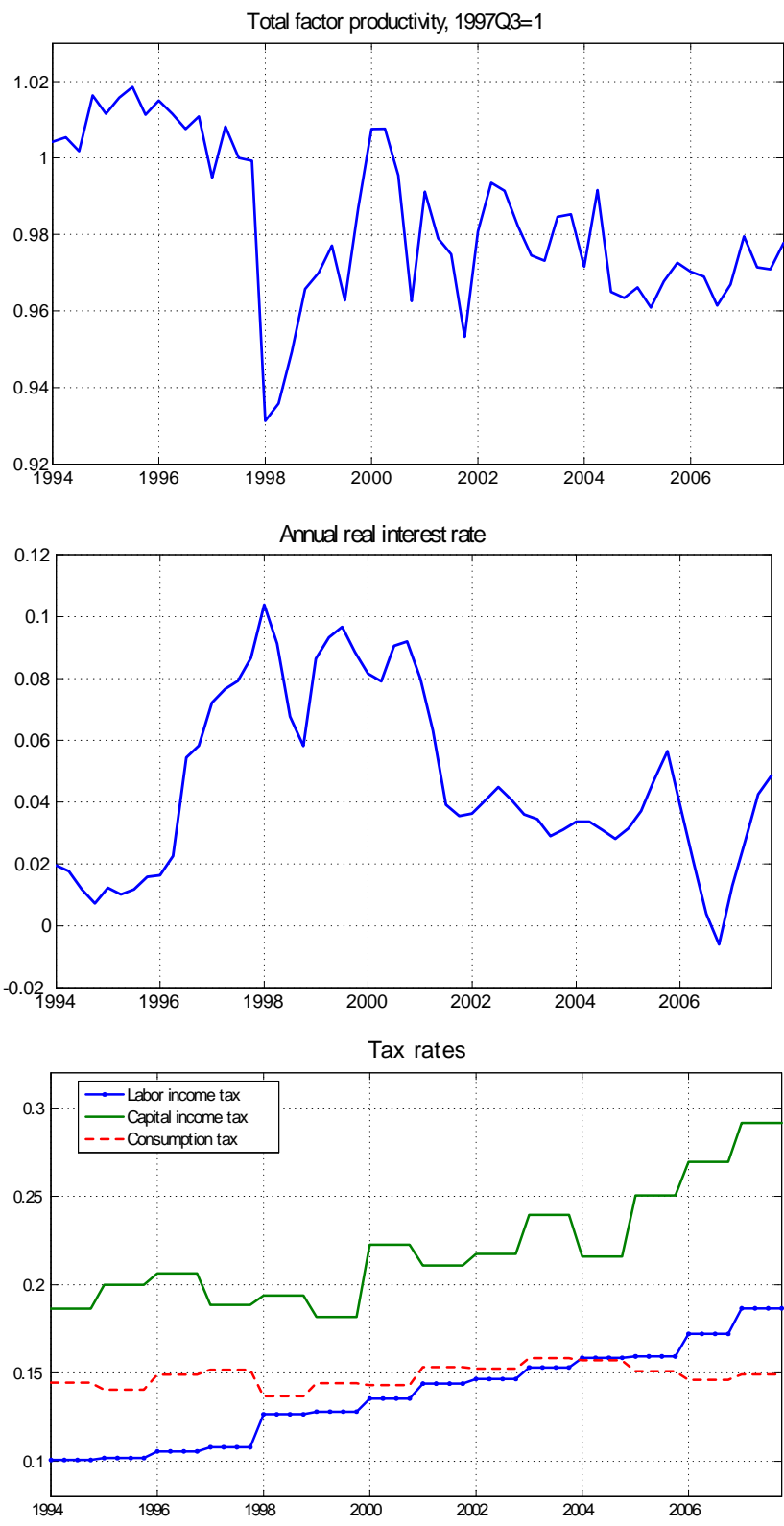


Figure 3: Exogenous Shocks
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The parameters of the model are calibrated using data from Korea for the period 1980-2007. The discount factor, β , is set to match the average annual real interest rate of 2.4% for the period. The parameter that measures the disutility from working, ψ , is set to match an average time spent working of 32% of total discretionary time before 1998. The curvature of labor in the GHH preference specification, ν , is set to 1.5 following Mendoza (1991). The curvature of the period utility, σ , is set to five following Neumeyer and Perri (2005). The depreciation rate, δ , is set to 8% annually following Meza and Quintin (2007). The adjustment cost parameter for capital, ϕ_k , is set so that the standard deviation of investment relative to output in the model matches the data. The adjustment cost parameter for assets, ϕ_a , is set to the minimum value that guarantees that the equilibrium solution is stationary. Since the model is solved using exogenous shocks that start in 1994, the initial values of household's net foreign assets and government's net foreign debt are set at their relative levels at the start of 1994. The parameter values are summarized in Table 1.

