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Consumption, Leisure, and Cross-country Welfare Costs of Business Cycles

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Abstract

We compute the welfare costs of business cycles for a broad panel of countries with aggregate data over the period 1950-2014. We find substantial cross-country variability in the estimated welfare costs of business cycles. Welfare costs appear to be larger in Latin American and Asian economies. Additionally, for some individual countries, the estimated welfare costs of business cycles are an order of magnitude larger than for the U.S. economy. Our estimates are robust to different country groupings, e.g., Advanced Economies vs. Emerging Markets, or Inflation Targeters vs. non-Targeters, different time periods, and the inclusion of the labor-leisure tradeoff in the utility function.

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1. Introduction

The debate around stabilization policy has been at the center of macroeconomics for many years. Among the results in the literature, one stands out - Lucas (1987, 2003) - famous result that the welfare gains from eliminating business cycles fluctuations, beyond the general stabilization polices that already took place, are negligible.

More specifically, Lucas (2003) assumes a representative agent whose isoelastic utility function depends only on per capita consumption, and whose measure of welfare is given by the expected discounted sum of his/her time separable utility function. Additionally, Lucas assumes that the logarithm of the deviation of annual per capita consumption around its trend is serially uncorrelated and normally distributed. Armed with these assumptions, Lucas estimates that the welfare gain from eliminating business cycles fluctuations, for the log utility case, is 0.05% of the average consumption level, which is negligible.

This result had a huge impact, having generated a large literature questioning and generalizing each assumption used by Lucas (2003). One strand of the literature focuses on relaxing the assumption of time separability of the utility function. As it is well known, in the time separable case with CRRA utility function, as the one used by Lucas (2003), the coefficient of relative risk aversion is constrained to be the inverse of the elasticity of substitution, despite the fact these parameters are unrelated. One example of paper in this strand of the literature is Tallarini (2000), who works in a non-expected utility framework in which the risk aversion coefficient can be disentangled from the elasticity of substitution. Tallarini (2000) finds much larger estimates of the welfare cost of business cycles. However, these larger estimates only appear at levels of risk aversion too high to be considered plausible. For example, Epaulard and Pommeret (2003) estimate that the welfare costs of business cycles can be more than 30% of the initial capital for a degree of risk aversion of 20, which is well above the range of plausible values for the risk aversion coefficient. On the other hand, for reasonable levels of risk aversion these models generate welfare costs of business cycles that are consistent with Lucas's original estimates.

A second strand in the literature, relaxes the hypothesis of a representative agent. There is a large literature assessing the welfare costs of business cycles in models with heterogeneous agents and incomplete markets, such as Krebs (2003, 2007), for instance. However, in general, these models generate welfare costs of the business cycles that are not much larger than Lucas's estimates. A third strand in the literature focus on the hypothesis of serially uncorrelatedness of the consumption series. For example, Reis (2009) assumes that consumption follows an AR (1) process, and he shows that persistence is an important determinant of the welfare costs of business cycles. He shows how to construct estimates of the welfare costs in the presence of persistence in the consumption process. He generates welfare estimates for the U.S. economy that are between 0.5% and 5% of average consumption, which are much larger than Lucas's original estimates. However, these estimates still suggest that the welfare costs of business cycle are relatively low.

One issue in the literature is that most of the studies use data for the U.S. only, which is a mature economy that exhibits high degree of stability, especially since after the World War II. In this sense, it is not surprising that one would not find large gains from eliminating business cycles fluctuations beyond the general stabilization policies already implemented. The same may not be true of other economies around the world, such as Latin American and Southeast Asian economies, which in the past have been subjected to wild economic fluctuations. Additionally, by focusing on the U.S. only one leaves out a wealth of data available from other countries. It would be informative to take into account cross-country data for a broad sample of countries to estimate the welfare cost of business cycles.

In this paper, we contribute to the literature in two ways. First, and, this is the main contribution of the paper, we use version 9.0 of the Penn World Tables (PWT) dataset to construct a panel with 38 countries and generate estimates of the welfare costs of business cycles over the period 1950-2014. The wealth of data in PWT, both in its cross-section and time series dimension, allows us to explore estimates across countries and over different time periods.

However, we also address a secondary question that surprisingly remains open in the literature. One of the leading textbook in macroeconomics, Romer (2019), suggests that the absence of the labor-leisure tradeoff in the utility function could potentially account for the low estimates of the welfare costs of business cycles. As the argument goes, since working-hours exhibit more cyclical variation than consumption, then including this source of variation in the utility function may account for the missing link that renders estimates of the welfare cost of business cycles so small. Interestingly, despite this literature being already in its maturity, we find no paper focusing specifically on the inclusion of working-hours (or, equivalently, leisure-hours) in the utility function in calculating the welfare gains from stabilization of the business cycles.[1] In this sense, our estimates of the welfare cost of business cycles consider a specification with leisure-hours included as an argument in the utility function.[2] By including the labor-leisure tradeoff in the utility function, we can check whether the variability in leisure-hours (or, equivalently, in working-hours) can potentially generate larger welfare costs of business cycles. Our estimates suggest that the addition of the labor-leisure tradeoff in the utility function does not change the estimated welfare costs of business cycles.[3]

Our estimates suggest that there is substantial cross-country variability in welfare gains from eliminating business cycles fluctuations. We emphasize that, as noted by Lucas (2003), these are welfare costs that come from fluctuations on a consumption profile that was already smoothed by macroeconomic stabilization policies. According to our estimates, the largest welfare costs of business cycles occur in Latin American economies. Among the Latin American economies, Venezuela stands out as the country that would benefit the most from stabilizing its business cycles, followed by Argentina and Peru. Asian economies would also benefit substantially from eliminating business cycles fluctuations, in large part because of the turbulent 1990s and some individual fast-growing countries, such as India.

