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HOW COSTLY ARE BORROWING COSTS? AN ANALYSIS OF ALTERNATIVE FISCAL POLICIES DURING CRISES

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Financial crises lead to substantial declines in output and consumption in emerging markets. 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 they face in bad times. This paper quantitatively analyzes the costs of reduced borrowing during crises by studying the effects of expansionary fiscal policies that would have been possible to implement, had the government been able to borrow more. The model shows that a 25% reduction of taxes on labor income, capital income, and consumption during the 1997 Korean crisis would have required an additional borrowing of 4.10% of GDP, while increasing output and consumption by 5.23 and 5.92 percentage points, respectively. When the effects of each tax rate are analyzed separately, labor tax reduction turns out to be more effective than the other policies.

Keywords: Fiscal Policy, Financial Crises, Business Cycle Fluctuations

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 developing countries face in bad times.[2] In crisis episodes, these countries experience current account surpluses associated with capital outflows. Figure A.1 in the Appendix shows output and the current account-to-GDP ratio for a group of emerging market economies. The figure illustrates the current account surpluses these countries experience in

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crisis episodes, which shows how the foreign borrowing of the economy decreases during an economic downturn.[3]

With interest rates increasing to very high levels, the cost of borrowing increases substantially during crises, leading to reduced borrowing, and this reduction entails some costs of its own. Because 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 tax rates are lowered during the year following the crisis so that the government borrowing increases. By reducing the tax rates and consequently increasing the foreign borrowing of the government by a certain amount, it is possible to see the effects that a borrowing decline imposes on the economy. The results of the analysis show how much of an expansion can be achieved if the government borrowing does not decline and an expansionary fiscal policy is implemented. 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 to disentangle the effect of a tax cut for each tax rate and see which one of these tax declines is more effective for an economic expansion.

The benchmark model, which uses the actual tax rates, generates the output and consumption patterns observed in the data reasonably well. The implications of the benchmark model are compared with the counterfactual case in which all tax rates are adjusted down 25%, which leads to an increase in government borrowing by 4.10% of output. This model generates higher output, consumption, and labor due to lower taxes. The increase in output with the proportional tax cut is 5.23 percentage points from a reduction of 12.96% to 7.73% during the crisis year and the increase in consumption is 5.92 percentage points. To analyze how each tax rate has contributed to this expansion, tax rates are reduced one at a time as an additional policy experiment. The results show that a reduction in the labor income tax rate is the most effective among the tax cuts, reducing output decline by 3.01 percentage points and consumption decline by 3.22 percentage points. The consumption tax cut by itself increases output and consumption by 2.14 and

2.53 percentage points, respectively. The effects of these policies on the public debt-to-GDP ratio, on the other hand, are a 1.64 percentage point increase for the labor tax cut and a 1.72 percentage point increase for the consumption tax cut, making the labor tax cut less costly in terms of additional borrowing. Reducing the capital tax rate alone leads to only a very small increase in all variables, making this tax cut the least effective.

All of the tax cuts lead to an improvement in welfare by reducing the economic contraction experienced during the crisis. The proportional tax reduction induces an increase in welfare equal to a permanent 0.078% increase in consumption. When the tax cuts are considered separately, a reduction in the labor income tax leads to the greatest increase in welfare among the three tax cuts.

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 Cole and Ohanian (1999), Bergoeing et al. (2002), the collection of papers edited by Kehoe and Prescott (2002), and Conesa et al. (2007) among others. Meza and Quintin (2007) use a small open economy version of the same model to explain the behavior of output and inputs during the 1994 Mexican crisis. Given that the model can account for the dynamics of the economy in crisis episodes quite well, it is used in this paper to quantitatively analyze the effects of expansionary fiscal policy during a crisis.

Using a similar model, Meza (2008) analyzes the effects of an increased consumption tax and reduced government spending during the 1994 Mexican 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. Although this paper also analyzes the effects of fiscal policy changes during a crisis, the link between external borrowing and changes in fiscal policy 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 the effects of fiscal policy changes. Another paper close to the current paper in terms of the method used is Ohanian (1997). He evaluates quantitatively the economic effects of the different policies used by the U.S. government to finance World War II and the Korean War, which were primarily financed by issuing debt and increasing taxes, respectively. 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.