The exogenous sequence of government purchases $\{g_t\}_{t=0}^{\infty}$ is specified as a constant fraction of output, i.e. $g_t = \gamma y_t$ for all t . The fraction of output that is used by the government, γ , is set to 11% to match the average value of the ratio of government purchases to GDP in Korea for the period 1980-1997. The starting value of transfers is computed as the level that keeps the government's starting value of foreign debt, b_0 , constant in the initial steady state given the taxes and the government purchases. Transfers are kept constant until the end of the sample period, i.e. 2007, and after this date they assume their new steady-state value and remain constant at this new level. The new steady-state value is calculated to make the intertemporal budget constraint of the government, equation (4), hold given the taxes and the government purchases. Government purchases and transfers are held the same in all experiments, while tax rates are changed in order to analyze the effects of tax cuts.

Table 1. Parameters of the benchmark model

Parameter	Description	Value
β	Discount factor	0.994
σ	Utility curvature	5
v	Labor curvature	1.5
ψ	Labor weight	1.636
α	Capital income share	0.3
δ	Depreciation rate	0.019
γ	Ratio of government purchases to GDP	0.11
ϕ_a	Bond holding cost	10^{-4}
ϕ_k	Capital adjustment cost	2.2
a_0	Initial foreign assets of the household	-6.5% of annual GDP
b_0	Initial foreign debt of the government	-3.7% of annual GDP

The capital adjustment cost function is assumed to be of the form

$$\Phi_k(k_{t+1}, k_t) = \frac{\phi_k}{2} (k_{t+1} - k_t)^2,$$

where $\phi_k > 0$.

The bond holding costs have the form

$$\Phi_a(a_{t+1}) = \frac{\phi_a}{2} (a_{t+1} - \bar{a})^2,$$

where \bar{a} is the steady-state level of foreign assets and $\phi_a > 0$.

5 Results

Following Meza and Quintin (2007) the model is solved under the assumption that agents foresee all shocks up to the third quarter of 1997, the last quarter before the crisis. After this date, they expect all shocks other than the interest rate to permanently assume their last values. As for the interest rate, households expect it to be constant at its initial steady state value, $\beta^{-1} - 1$, the only value compatible with zero long-run consumption growth. Therefore, agents do not expect a crisis to occur at the end of 1997 and they revise their expectations of future shocks when they observe the values of shocks in the last quarter

of 1997. At this date, they update their expectations about the exogenous shocks to their actual values. This assumption is an approximation to a situation where households assign a positive but very small probability to the possibility of a crisis.

To compute the competitive equilibrium, the system of nonlinear equations that consists of the first-order conditions and the budget constraint of the government are solved numerically. This involves feeding in the exogenous shocks, government purchases and transfers, and solving for the allocations that satisfy the first-order conditions. In the benchmark model steady-state transfers are adjusted until the government's intertemporal budget constraint is satisfied, with the given tax rates and government purchases. In the other experiments government purchases and transfers are held the same as the benchmark model, and steady-state taxes are adjusted until the government's intertemporal budget constraint is satisfied.

Figure 4 shows the paths of output, consumption, labor and capital-output ratio for the benchmark model and compares them to the data. Each time series is scaled by its respective value in the third quarter of 1997 to focus on the impact of the crisis. The quantitative predictions of the model for the crisis year are also summarized in Table 2.

Output series generated by the model follows the data quite closely. Particularly, the model generates a fall in output very close to the data in the crisis episode, even though the path of output in the model stays below the data starting in 2000. GDP falls by 12.2% in the data and by 11.6% in the model from the last quarter of 1997 to the last quarter of 1998 in annual terms. The fall in labor supply is also very close in the data and the model. The labor supply falls by 9.6% in the data and 8.4% in the model in annual terms. The figure shows that the model generates a fall in labor input as soon as TFP falls during the crisis. However, the fall in labor input occurs with a slight lag in the data, and the recovery also occurs with a lag. The capital-output ratio generated by the model also closely follows the data.