Additionally, as mentioned above, we find that introducing leisure-hours in the utility function does not change substantially estimates of the welfare cost of business cycle. This finding derives from the fact that leisure-hours/working-hours exhibit a smooth trend, with little cyclical variation, which, if stabilized, translates into negligible welfare gains. Intuitively, change in utility from reduced leisure and increased consumption in boom times, exactly offsets the change in utility from increased leisure and reduced consumption in recession times.

This paper is structured as follows. Section 2 discusses the methodology. Section 3 discusses the data. Section 4 presents estimates of the welfare cost of business cycles. Section 5

[1] Romer (2019), on p. 595, cites Romer and Ball (1990) as having found that the variability in working-hours could be substantial and, as a result of that, it could be the source of welfare costs of business fluctuations. Although this may be the case, Romer and Ball (1990) is concerned primarily with real and nominal rigidities in a New Keynesian model, and not welfare costs of business cycles. Older editions of Romer's textbook contain the same information, e.g., Romer (2012, p. 530).

[2] The idea of including leisure-hours in the utility function is not new. For example, Otrok (2001) has a similar specification, although his paper is concerned with time non-separabilities in preferences.

[3] We choose to work with leisure-hours, following Otrok (2001). However, equivalently, we could have used working-hours in the utility function. This choice is inconsequential for our results, as will be clear in section 2 below.

presents an alternative set of estimates, intended as a robustness check on our initial estimates. Finally, section 6 concludes the paper.

2. Methodology

We estimate the welfare cost of the business cycles using two different methodologies. First, we extend the methodology in Lucas (2003) by including leisure in the utility function. Specifically, we assume that consumption and leisure are jointly lognormal, and we then compute the compensating parameter λ that corresponds to a level of welfare in which consumption and leisure are held constant at their respective mean values.

Second, we consider an agnostic approach in which we assume a continuously differentiable utility function in consumption and leisure, and second-order Taylor expand it around the mean values of consumption and leisure. We then obtain an expression for the amount of consumption that would leave an individual with a utility level consistent with the utility level achieved if consumption and leisure were completely smoothed.

As Lucas (2003) is our main reference, we briefly review his main result here. Lucas (2003) assumes that consumption is log-normally distributed as follows:

$$c_t = Ae^{\mu t}e^{-0.5\sigma^2}\varepsilon_t \qquad (1)$$

Where $log(\varepsilon_t)\sim N(0,\sigma^2)$, so that we have $E\left(e^{-0.5\sigma^2}\varepsilon_t\right) = 1$, and expected consumption is given by $E(c_t) = Ae^{\mu t}$. Additionally, the representative consumer is risk-averse, with utility given by a CRRA utility function, $u(c) = \frac{c^{1-\theta}}{1-\theta}$, for $\theta \neq 1$, and $u(c) = log(c)$ for $\theta = 1$.

To determine the welfare gains from stabilizing consumption around its trend, Lucas multiply the risky consumption path by a constant $(1+\lambda)$, at all points, across time and states, so that the representative consumer is indifferent between the deterministic consumption path and the compensated risky path. More specifically, Lucas's measure of welfare gain is calculated by solving for λ in the equation below:

$$E\left\{\sum_{t=0}^{\infty}\beta^t\frac{\left((1+\lambda)c_t\right)^{1-\theta}}{1-\theta}\right\} = \sum_{t=0}^{\infty}\beta^t\frac{\left(Ae^{\mu t}\right)^{1-\theta}}{1-\theta} \qquad (2)$$

Where $\beta \in (0,1)$ is the intertemporal discount rate, and consumption is given by equation (1). Lucas (2003) shows that the expression for λ is given by:

$$\lambda \cong 0.5\theta\sigma^2 \qquad (3)$$

The compensating parameter depends on the coefficient of relative risk aversion (θ), and on the variance of the deviation of log consumption around its trend (σ^2), which is a measure of risk.

According to Lucas's estimates, for the log utility case, we have that $\lambda = 0.05\%$ of consumption. This finding suggests that the welfare gain associated with stabilizing the business cycles is negligible.