2. THE MODEL

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

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

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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.[4]

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

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

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 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 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, given by

$$y_t = z_t k_t^{\alpha} l_t^{1-\alpha}, \tag{3}$$

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

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 noncontingent 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

$$g_t + T_t + (1+r_t)\, b_t = \tau_t^c c_t + \tau_t^l w_t l_t + \tau_t^k (q_t-\delta) k_t + b_{t+1}. \tag{4}$$

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

$$\sum_{t=0}^{\infty} p_t\,(g_t+T_t) + p_0\,(1+r_0)\, b_0 = \sum_{t=0}^{\infty} p_t \left[\tau_t^c c_t + \tau_t^l w_t l_t + \tau_t^k (q_t-\delta) k_t\right], \tag{5}$$

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where p_t, defined as follows, is the discount factor:

$$p_t = \prod_{i=0}^{t} \frac{1}{1+r_i}. \quad (6)$$

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 (5).

3. DATA AND CALIBRATION

The model is solved using data from the Korean economy. Figure 1 shows per capita GDP, consumption, and investment in Korea for the period 1990–2007. All series are linearly detrended by the average annual growth rate of output between 1980 and 2007, and they are normalized so that the values for the third quarter of 1997, which is the last quarter before the crisis, equal one.

During the crisis in 1998, the declines in output and consumption are quite large, and consumption falls more than output. Output decreases by 12.17% and consumption decreases by 17.96% annually from 1997 to 1998. 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 markets. Investment, being the most volatile of all series, falls by 25.05% in the same year. Even though all variables start increasing after a few quarters, they do not reach their precrisis levels and they have declining trends starting roughly in 2000.[5]

To solve the model, the paths of exogenous shocks $\{z_t, r_t, \tau_t^c, \tau_t^l, \tau_t^k\}_{t=0}^{\infty}$ are computed using quarterly data for the period 1995Q2–2007Q4. The analysis is started in 1995Q2 because of the availability of interest rate data.

The series for TFP is computed as

$$z_t = \frac{y_t}{k_t^{\alpha} l_t^{1-\alpha}}, \quad (7)$$

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 used in the real business cycle literature. Otsu (2008), following Young (1995), uses 0.297 for the capital share parameter in a study of the Korean crisis.

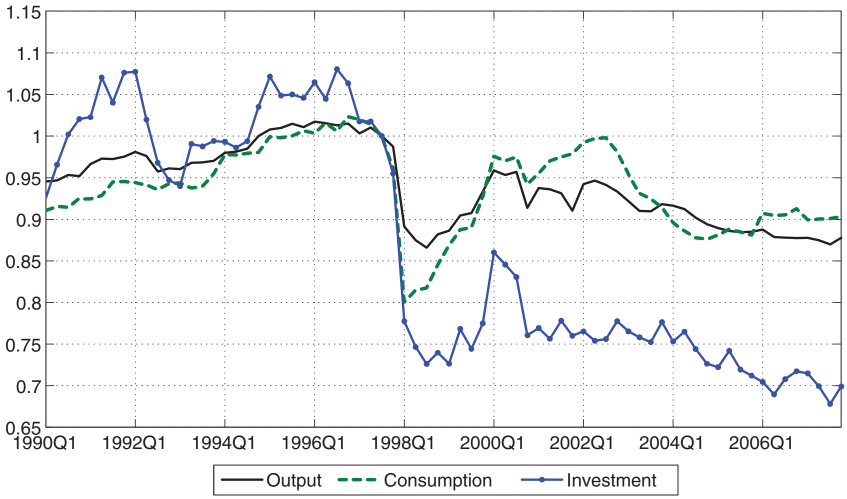

FIGURE 1. Korean data between 1990 and 2007.

The real interest rate is computed by subtracting the expected inflation rate from the nominal interest rate. The nominal interest rate is the yield on treasury bonds with a three-year maturity obtained from the Bank of Korea.[6] 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 et al. (1994). The calculated tax rates are average effective tax rates, defined as the ratio of the tax revenue to the tax base. The details of the computation are given in the Appendix. Because the data used in these computations are available on an annual basis, taxes are measured annually and are assumed to remain constant throughout each year.