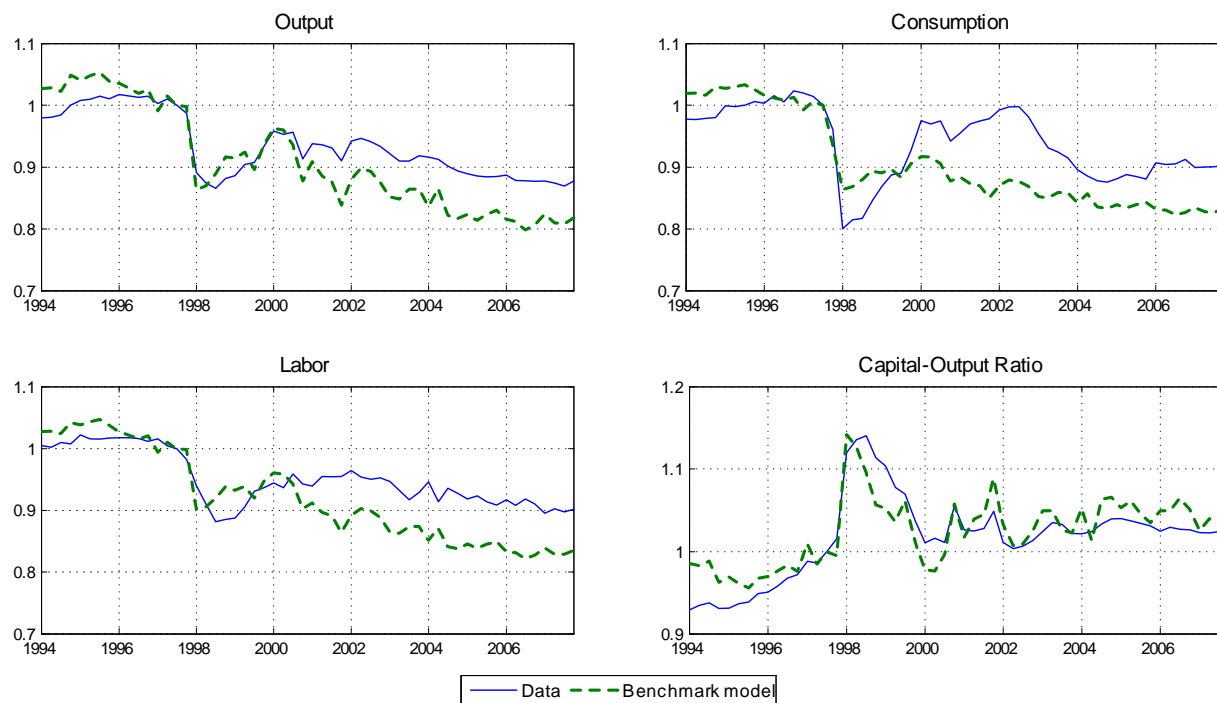


Figure 4: Predictions of the benchmark model

The path of consumption generated by the model moves in the same direction as the data, however it is smoother, as would be expected in a standard model. The decline in consumption from 1997 to 1998 is 17.9% in the data, whereas it is 10.9% in the model. During the crisis, households reduce their consumption due to declining output and higher real interest rate, however, this decline is not as big as the decline in the data. Households increase their borrowing during the crisis and consume more than in the data, at the cost of lower consumption in the future. However, the model still generates a sizable reduction in consumption—it falls by about the same percentage as output.

In order to see the effects of additional borrowing, the model is solved under the assumption that the government borrows an additional amount equal to 4.7% of GDP during the crisis. This is equal to the reduction in net foreign debt of the Korean government during 1998; hence, this analysis reveals the amount of tax reduction that could have been implemented and its effects, had the government's net foreign debt level not changed during

the crisis. In this experiment, government purchases and transfers are held constant while the tax rates on consumption, labor income and capital income are reduced proportionally. The changes in taxes are chosen to increase the government debt by 4.7% of GDP by the end of 1998. As government outlays are held constant, the reduction in government revenues is compensated by an increase in steady-state tax rates. All of the tax rates are increased proportionally in the steady state in order for the government's intertemporal budget constraint to hold. The results of this experiment are presented together with the results from the benchmark model in Figure 5.