We extend Lucas´s (2003) to include leisure in the utility function as follows.[4] We assume that consumption and leisure are jointly log-normally distributed according to

$$c_t = Ae^{\mu t-0.5\sigma_p^2}p_t \qquad (4)$$

$$l_t = Be^{\xi t-0.5\sigma_q^2}q_t \qquad (5)$$

[4] As mentioned in the introduction, our estimates do not depend on whether we use leisure-hours or working-hours in the utility function. We define leisure-hours as follows, leisure-hours=8760-(working-hours), therefore, the variance of leisure-hours equals the variance of working-hours. It is really a matter of preferences to either use a "good" (leisure-hours) or a "bad" (working-hours) in the utility function. Ultimately, the change in the sign of the marginal (des)-utility, will be compensated by the change in the sign of the correlation term between leisure-hours and working-hours.

Where we have that

$$\begin{bmatrix} log(p_t) \\ log(q_t) \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_p^2 & \sigma_{pq} \\ \sigma_{qp} & \sigma_q^2 \end{bmatrix}\right) \qquad (6)$$

The expected values of consumption and leisure are given, respectively, by $E[c_t] = Ae^{\mu t}$ and $E[l_t] = Be^{\xi t}$, where μ is the trend growth rate of consumption and ξ is the trend growth rate of leisure-hours.[5]

We assume that utility is non-separable and it is given by $u(c,l) = \frac{[cl^{\eta}]^{1-\theta}}{1-\theta}$, for $\theta \neq 1$, where θ is the coefficient of relative risk aversion and η is the parameter of the leisure term. To find the compensating parameter, we must solve for λ in the following equation:

$$E\left[\sum_{t=0}^{\infty} \beta^t \frac{\left[(1+\lambda)c_t l_t^{\eta}\right]^{1-\theta}}{1-\theta}\right] = \sum_{t=0}^{\infty} \beta^t \frac{\left[Ae^{\mu t}(Be^{\xi t})^{\eta}\right]^{1-\theta}}{1-\theta} \qquad (7)$$

As in Lucas (2003), we multiply the risky consumption stream by a constant parameter λ. It can be shown that the compensating parameter is given by:

$$\lambda \cong \frac{\theta}{2}\sigma_p^2 + \frac{\eta[1-\eta(1-\theta)]}{2}\sigma_q^2 + 2\eta\sigma_{pq} \qquad (8)$$

The first term in equation (8), is the Lucas's term, which corresponds to equation (3), as derived by Lucas (2003). The second term in equation (8), captures the effect of the variability of leisure-hours on welfare, and the third term captures the effect of the interaction between consumption and leisure-hours on welfare, which can be positive or negative. For the case in which $\theta = 1$, the utility function converges to:

$$u(c,l) = log(c) + \eta log(l) \qquad (9)$$

And, the expression for the compensating parameter is given by

$$\lambda \cong 0.5\sigma_p^2 + 0.5\eta\sigma_q^2 \qquad (10)$$

Below we discuss how to estimate the quantities σ_p^2, σ_q^2, and σ_{pq}.

As mentioned above, we also consider an alternative approach to compute the welfare costs of business cycles, which we call the agnostic procedure.[6] In this case, we second-order Taylor expand a well-behaved utility function in consumption and leisure, given by $u(c,l)$, around the mean values of consumption (c_0) and leisure (l_0). We obtain the following expression:

$$u(c,l) = f(c_0,l_0) + \frac{\partial u}{\partial c}(c-c_0) + \frac{\partial u}{\partial l}(l-l_0) + \frac{1}{2}\frac{\partial^2 u}{\partial c^2}(c-c_0)^2 + \frac{1}{2}\frac{\partial^2 u}{\partial l^2}(l-l_0)^2 + \frac{\partial^2 u}{\partial c \partial l}(c-c_0)(l-l_0) \qquad (11)$$

Taking the expected value of the above expression, we find that

$$E[u(c,l)] = u(c_0,l_0) + \frac{1}{2}\frac{\partial^2 u}{\partial c^2}\sigma_c^2 + \frac{1}{2}\frac{\partial^2 u}{\partial l^2}\sigma_l^2 + \frac{\partial^2 u}{\partial c \partial l}\sigma_{cl} \qquad (12)$$

If we eliminate all the variability in consumption and leisure, the gain in expected utility, denoted by du, is given by

[5] A perceptive referee raised an important point related to the introduction of leisure in the utility function. Our analysis does not take account of distributional effects of the welfare cost of business cycles, which Lucas (2003) acknowledges as potentially important. Although the average welfare costs may be negligible, they may be large for some individuals. In this sense, according to the referee, the introduction of leisure in the utility function may amplify the bias caused by distributional effects, because one cannot assume that all individuals have the same number of leisure/working-hours. We acknowledge this point, however, the question we address by including leisure-hours in the utility function is related to the explanatory power of this variable as a potential source of welfare cost of business cycles, as argued in Romer (2019).