Figure 2 plots the paths of exogenous shocks for the period 1995Q2–2007Q4. The first panel shows the path of TFP, where the value for the third quarter of 1997 is normalized to one. The TFP reaches its lowest level in the first quarter of 1998, with a decline of 7.19% relative to its value in 1997Q3. In annual terms, the fall in average TFP is 5.98% from 1997 to 1998. For the same time period, output falls by 12.17%, labor falls by 9.62%, and capital falls by 0.96%. Because 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 increases starting in 1996 before the crisis erupts. It remains high during 1997 and 1998 before it declines in the third quarter of 1998. The highest level it reaches during this period is 8.6% in annual terms in 1997Q4.

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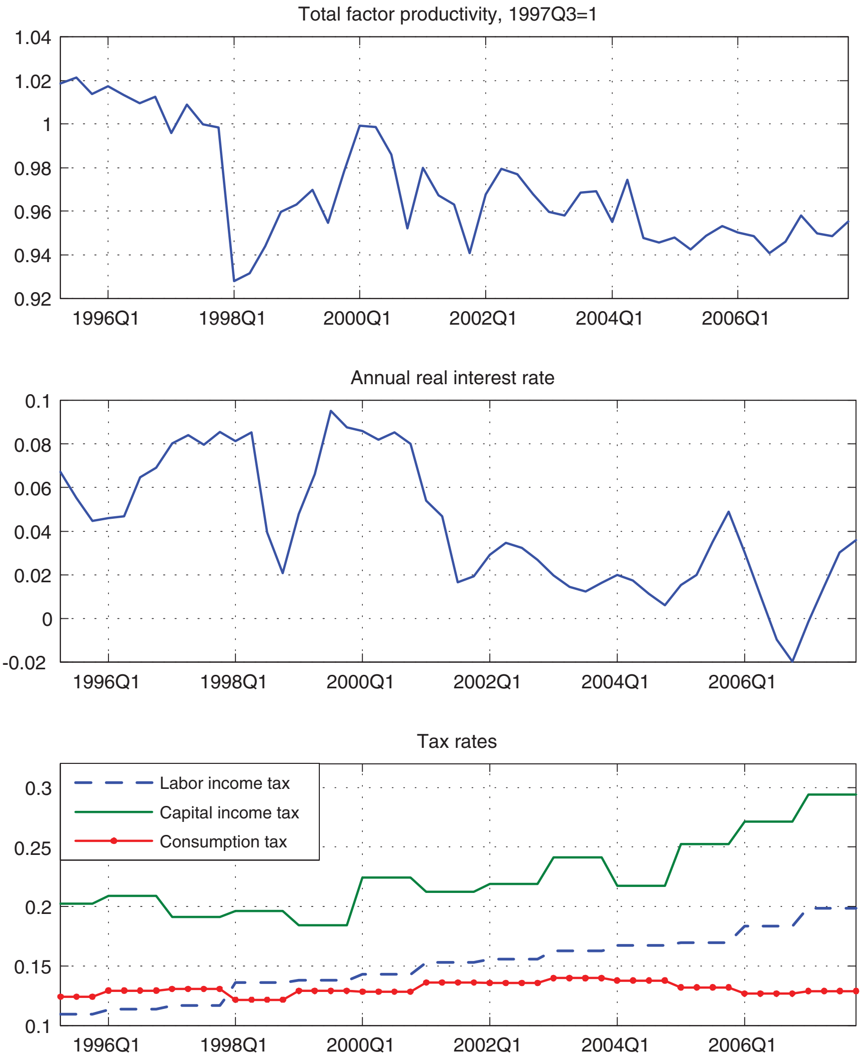

FIGURE 2. Exogenous shocks.

The capital and labor income tax rates have increasing trends, starting roughly in 1998. The labor income tax rate increases from 11.6% to 13.6% in 1998, while the capital tax rate increases slightly from 19.1% to 19.7%. The consumption tax rate does not change much throughout this period and remains around 13%. In 1998 it decreases from 13.1% to 12.2%.