The proportional tax cut required to induce the government to borrow an additional amount equal to 4.7% of GDP is 25.7% of the initial levels. This amounts to about a 3.3 percentage point decline in labor income tax, 5 percentage point decline in capital income tax and 3.5 percentage point decline in consumption tax, from their initial levels of 12.7%, 19.4% and 13.7% respectively. The tax rates used in the different counterfactual analyses are presented in Table 3. As a result of the proportional tax cut, output decline is reduced by 5.5 percentage points. In the benchmark model output decreases by 11.6%, whereas in the case of expansionary fiscal policy it decreases by 6.1%. Since taxes on both capital and labor income are reduced, households choose to work more and accumulate more capital. However, since capital accumulation occurs slowly and this tax cut only lasts a year, it does not have an important effect on the capital stock, and the most important factor in the different response of output is the change in labor. With a decrease in the labor income tax, labor supply increases substantially: it only decreases by 0.2% compared to an 8.4% decline before the tax cut. Consumption increases, both because the consumption tax rate is lower and the marginal utility of consumption is higher due to a higher labor effort. The decline in consumption goes from 10.9% to 4.3%. While the capital stock increases slightly, the capital-output ratio decreases as output is higher in this case.

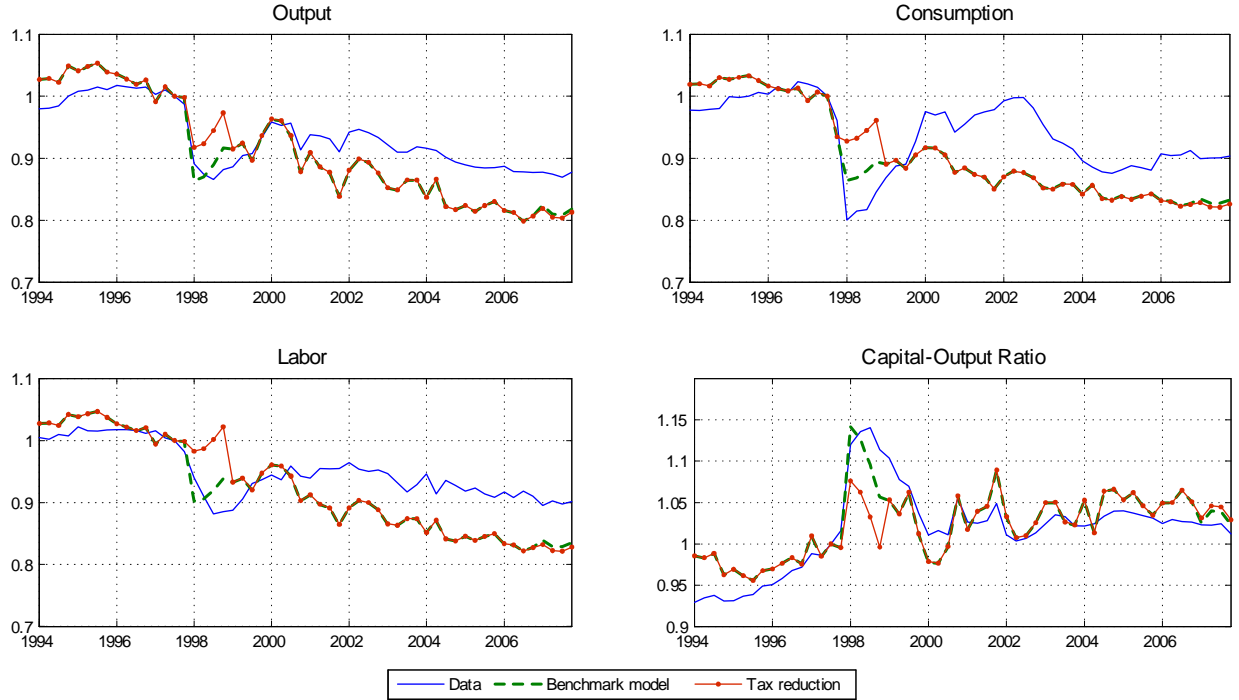


Figure 5: Predictions of the benchmark model and the proportional tax reduction

The steady-state tax rates have to be increased by about 2% in order for the intertemporal budget constraint of the government to hold. As a result, steady-state values of output, consumption, labor and capital are lower by 2.3%, 2.27%, 1.99% and 3.03%, respectively. This leads to a trade-off between the short-run and the long-run effects of the policy, which requires an analysis of the welfare effects. The change in welfare by the implemented policy is represented by the permanent change in consumption required to equate lifetime utility under the counterfactual policy to lifetime utility under the baseline policy. The results of the welfare analysis are given in Table 2 and are interpreted below.