[6] This is the approach taken by Romer (2019, 2012).

$$du = -\left(\frac{1}{2}\frac{\partial^2 u}{\partial c^2}\sigma_c^2 + \frac{1}{2}\frac{\partial^2 u}{\partial l^2}\sigma_l^2 + \frac{\partial^2 u}{\partial c \partial l}\sigma_{cl}\right) \qquad (13)$$

To obtain the gain in consumption that yields this gain in expected utility, we, first, totally differentiate the utility function:

$$du = \frac{\partial u}{\partial c}dc + \frac{\partial u}{\partial l}dl \qquad (14)$$

Additionally, we assume that consumption is a function of working-hours à la Robinson Crusoe, that is:

$$c = f(\bar{l} - l) \qquad (15)$$

Where $\bar{l}$ denotes the total number of hours available for leisure and work (which we set at 8760 hours annually), so that $\bar{l} - l$ is working-hours. Then, totally differentiating expression (15), we get $dc = -MPL \cdot dl$, where $MPL = f'(\bar{l} - l)$, denotes the marginal product of labor. Therefore, we can write $dl = -MPL^{-1} \cdot dc$. Substituting this last expression in equation (14), we obtain an expression for du as a function of dc. Substituting this expression in equation (13) and solving for dc, we obtain the following expression:

$$dc = \frac{-[0.5 \cdot u_{cc} \cdot \sigma_c^2 + 0.5 \cdot u_{ll} \cdot \sigma_l^2 + u_{cl} \cdot \sigma_{cl}]}{u_c - MPL^{-1} \cdot u_l} \qquad (16)$$

Rearranging equation (16) to write it as a proportion of consumption, we have that:

$$\frac{dc}{c} = \frac{-[0.5 \cdot u_{cc} \cdot c^{-1}\sigma_c^2 + 0.5 \cdot u_{ll} \cdot c^{-1}\sigma_l^2 + u_{cl} \cdot c^{-1}\sigma_{cl}]}{u_c - MPL^{-1} \cdot u_l} \qquad (17)$$

First, we consider the separable utility function below

$$u(c,l) = \frac{c^{1-\theta} - 1}{1-\theta} + \frac{l^{1-\psi}}{1-\psi} \qquad (18)$$

Where θ is the coefficient of relative risk aversion, and the parameter ψ determines the elasticity of the labor supply. Therefore, using (17), we obtain the following expression for dc/c:

$$\frac{dc}{c} = \frac{0.5\theta(\sigma_c/c)^2 + 0.5\psi c^{\theta-1} l^{1-\psi}(\sigma_l/l)^2}{1 - MPL^{-1} c^{\theta} l^{-\psi}} \qquad (19)$$

As in equation (8) above, the first term in the numerator of equation (19), given by $0.5\theta(\sigma_c/c)^2$, is the Lucas's term. The introduction of leisure in the utility function, in a separable way, adds two additional terms in the equation for the welfare costs of business cycles fluctuations. The first term adds to the Lucas's term in the numerator, and it refers to the effects of the variability in leisure-hours on welfare. That is, the variance of leisure-hours adds up to the variance of consumption, which increases the total variance of the process, decreasing the welfare of a risk-averse individual. The third term, which appears in the denominator of expression (19), is an adjusting factor that must be applied to correct for the amount of consumption given to the individual to stabilize its utility level, given that the compensating parameter λ only applies to the consumption stream, leaving out any adjustment on the amount of leisure.

In addition to the utility function in (18), we also consider a non-separable functional form, given by $u(c,l) = \frac{[cl^{\eta}]^{1-\theta}}{1-\theta}$. In this case, the expression for dc/c, for $\theta \neq 1$, is given by:

$$\frac{dc}{c} = \frac{0.5\theta(\sigma_c/c)^2 + 0.5\eta[1-\eta(1-\theta)](\sigma_l/l)^2 + \eta(\theta-1)(\sigma_c/c)(\sigma_l/l)\rho_{cl}}{1 - \eta MPL^{-1} c l^{-1}} \qquad (20)$$

Where ρ_{cl} is the correlation coefficient between consumption and leisure-hours. Compared to expression (19), equation (20) has one additional term in the numerator. The new term shows that the variability of leisure-hours may or may not add to consumption risk, because now we have, in addition to the variance term of leisure-hours, the correlation term between consumption and leisure-hours. The correlation term may work as a hedge to consumption risk, in which case its sign will be negative, i.e., $\rho_{cl} < 0$, or it can add to consumption risk, in which case its sign will be positive, i.e., $\rho_{cl} > 0$.

In general, the level of consumption correlates negatively with leisure-hours. However, the pattern in the data is varied, with consumption and leisure-hours positively correlated in many countries. Therefore, a priori the inclusion of leisure-hours in the utility function in a non-separable fashion may increase or decrease the amount of consumption needed to stabilize welfare in the face of economic fluctuations. For the log utility case, when $\theta = 1$, equation (20) reduces to:

$$\frac{dc}{c} = \frac{0.5(\sigma_c/c)^2 + 0.5\eta(\sigma_l/l)^2}{1 - \eta MPL^{-1} cl^{-1}} \qquad (21)$$

Finally, we use equations (17), (19), (20), and (21) to estimate the welfare cost of business cycles fluctuations.

3. Data

We use the PWT dataset version 9.0 to construct a panel of 38 countries with annual time series data over the period 1950-2014. The set of countries included in the panel was selected based on data availability. In general, the main constraint we faced was missing data on the average working-hours (AVH), which we use to construct the series for leisure-hours.