The parameters of the model are calibrated using data for the period 1980–2007 and the parameter values are summarized in Table 1. The discount factor, β, is set to match the average annual real interest rate of 4.25% for the period. The

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TABLE 1. Parameters of the benchmark model

Parameter	Description	Value
β	Discount factor	0.9896
σ	Utility curvature	5
υ	Labor curvature	1.5
ψ	Labor weight	2.0663
α	Capital income share	0.3
δ	Depreciation rate	0.0108
γ	Ratio of government purchases to GDP	0.11
ϕ_a	Bond holding cost	10^{-4}
ϕ_k	Capital adjustment cost	1.65
a_0	Initial foreign assets of the household	−6.43% of annual GDP
b_0	Initial foreign debt of the government	−3.30% of annual GDP

parameter that measures the disutility from working, ψ, is set to match an average time spent working of 28% 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 value of the depreciation rate, δ, is set by the perpetual inventory method used to construct the series for the capital stock following Conesa et al. (2007). It is chosen to be consistent with the average ratio of depreciation to GDP, which equals 11.46% in the data.

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 adjustment cost parameter ϕ_k is set so that the standard deviation of investment relative to output in the model matches the data. 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 $\phi_a > 0$. The adjustment cost parameter ϕ_a is set to the minimum value that guarantees that the equilibrium solution is stationary. Because the model is solved using exogenous shocks that start in 1995Q2, the initial values of the household's net foreign assets, a_0, and the government's net foreign debt, b_0, are set at their respective levels at the end of the first quarter of 1995.

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, 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 (5), hold given the taxes and the government purchases.

4. 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 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 is 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, for government purchases that equal a γ fraction of output and the given tax rates. To analyze the effects of additional borrowing during the crisis, the model is then solved with reduced tax rates for 1998. A tax cut of 25% is chosen for a baseline analysis and all of the tax rates are reduced by 25% of their 1998 levels, while the government purchases are held the same as the benchmark model. The steady-state transfers are again adjusted until the government's intertemporal budget constraint is satisfied.

Figure 3 shows the paths of output, consumption, labor, and capital–output ratio for the benchmark model and compares them with 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 annual changes in the variables from 1997 to 1998 in the data and the benchmark model are also reported 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,

TABLE 2. Benchmark model and proportional tax reduction

Annual change in	Data	Benchmark model	Proportional tax reduction	Change relative to benchmark
Output	−0.1217	−0.1296	−0.0773	0.0523
Consumption	−0.1796	−0.1206	−0.0614	0.0592
Labor	−0.0962	−0.0974	−0.0193	0.0781
Capital	−0.0023	−0.0232	−0.0225	0.0007
Change in debt-to-GDP ratio (% points)				4.10
Reduction in steady-state transfers				1.42%
Change in welfare (% consumption)				0.078%

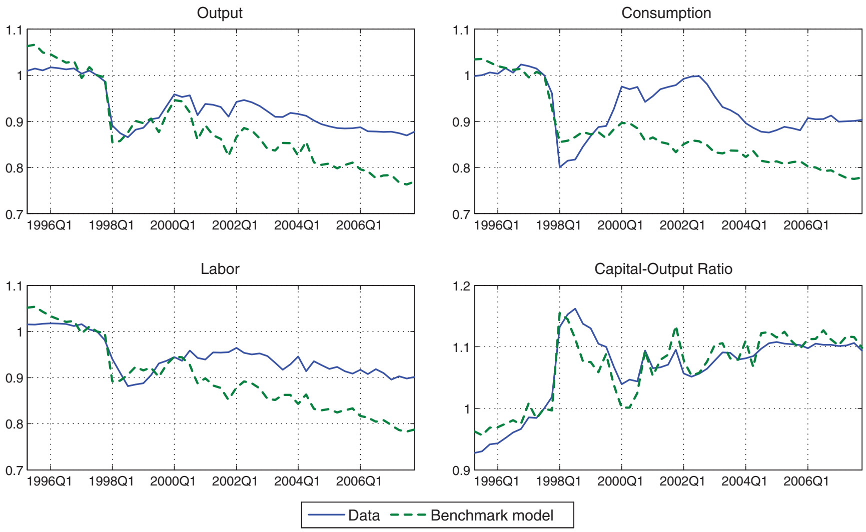

FIGURE 3. Predictions of the benchmark model.

even though the path of output in the model stays below the data starting in 2000. In annual terms, GDP falls by 12.17% in the data and by 12.96% in the model from 1997 to 1998. The fall in labor supply is also very close in the data and the model. The labor supply falls by 9.62% in the data and 9.74% 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 follows the data closely.