In order to compare the effects of tax cuts of the three taxes separately, the model is also solved for the cases where only one of the tax rates is reduced. Again government purchases and transfers are held constant, and in each case one of the taxes is reduced just enough to allow the government's debt-to-GDP ratio to increase by 4.7 percentage points. This amounts to a labor income tax cut of 9.8 percentage points, capital income

tax cut of 17 percentage points and consumption tax cut of 9.4 percentage points. In each case steady-state tax rates for all taxes are increased proportionally for the intertemporal budget constraint of the government to hold. The resulting series are illustrated in Figure 6.

Table 2. Quantitative Results

Change in	Data	Benchmark Model	Proportional tax reduction	Labor tax reduction	Capital tax reduction	Cons. tax reduction
Output	-0.122	-0.116	-0.061	-0.030	-0.116	-0.047
Consumption	-0.179	-0.109	-0.043	-0.006	-0.109	-0.020
Labor	-0.096	-0.084	-0.002	0.046	-0.084	0.020
Capital	-0.007	-0.021	-0.020	-0.020	-0.020	-0.020
Welfare cost relative to benchmark			0.36%	0.26%	0.51%	0.37%

Changing the labor tax rate is the most effective on both output and consumption among these tax rates. With a reduction in the labor tax rate, output decline is reduced by 8.6 percentage points compared to the benchmark model. Consumption decreases by only 0.6% between the last quarter of 1997 and the last quarter of 1998 in annual terms compared to 10.9% in the benchmark model. With the labor income tax rate being reduced by such a high percentage, labor effort increases by 4.6% during the crisis. The capital tax rate almost has no effect on output and consumption, producing the same paths as the benchmark model. Reducing the consumption tax has an intermediate effect. In this case output reduction decreases by about 7 percentage points and consumption reduction by 8.8 percentage points. This policy is less effective than the labor tax reduction policy but more effective than a proportional tax cut.