Consumption per capita is constructed as follows: $c = CSHC \cdot RGDPO/POP$, where RGDPO denotes the output side real GDP at chained PPP in constant 2005 dollars, CSHC denotes the share of consumption in GDP, and POP denotes the total population.

The marginal product of labor, denoted by MPL, is calculated as $LABSH \cdot RGDPO/POP$, where LABSH denotes the labor share, and POP is total population as defined above.

The leisure-hours series is constructed as follows, $Leisure = 8760 - AVH$, where 8760 is the total number of hours in one year (365days·24hours/day=8760hours) and AVH is the average number of hours worked per year.

To implement equations (8) and (10), we estimate the parameters σ_p, σ_q and σ_{pq} for individual countries according to the following procedure: (i) First, for each country, we detrend the time series for consumption per capita, and leisure-hours, assuming an exponential-trend model. For example, for consumption per capita c_t, we estimate the model $log(c_t) = \alpha + \mu t + \varepsilon_t$, and get the residuals to obtain consumption detrended; (ii) Based on the detrended time series for consumption per capita and leisure-hours, we compute the standard deviations and the correlation between the two series, and take them as estimates of σ_p, σ_q and σ_{pq}, respectively.

To calculate the welfare costs of business cycle using the agnostic procedure, we implement equations (17), (19), (20) and (21), so that we need to estimate the quantities $\frac{\sigma_c}{c}, \frac{\sigma_l}{l}$ and ρ_{cl} by country. To compute σ_c and σ_l, we compute the standard deviation of the Hodrick-Prescott detrended series for consumption per capita and leisure-hours, respectively. We treat c and l in equations (17), (19), (20) and (21) as simple averages of the time series for consumption per capita and leisure-hours, respectively. The quantity ρ_{cl}, is computed as the correlation coefficient between the HP detrended consumption per capita and leisure-hours.

For the coefficient of relative risk aversion, we follow Lucas (2003) and set $\theta = 5$ for all specifications except in the logarithmic utility case in which the coefficient of relative risk aversion is unitary. For the labor supply parameter, we set $\eta = 1$ for Lucas's procedure in the non-separable case, whereas for the agnostic approach in the non-separable case we set $\eta = 5$. For the separable case, for both procedures, we set $\theta = \psi = 5$, and $\theta = 1$ and $\psi = 5$ for the logarithmic utility.

Estimates of the welfare cost of business cycles tend to increase linearly with the coefficient of relative risk aversion, whereas they are largely insensitive with respect to the labor supply parameter, except for the case of separable utility in consumption and leisure in the agnostic procedure. In this case, for $\theta = 5$, values of η less than four, produce negative estimates of the welfare cost of business cycle.[7] For all other specifications, changes in the labor supply parameters, either η or ψ, produce minor changes in the estimated welfare costs.

4. Estimates of the Welfare Costs of Business Cycle

Table 1 displays summary measures of welfare costs estimates of the business cycles for three groups of countries, namely, Developed countries, Latin America, and Asian, as well as individual estimates for the U.S., which we take it as our benchmark country. Estimates were generated using all available data for the years 1950-2014.

Column (1) displays estimates of the welfare cost for the U.S. following Lucas's (2003) procedure with consumption only in the utility function. Our estimate of 0.35% is about seven times Lucas´s original estimate, however it is still negligible. Column (2) displays estimates for the U.S. based on the non-separable utility case with consumption and leisure, extending Lucas's procedure. Interestingly, in this case, our estimate is numerically equal to the estimate in column (1). That is, for the U.S. economy, the addition of leisure in the utility function does not change the estimated welfare cost of business cycles. This suggests that changes in utility caused by reduced leisure and added consumption in boom times, and added leisure and reduced consumption in recession times, exactly offset each other.

Column (3) displays estimates of the welfare cost following Lucas's procedure with logarithmic utility in consumption and leisure. In this case, our estimate practically coincides with the original one in Lucas (2003), which, again, suggests that including leisure-hours in the utility function does not alter the estimated welfare cost of business cycles.

Column (4) shows welfare cost estimates for the U.S. following the agnostic procedure assuming that consumption is the single argument in the utility function. Our estimate of 0.08% is close to the original one generated by Lucas (2003). Additionally, including leisure in the utility function in a non-separable way, shown in column (5), produce a slightly larger estimate of the welfare cost (0.10%). Moreover, with logarithmic utility in consumption and leisure, the estimate drops to near zero at 0.02% (column 6).

For Developed economies, following Lucas's (2003) procedure, column (1) shows that the average benefit from eliminating consumption fluctuations is 2.34%, whereas the median is 1.61%. The standard deviation is quite large, at 2.26%. Once we include leisure in the utility function in a non-separable way, column (2), we find estimates that mimic those found by using Lucas's original procedure. For the logarithmic utility case, in which the coefficient of relative risk aversion is unitary, shown in column (3), produces estimates that are one-fifth of those in column (2), in which we assume that the degree of risk aversion is five.