The path of consumption generated by the model moves in the same direction as in the data; however, it is smoother, as would be expected in a standard model. The decline in consumption from 1997 to 1998 is 17.96% in the data, whereas it is 12.06% in the model. During the crisis, households reduce their consumption because of 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 in the model 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.

To see the effects of additional borrowing during the crisis, the model is solved with a 25% tax cut in 1998. With government outlays held constant for the crisis period, reduced tax rates result in an increase in government debt. This analysis, therefore, shows how much of an expansion would have been possible with such an increase in the government's debt level. A 25% tax cut amounts to a 3.34 percentage point decline in labor income tax, a 4.93 percentage point decline in capital income tax, and a 3.05 percentage point decline in consumption tax, from their initial levels of 13.6%, 19.7%, and 12.2%, respectively. In order to compare

TABLE 3. Tax rates

	Data and benchmark model	Proportional tax reduction	Labor tax reduction	Capital tax reduction	Consumption tax reduction
τ^l	13.60%	10.20%	10.20%	13.60%	13.60%
τ^k	19.70%	14.78%	19.70%	14.78%	19.70%
τ^c	12.20%	9.15%	12.20%	12.20%	9.15%

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. The tax rates used in the different counterfactual analyses are presented in Table 3.

The quantitative results in terms of the changes in the main macroeconomic variables during the crisis year for the proportional tax reduction are reported in Table 2 and presented together with the results from the benchmark model in Figure 4.

The last column in Table 2 shows the change in each variable in the proportional tax reduction case compared with the benchmark model, showing the effects of the tax cut. As a result of the proportional tax cut, output decline is reduced by 5.23 percentage points. In the benchmark model output decreases by 12.96%, whereas in the case of expansionary fiscal policy it decreases by 7.73%. The increase in output is due mainly to the change in labor supply, which increases substantially as a result of the tax cut on labor income. Labor only decreases by 1.93% compared to a 9.74% decline before the tax cut. Consumption increases both because the consumption tax rate is lower and because the marginal utility of

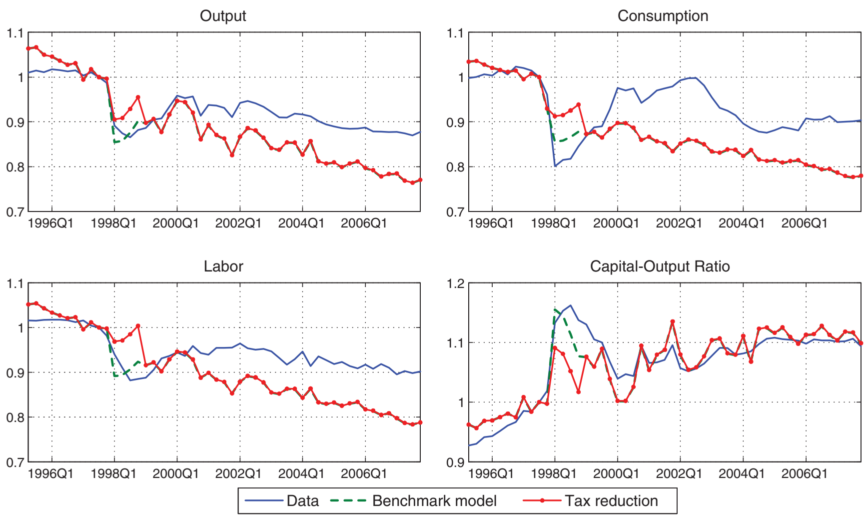

FIGURE 4. Predictions of the benchmark model and the proportional tax reduction.

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consumption is higher as a result of higher labor effort. The decline in consumption goes from 12.06% to 6.14%, resulting in a 5.92 percentage point increase. With the reduction in the capital income tax rate, households increase their investment. However, because capital accumulation occurs slowly and the tax cut lasts only one year, the capital stock increases only slightly by 0.07%.