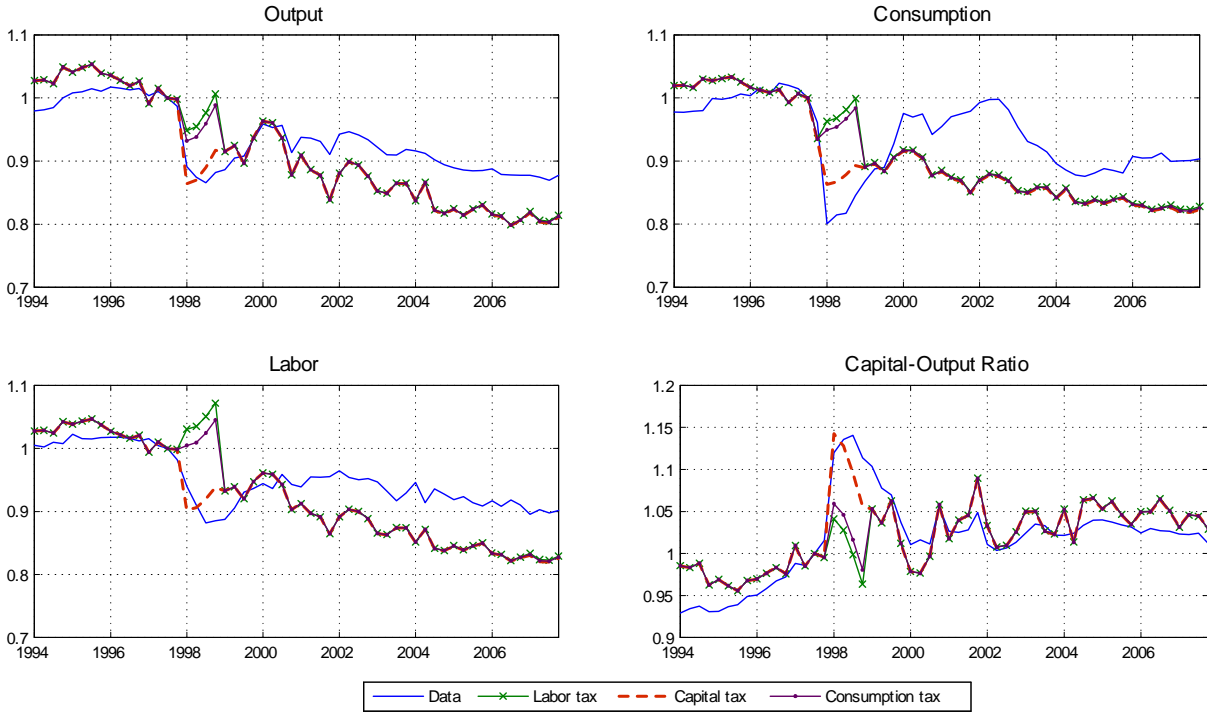


Figure 6. Comparison of reductions in each tax rate

The welfare comparison of the analyzed policies are also presented in Table 2. All cases of expansionary fiscal policy lead to lower welfare than the benchmark model. The welfare cost of each policy is represented by the permanent change in consumption required to equate lifetime utility under the counterfactual policy to lifetime utility under the baseline policy. Except the case of a reduction in the capital income tax, all policies lead to higher output, consumption and labor than the baseline policy during the crisis. While higher consumption increases welfare, higher labor effort reduces it. In all cases, output, consumption and labor are reduced in the long run due to higher steady-state taxes, which counteracts the short-run effects of these policies. Welfare is lowest in the case of a reduction in the capital income tax and highest in the case of a reduction in the labor income tax. The steady-state values of the model variables are about the same for all policies and labor income tax is the most effective in terms of increasing consumption and output during the crisis. Therefore, it leads to the highest welfare level. Overall, the results show that labor

income tax reduction is the most effective in terms of increasing output and consumption and it is also the least costly in welfare terms.

Table 3. Tax rates

	Data and Benchmark Model	Proportional tax reduction	Labor tax reduction	Capital tax reduction	Cons. tax reduction
τ^l	12.7%	9.4%	2.9%	12.7%	12.7%
τ^k	19.4%	14.4%	19.4%	2.4%	19.4%
τ^c	13.7%	10.2%	13.7%	13.7%	4.3%

In the benchmark analysis, a proportional tax cut of 25.7% results in an increase in the debt-to-GDP ratio by 4.7 percentage points and the resulting output drop in the crisis year is about 6%, compared to 11.6% without any tax cut. In order to analyze the relationship between government debt and expansion in output achieved through the tax cut that the additional borrowing finances, the model is solved for different levels of proportional tax cuts. The increase in the debt-to-output ratio and the resulting output reductions in the crisis year are plotted in Figure 7. As the figure shows, without any tax cut, which implies zero additional borrowing, the output drop is 11.6%. Reducing this by half leads to an additional external debt of about 5% of output, and completely eliminating the output drop leads an additional debt burden of slightly more than 10% of output. Such an expansion in output requires a tax cut of about 53% of the initial levels.

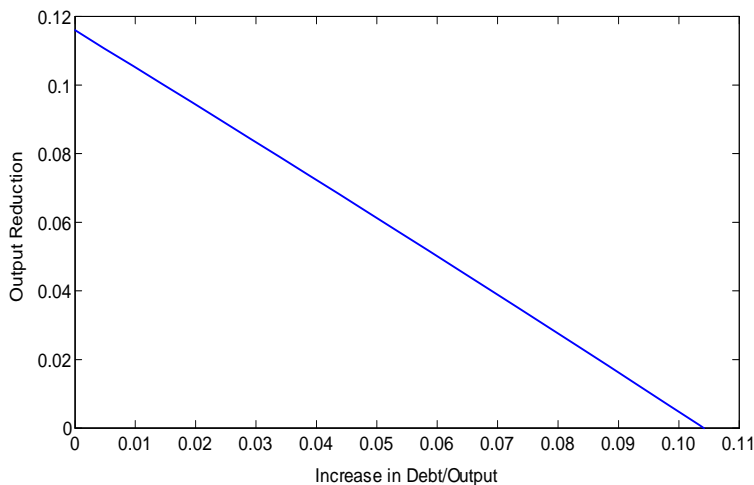


Figure 7. Additional borrowing and resulting output reductions

6 Conclusions

Emerging market economies experience severe declines in consumption and output during financial crises. The expected fiscal policy response in such episodes is reducing taxes and increasing government spending so as to stimulate the economy. However, fiscal policy is procyclical in developing countries, as documented by a large literature. The fact that governments resort to spending cuts and tax increases, exacerbating the effects of the crisis, is usually attributed to borrowing constraints faced by these countries in bad times. This is supported by the evidence on procyclicality of capital flows to developing countries and large outflows of capital experienced in crisis episodes.