Following Lucas's methodology, with and without leisure in the utility function, the average welfare cost of business cycles for Latin American economies is about 7% (columns 1 and 2), whereas assuming logarithmic utility gives an estimate of 1.43%, on average (column 3). Given the history of economic volatility in Latin America, it is not surprising that estimates of the welfare cost of business cycles fluctuations in this region are larger and more volatile than compared with the rest of the world.

[7] These simulations are available upon request.

Table I: Estimates of Welfare Costs of Business Cycles Fluctuations for Selected Groups of Countries and the U.S., 1950-2014 – Summary Statistics

Group	Lucas (2003) Col. (1)	AM - non separable Col. (2)	AM - Log Util. Col. (3)	AG - Cons. Only Col. (4)	AG - non-separable Col. (5)	AG - Log Util. Col. (6)
US	0.35%	0.35%	0.07%	0.08%	0.10%	0.02%
Developed						
Average	2.34%	2.38%	0.47%	0.33%	0.36%	0.07%
Median	1.63%	1.63%	0.33%	0.33%	0.35%	0.07%
Std. Dev.	2.26%	2.23%	0.45%	0.26%	0.27%	0.05%
Max	10.24%	9.92%	2.06%	1.32%	1.40%	0.27%
Min	0.26%	0.26%	0.05%	0.06%	0.07%	0.01%
Latin Am.						
Average	7.13%	7.14%	1.43%	1.19%	1.24%	0.24%
Median	6.13%	6.14%	1.23%	0.64%	0.69%	0.13%
Std. Dev.	4.53%	4.55%	0.91%	1.04%	1.07%	0.21%
Max	14.48%	14.53%	2.90%	2.91%	2.97%	0.58%
Min	3.02%	3.08%	0.60%	0.36%	0.37%	0.07%
Asian						
Average	4.90%	5.00%	0.99%	0.70%	0.72%	0.14%
Median	3.99%	4.07%	0.80%	0.76%	0.72%	0.15%
Std. Dev.	3.63%	3.64%	0.73%	0.27%	0.26%	0.05%
Max	12.54%	12.55%	2.51%	1.06%	1.03%	0.21%
Min	1.88%	1.91%	0.38%	0.30%	0.32%	0.06%

Notes: AM denotes Arrigoni-Mello, AG denotes Agnostic procedure. Estimates in column (1) are based on equation (3). Estimates in column (2) are based on equation (8). Estimates in column (3) are based on equation (10); Estimates in column (4) are based on the Lucas's term in equation (19); Estimates in column (5) are based on equation (2), and Estimates in column (6) are based on equation (21). Estimates in columns (1)-(3) assume $\theta = 5$ and $\eta = 1$, whereas estimates in columns (4)-(6) assume $\theta = \eta = 5$. The list of Developed countries includes the following: Austria, Belgium, Switzerland, Germany, Denmark, Spain, Finland, France, United Kingdom, Ireland, Iceland, Italy, Luxembourg, Netherlands, Norway, Portugal, Sweden, Canada, Australia, New Zealand, and Japan. Latin American countries: Argentina, Brazil, Colombia, Peru, and Venezuela. Asian countries: Hong Kong, Indonesia, India, Malaysia, Singapore, South Korea, and Thailand. Three countries in our sample were left out of the above classification, namely, Poland, Cyprus, and Turkey.

Average welfare costs estimates for Latin American economies using the agnostic procedure (columns 4-6) fall in the range 0.24% to 1.24%. Although these estimates are relatively low, they still are much larger than compared with other countries.

Estimates for Asian countries fall in between estimates for Developed and Latin American countries. For example, following Lucas's procedure, the average estimated welfare cost of business cycles is 4.90%, compared to 7.13% for Latin America, and 2.34% for Developed countries. Following the agnostic procedure with and without leisure in the utility function (columns 4 and 5), welfare costs estimates stay at 0.70% and 0.72%, respectively. For the logarithmic utility case the estimated welfare cost is 0.14%.

Table II below displays estimates for individual countries for the Lucas consumption-only case and its extended version including consumption and leisure in the utility function for the entire sample period, 1950-2014. Estimates in column (1) suggest that the highest estimated welfare benefit of eliminating consumption fluctuations is for Venezuela, at 14.48%. This is somehow expected, given the downward economic spiral Venezuela is going through in the last several years.

Similarly, the estimated welfare cost for Argentina, following Lucas (2003), in column (1), reaches almost 10% of the consumption level. Other Latin American countries also present relatively high estimates, such as Peru (8.15%), Brazil (3.28%), Colombia (4.11%), and Mexico (3.02%).

Column (1) also exhibits large estimates of the welfare costs for some developed economies, such as Germany (4.04%), Spain (4.25%), Italy (4.79%), and Japan (10.24%). One factor potentially explaining these large estimates is the sample period, which includes the post-World War II period, which was characterized by fast growth from 1950 to 1980, followed by a slowdown in economic activity.

Estimates in column (2) includes the labor-leisure tradeoff in the Lucas's procedure and are numerically close to estimates in column (1), which are based on the consumption-only utility function. Again, this suggests that the inclusion of leisure-hours does not affect estimates of the welfare cost of business cycles. Estimates in column (3), for the logarithmic utility case when the degree of risk aversion is unitary, produce welfare costs that are one-fifth of those in column (1), when the degree of risk aversion is five.