The increase in the public debt-to-GDP ratio resulting from the proportional tax cut is 4.10 percentage points. Because the government outlays are held constant for the crisis period, reduced tax rates lead to an increase in government debt. However, the revenue loss by the government because of the tax cut has to be compensated for in the long run. Therefore, the steady-state transfers are reduced so that the present-value budget constraint of the government, equation (5), holds. The required reduction in transfers is 1.42% of the steady-state transfers used in the benchmark analysis. The change in welfare as a result of the implemented policy is also presented in the table. Although there is an increase in output and consumption in the short run, the revenue loss of the government has a cost of lower consumption in the long run because of reduced transfers to the household. In total, the results show that the tax reduction leads to a welfare gain. The change in welfare is represented by the permanent change in consumption required to equate lifetime utility under the counterfactual policy to the lifetime utility under the baseline policy, and the welfare gain equals a permanent 0.078% increase in consumption.

In the proportional tax reduction case, the results show the combined effect of tax cuts on all types of taxes. In order to disentangle the effect of each tax rate, the same analysis is carried out for a 25% cut in each tax rate separately, and the results are reported in Table 4. When the tax rates are reduced one by one, the tax cut on labor income turns out to have contributed the most to reducing the declines in output, consumption, and labor. The decline in output is reduced by 3.01 percentage points with a labor tax cut, whereas it is reduced by 2.14 percentage points with a consumption tax cut. Consumption decline is reduced by 3.22 and 2.53 percentage points, respectively, for the two tax cuts, making the labor income tax cut more effective again. The decline in labor is lower with a labor income tax cut as well. A reduction in the capital tax rate is the least effective of all policies, leading to a very small increase in all variables.

The increase in the debt-to-GDP ratio and the reduction in the steady-state transfers are lower with the labor income tax cut than with the consumption tax cut. Because the reduction in the labor tax generates a greater economic expansion at a lower cost than the consumption tax cut, it also leads to a higher welfare gain. Although the long-run cost of the capital tax cut is the lowest, because it has a very small effect on all variables during the crisis period, the welfare gain is the smallest under this policy.

In order to see how the results change depending on the magnitude of the tax cut, the model is solved for proportional tax reductions of 15% and 35% as additional counterfactual analyses, and the results are reported in Table 5. An increase in the government's debt level by 2.44% of output is associated with a 15% tax cut and

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TABLE 4. Increase relative to benchmark for each type of tax

Annual change in	Benchmark model	Proportional tax reduction	Labor tax reduction	Capital tax reduction	Consumption tax reduction
Output	−0.1296	0.0523	0.0301	0.0001	0.0214
Consumption	−0.1206	0.0592	0.0322	0.0001	0.0253
Labor	−0.0974	0.0781	0.0447	0.0001	0.0317
Capital	−0.0232	0.0007	0.0003	0.0002	0.0002
Change in debt-to-GDP (% points)		4.10	1.64	0.68	1.72
Reduction in steady-state transfers		1.42%	0.52%	0.24%	0.58%
Change in welfare (% consumption)		0.078%	0.045%	0.003%	0.033%

TABLE 5. Different levels of proportional tax reduction

Annual change in	15% tax reduction	25% tax reduction	35% tax reduction
Output	0.0310	0.0523	0.0739
Consumption	0.0348	0.0592	0.0847
Labor	0.0462	0.0781	0.1109
Capital	0.0004	0.0007	0.0009
Change in debt-to-GDP (% points)	2.44	4.10	5.79
Reduction in steady-state transfers	0.82%	1.42%	2.06%
Change in welfare (% consumption)	0.049%	0.078%	0.105%

leads to a 3.10 percentage point increase in output. An additional debt of 5.79% of output, on the other hand, increases output by 7.39 percentage points. With this policy, the labor supply actually increases during the crisis year by 1.35%, compared with the 9.74% decline in the benchmark model without any tax cut. The welfare gain also increases with the magnitude of the tax cut.

5. CONCLUSIONS

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. In the analysis, the tax rates on consumption, capital income, and labor income are reduced by 25% during the crisis, leading to an additional borrowing of 4.10% of GDP. Such a tax cut results in an increase in output by 5.23 percentage points and in consumption by 5.92 percentage points, showing how much of an expansion would have been possible with additional government debt of 4.10% of GDP. This policy is welfare-improving, with a welfare gain equal to a permanent 0.078% increase in 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 terms of reducing the economic contraction and leads to a greater welfare gain as well.