This paper quantitatively analyzes the costs of reduced government borrowing during a financial crisis by studying the effects of tax reductions that would have been possible if the government had access to additional borrowing, using a small open economy version of the neoclassical growth model. The question is analyzed in the context of the 1997 financial crisis in Korea. Following the crisis, the decline in net foreign debt of the Korean government is about 4.7% of the GDP in 1998. In the analysis, the tax rates on consumption, capital

income and labor income are reduced proportionally by an amount that would keep the government's debt level constant during the crisis, i.e. leading to an additional borrowing of 4.7% of GDP. Such a tax cut leads to an increase in output of 5.5 percentage points and in consumption of 6.6 percentage points, showing the costs of reduced borrowing in terms output and consumption.

When the tax rates are reduced one by one and the effects of each tax rate are analyzed separately, labor income tax reduction turns out to be more effective than the other policies. In this case, output decline during the crisis is reduced by about 8.6 percentage points and consumption decline is almost completely eliminated. In all cases, steady-state taxes have to be raised by about 2% in order to pay for the additional borrowing resulting from the tax reduction. This leads to a 2.3% decline in output and a 2.27% decline in consumption in the steady state. It is also found that completely eliminating the output drop in the crisis year requires an additional government borrowing of about 10% of GDP.

The welfare comparison of the alternative tax policies reveals that they all lead to a decline in welfare relative to the benchmark model. However, the least costly policy in terms of welfare is the labor tax reduction. The steady-state values of the model variables are about the same for all policies and labor income tax is the most effective in terms of increasing consumption and output during the crisis. Therefore, it leads to the highest welfare level. The analysis shows that the most effective way of stimulating output and consumption is through a labor income tax cut, and if the government decides to implement expansionary fiscal policy, it should give a higher weight to labor income tax in order to achieve the highest effect.

References

- [1] Aguiar, M., Gopinath, G., 2007. "Emerging Market Business Cycles: The Cycle is the Trend," *Journal of Political Economy*, 115 (1), 69-102.
- [2] Aizenman, J., Gavin, M., Hausmann, R., 1996. "Optimal Tax Policy with Endogenous Borrowing Constraints," NBER Working Paper No.5558.
- [3] Bergoeing, R., Kehoe, P. J., Kehoe, T. J. , Soto, R., 2002. "A Decade Lost and Found: Mexico and Chile in the 1980s," *Review of Economic Dynamics*, 5 (1), 166-205.
- [4] Conesa, J. C., Kehoe, T. J., Ruhl, K. J., 2007. "Modeling great depressions: the depression in Finland in the 1990s," *Quarterly Review*, Federal Reserve Bank of Minneapolis, issue Nov, 16-44.
- [5] Correia, I., Neves, J. C., Rebelo, S., 1995. "Business cycles in a small open economy," *European Economic Review*, 39 (6), 1089–1113.
- [6] Gavin, M., Perotti, R., 1997. "Fiscal Policy in Latin America," *NBER Macroeconomics Annual* (Cambridge, Mass.: MIT Press), pp. 11-61.
- [7] Greenwood, J., Hercowitz, Z., Huffman, G. W., 1988. "Investment, capacity utilization, and the real business cycle," *American Economic Review*, 78 (3), 402–417.
- [8] Ilzetzki, E., Vegh, C. A., 2008. "Procyclical Fiscal Policy in Developing Countries: Truth or Fiction?," NBER Working Papers 14191.
- [9] Kaminsky, G., Reinhart, C., Vegh, C. A., 2004. "When It Rains It Pours: Procyclical Capital Flows and Macroeconomic Policies," in *NBER Macroeconomics Annual*, edited by Mark Gertler and Kenneth Rogoff, Cambridge, MA: MIT Press.
- [10] Kose, M. A., 2002. "Explaining business cycles in small open economies ‘How much do world prices matter?’," *Journal of International Economics*, 56 (2), 299-327.