In conclusion, estimates in Table II suggest that welfare costs of the business cycles, as computed following Lucas's procedure, can be large for certain countries. Again, we emphasize that these welfares costs emerge on top of the stabilization policies already implemented in the consumption and leisure-hours series. Additionally, the inclusion of the leisure-hours in the utility function does not alter estimates of the welfare costs of business cycles, contrary to some claims in the literature.

Table III displays estimates of the welfare cost of business cycles for individual countries over the period 1950-2014 following the agnostic procedure. There are two noticeable features in Table III. First, comparing methodologies, we observe that Lucas's procedure (column 1) generates estimates of the welfare costs that are substantially larger than those generated by the agnostic procedure (column 2). In some cases, by a factor of five or even ten. This is the case for Argentina, for example, where the estimated welfare cost in column (1) is 9.71%, whereas in column (2) is 2.03%.

Second, estimates generated for the case in which the utility function includes only consumption (column 2), are numerically close to the ones in which leisure is also included in the utility function (column 3), repeating the pattern we observe in Table II.

Table II: Estimates of the Welfare Costs of Business Cycles following Lucas's procedure, with and without leisure in the utility function

Country	Lucas (2003) Col. (1)	AM - non-separable Col. (2)	AM - log utility Col. (3)
Argentina	9.71%	9.72%	1.94%
Australia	0.26%	0.26%	0.05%
Austria	1.64%	1.65%	0.33%
Belgium	1.52%	1.61%	0.31%
Brazil	3.28%	3.22%	0.66%
Canada	0.45%	0.50%	0.09%
Switzerland	0.62%	0.62%	0.12%
Colombia	4.11%	4.10%	0.82%
Cyprus	4.92%	4.94%	0.99%
Germany	4.04%	4.27%	0.81%
Denmark	0.92%	0.96%	0.19%
Spain	4.25%	4.09%	0.85%
Finland	0.73%	0.74%	0.15%
France	2.15%	2.26%	0.43%
UK	1.63%	1.63%	0.33%
Hong Kong*	4.44%	4.55%	0.89%
Indonesia*	1.88%	1.91%	0.38%
India*	12.54%	12.55%	2.51%
Ireland	1.77%	1.85%	0.36%
Iceland	4.04%	4.37%	0.82%
Italy	4.79%	4.93%	0.96%
Japan	10.24%	9.92%	2.06%
South Korea	5.91%	6.30%	1.23%
Luxembourg	1.53%	1.59%	0.31%
Mexico	3.02%	3.08%	0.60%
Malaysia*	3.99%	4.07%	0.80%
Netherlands	2.52%	2.56%	0.51%
Norway	1.33%	1.24%	0.27%
N. Zealand	1.42%	1.42%	0.29%
Peru	8.15%	8.17%	1.63%
Poland*	0.61%	0.61%	0.12%
Portugal	3.06%	3.09%	0.62%
Singapore*	2.21%	2.26%	0.45%
Sweden	0.31%	0.33%	0.07%
Thailand*	3.35%	3.36%	0.67%
Turkey	1.36%	1.33%	0.28%
US	0.35%	0.35%	0.07%
Venezuela	14.48%	14.53%	2.90%

Note: AM denotes Arrigoni-Mello. Starred countries have a shorter sample period due to missing data: Hong Kong (1960-2014), Indonesia (1970-2014), India (1970-2014), Malaysia (1970-2014), Poland (1990-2014), Singapore (1960-2014), and Thailand (1970-2014). Estimates in column (1) are based on equation (3) assuming $\theta = 5$. Estimates in column (2) are based on equation (8) assuming $\theta = 5$ and $\eta = 1$. Estimates in column (3) are based in equation (10) assuming $\theta = \eta = 1$.

Table III: Estimates of the Welfare Costs of Business Cycles following Lucas's procedure, and the Agnostic approach, with and without leisure in the utility function