NOTES

1. See, among others, Gavin and Perotti (1997), Lane (2003), Talvi and Vegh (2005), Kaminsky et al. (2005), and Ilzetzki and Vegh (2008).
2. See Gavin and Perotti (1997), Aizenman et al. (2001), and Mendoza and Oviedo (2006).
3. The crisis dates covered in the sample are December 2001 for Argentina, July–November 1997 for Indonesia, Korea, and Thailand, December 1994 for Mexico, and February 2001 for Turkey. Annual HP-filtered series are used.
4. See Mendoza (1991), Correia et al. (1995), Kose (2002), and Neumeyer and Perri (2005), among others.
5. The average annual growth rate of GDP is 5.33% for the 1980–1997 period and 4.61% for the 1999–2007 period. Therefore, linearly detrending the series with the average growth rate for the whole period results in declining trends after the crisis.
6. Because data on bond yields with a shorter maturity are available starting only in 2000, the yields on treasury bonds with a three-year maturity are used in the model solution.

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APPENDIX

A.1. Construction of the Series Used in the Paper

GDP: The data on GDP are obtained from the IMF's International Financial Statistics database (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 wons, I took the ratio of nominal investment to nominal GDP and multiplied by GDP in 2005 prices. This series is then seasonally adjusted. To construct the capital stock series by the perpetual inventory method, the capital stock at the beginning of the investment series and a value for the depreciation rate, δ, have to be determined. I follow Conesa et al. (2007) in setting these values. The depreciation rate is chosen to be consistent with the average ratio of depreciation to GDP observed in the data over the 1980–2007 period, which equals 0.1146. The value of the capital stock is set so that the capital–output ratio in the initial period matches the average capital–output ratio over some reference period. The initial capital stock is therefore set so that the capital–output ratio in 1960 matches its average over 1961–70.

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

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 the 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 and 2007, which is 4.62%.

Tax rates: The tax rates have been computed using the method described by Mendoza et al. (1994).

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

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: Employers' 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 other data used in the computation of the tax rates come from the Bank of Korea and are categorized as follows:

C: Private final consumption expenditure
G: Government final consumption expenditure
GW: Compensation of employees paid by government
W: Wages and salaries
HHOS: Household operating surplus
HHPI: Household property income
OS: Operating surplus

Consumption tax rate:

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

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

$$\tau_h = \frac{1100}{W + \text{HHOS} + \text{HHPI}}.$$

Tax rate on labor income:

$$\tau_l = \frac{\tau_h W + 2000 + 3000}{W + 2200}$$

Tax rate on capital income:

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

A.2. The Relationship between Output and Current Account in Emerging Market Economies

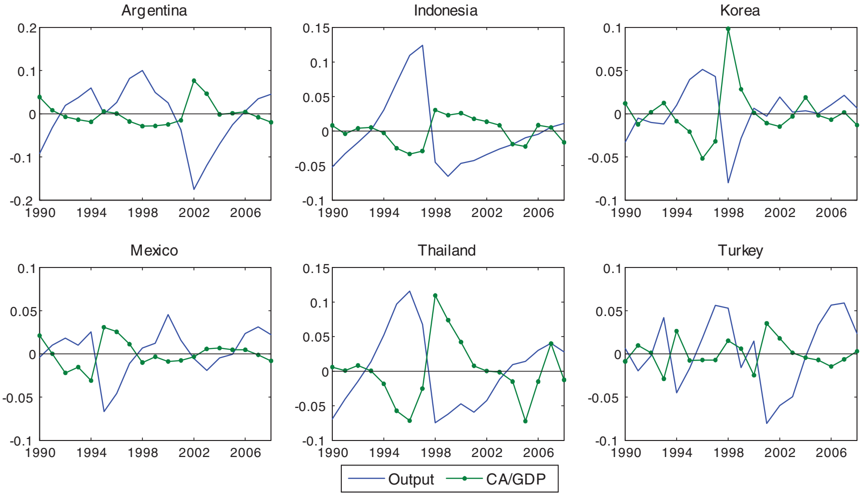

FIGURE A.1. Output and current account-to-GDP ratio in emerging market economies.

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