- [11] Lane, P. R., 2003. "The Cyclical Behavior of Fiscal Policy: Evidence from the OECD," *Journal of Public Economics*, 87, 2661-2675.
- [12] Lane, P. R., Milesi-Ferretti, G. M., 2007. "The External Wealth of Nations Mark II," *Journal of International Economics*, 73, 223-250.
- [13] Meza, F., 2008. "Financial Crisis, Fiscal Policy, and the 1995 GDP Contraction in Mexico," *Journal of Money, Credit and Banking*, 40 (6), 1239-1261.
- [14] Meza, F., Quintin, E., 2007. "Factor Utilization and the Real Impact of Financial Crises," *The B.E. Journal of Macroeconomics: Vol. 7: Iss. 1 (Advances)*, Article 33.
- [15] Mendoza, E. G., 1991. "Real business cycles in a small open economy," *American Economic Review*, 81 (4), 797-818.
- [16] Mendoza, E. G., Oviedo, P. M., 2006. "Fiscal Policy and Macroeconomic Uncertainty in Developing Countries: The Tale of the Tormented Insurer," *NBER Working Papers* 12586.
- [17] Mendoza, E. G., Razin, A., Tesar, L. L., 1994. "Effective tax rates in macroeconomics: Cross-country estimates of tax rates on factor incomes and consumption," *Journal of Monetary Economics*, 34 (3), 297-323.
- [18] Neumeyer, P. A., Perri F., 2005. "Business cycles in emerging economies: the role of interest rates," *Journal of Monetary Economics*, 52 (2), 345-380.
- [19] Ohanian, L. E., 1997. "The Macroeconomic Effects of War Finance in the United States: World War II and the Korean War," *American Economic Review*, 87 (1), 23-40.
- [20] Otsu, K., 2008. "A Neoclassical Analysis of The Korean Crisis," *Review of Economic Dynamics*, 11 (2), pages 449-471, April.

- [21] Schmitt-Grohe, S., Uribe, M., 2003. "Closing small open economy models," *Journal of International Economics*, 61 (1), 163–185.
- [22] Talvi, E., Végh, C. A., 2005. "Tax Base Variability and Pro-cyclical Fiscal Policy in Developing Countries," *Journal of Development Economics*, 78, 156-190.

7 Appendix

Construction of the Series Used in the Paper

GDP: The data on GDP are obtained from IFS. To compute real GDP in constant 2005 prices, I multiplied the real GDP index by the nominal value of annual GDP in 2005.

Capital Stock: The capital stock is generated using a perpetual inventory method. The investment series used to compute the capital stock is the gross fixed capital formation series reported by IFS. To convert this nominal series into 2005 won I took the ratio of nominal investment to nominal GDP, and then multiplied with the GDP series in 2005 prices. This series is then seasonally adjusted. For the perpetual inventory method, I used a yearly depreciation rate of 0.08 as Meza and Quintin (2007). To set the initial capital stock, I follow Young (1995) and Meza and Quintin(2007), and assume that the growth rate of investment in the first five years of the series is representative of the growth of investment in previous years.

Labor Input: I first calculated total hours worked by multiplying average weekly hours with total employment. This series is scaled by total weekly discretionary time (divided by 98 as in Correia et al., 1995), and seasonally adjusted, which is then used as the measure of total hours worked to calculate total factor productivity as explained below.

To calibrate the parameter that measures the disutility from working, ψ , a measure of total hours per capita is needed. Therefore, I divide total hours worked by the total working age population, which is population of age 15 and higher. I then set ψ so that the steady state labor supply equals average of total hours per capita as a fraction of total discretionary time. All data come from Statistics Korea (Korean Statistical Information Service).

Total Factor Productivity: The data on TFP have been constructed as

$$z_t = \frac{y_t}{k_t^\alpha l_t^{1-\alpha}}$$

where y_t and k_t are detrended output and capital series. Both series are linearly detrended by the average annual growth rate of real GDP between 1980-2007, which is 4.62%.

Tax rates: The tax rates have been computed using the method described by Mendoza, Razin and Tesar (1994).

The tax categories reported in OECD's Revenue Statistics database are:

- 1100: Taxes on income, profits and capital gains of individuals
- 1200: Taxes on income, profits and capital gains of corporations
- 2000: Total social security contributions
- 2200: Employer's contributions to social security
- 3000: Taxes on payroll and workforce
- 4100: Recurrent taxes on immovable property
- 4400: Taxes on financial and capital transactions
- 5110: General taxes on goods and services
- 5121: Excise taxes

The National Accounts data used in the computation of the tax rates come from the Korean Statistical Information Service and are categorized as follows:

- C: Consumption
- CE: Compensation of employees
- HHOS: Household Operating Surplus
- HHPI: Household Property Income
- OS: Operating Surplus

Consumption tax rate:

$$\tau_c = \frac{5110 + 5121}{C - (5110 + 5121)}$$

In order to construct labor income and capital income tax rates, first the average tax rate on household's total income is computed:

$$\tau_h = \frac{1100}{CE - 2200 + HHOS + HHPI}$$

Tax rate on labor income:

$$\tau_l = \frac{\tau_h(CE - 2200) + 2000 + 3000}{CE}$$

Tax rate on capital income:

$$\tau_k = \frac{\tau_h(HHOS + HHPI) + 1200 + 4100 + 4400}{OS}$$