Country	Lucas (2003) Col. (1)	AG Cons. Only Col. (2)	AG non-separable Col. (3)	AG Log utility Col. (4)
Argentina	9.71%	2.03%	1.91%	0.41%
Australia	0.26%	0.06%	0.06%	0.01%
Austria	1.64%	0.14%	0.13%	0.03%
Belgium	1.52%	0.34%	0.35%	0.07%
Brazil	3.28%	0.73%	0.73%	0.15%
Canada	0.45%	0.10%	0.09%	0.02%
Switzerland	0.62%	0.16%	0.17%	0.03%
Colombia	4.11%	0.36%	0.35%	0.07%
Cyprus	4.92%	1.40%	1.40%	0.28%
Germany	4.04%	0.17%	0.17%	0.03%
Denmark	0.92%	0.24%	0.24%	0.05%
Spain	4.25%	0.39%	0.38%	0.08%
Finland	0.73%	0.33%	0.33%	0.07%
France	2.15%	0.19%	0.19%	0.04%
UK	1.63%	0.38%	0.37%	0.08%
Hong Kong	4.44%	0.84%	0.88%	0.17%
Indonesia	1.88%	0.76%	0.79%	0.15%
India	12.54%	0.30%	0.30%	0.06%
Ireland	1.77%	0.49%	0.49%	0.10%
Iceland	4.04%	1.32%	1.30%	0.27%
Italy	4.79%	0.37%	0.37%	0.07%
Japan	10.24%	0.24%	0.25%	0.05%
South Korea	5.91%	0.48%	0.49%	0.10%
Luxembourg	1.53%	0.39%	0.39%	0.08%
Mexico	3.02%	0.55%	0.56%	0.11%
Malaysia	3.99%	0.94%	0.93%	0.19%
Netherlands	2.52%	0.37%	0.38%	0.07%
Norway	1.33%	0.37%	0.37%	0.07%
New Zealand	1.42%	0.25%	0.25%	0.05%
Peru	8.15%	0.53%	0.53%	0.11%
Poland	0.61%	0.31%	0.31%	0.06%
Portugal	3.06%	0.41%	0.40%	0.08%
Singapore	2.21%	1.06%	1.05%	0.21%
Sweden	0.31%	0.17%	0.18%	0.03%
Thailand	3.35%	0.53%	0.53%	0.11%
Turkey	1.36%	0.56%	0.57%	0.11%
United States	0.35%	0.08%	0.08%	0.02%
Venezuela	14.48%	2.91%	2.90%	0.58%

Note: AM denotes Arrigoni-Mello. Starred countries have a shorter sample period due to missing data: Hong Kong (1960-2014), Indonesia (1970-2014), India (1970-2014), Malaysia (1970-2014), Poland (1990-2014), Singapore (1960-2014), and Thailand (1970-2014). Estimates in column (1) are based on equation (3) assuming $\theta = 5$. Estimates in column (2) are based on the Lucas's term in equation (19) assuming $\theta = 5$. Estimates in column (3) are based in equation (20) assuming $\theta = \eta = 5$. Estimates in column (4) are based on equation (21) with $\theta = \eta = 1$.

Estimates in column (4) are computed for the logarithmic utility case in both arguments, consumption and leisure, following the agnostic procedure. These estimates are proportional to the ones in column (3), with the constant of proportionality equal to one-fifth. This reflects the fact that the degree of risk aversion used to generate estimates in column (3) is five, whereas in the logarithmic utility case, as it is well known, the degree of risk aversion is unitary, and the fact that the inclusion of leisure-hours does not alter estimates of the welfare costs.

5. Robustness Check

As a robustness check to the split Developed/Latin America/Asian countries, we compute the welfare costs of business cycles for alternative country groupings and time periods. First, we generate estimates of the welfare costs for developed countries for selected time periods. We consider four different time periods, namely: (i) the Bretton Woods (BW) period comprising the years 1950-1970; (ii) the Great Inflation (GI) period, 1965-1982; (iii) the Great Moderation (GM) period, 1983-2007; and (iv) the Great Recession (GR) years, comprising the years 2008-2014. Second, we generate estimates of the welfare costs of business cycles grouping the countries as Inflation Targeting (IT) economies and non-Inflation Targeting (non-IT) economies.

Table IVa displays estimates of the welfare costs of business cycles for the four time periods listed above using Lucas's methodology and the agnostic procedure with consumption only in the utility function. According to estimates in Table IVa, following Lucas's methodology, columns (1)-(4), among the four time periods above, the Bretton Woods period is the one associated with the largest welfare costs of business cycles. For the Bretton Woods period, the average welfare cost is 1.57% with a standard deviation of 2.03%. This large estimated average is being pushed by Germany (with welfare cost of 3.61%) and Japan (with welfare cost of 8.36%), two of the most affected economies in World War II.

Estimates in column (2) for the Great Inflation period suggest that the average welfare costs of business cycles is 1% with a standard deviation of 1%. Over this period, the welfare costs of business cycles is estimated to be around 3% for Belgium, Italy and Portugal. A similar pattern emerges in column (3) for the Great Moderation period, with the average welfare cost at 1.2% with a standard deviation of 1.1%. Portugal, Ireland and Japan present estimates of the welfare cost at around 3%. The Great Recession period produces the smallest welfare costs of business cycles, being on average only 0.53%, with a standard deviation of 0.58%. Interestingly, according to the agnostic procedure, columns (5)-(8), estimates of the welfare cost fall in the interval (0.15%, 0.27%), on average, much smaller than the ones generated by the Lucas's procedure.

Estimates in Table IVb below, reproduce estimates of the welfare costs of business cycle from Table IVa with leisure-hours included in the utility function. Columns (1)-(4) display welfare costs estimates following Lucas's procedure, and we can observe that these estimates are numerically close to the ones in Table IVa. Again, the Bretton Woods period produces the largest welfare costs of business cycles, with the average estimated welfare cost at 1.55% with a standard deviation of 1.93%. For the Bretton Woods period, the average welfare cost is pushed up by estimates of Japan (8.36%), Spain (3.96%), Germany (3.61%), and Austria (2.60%).

The Great Inflation produces an average estimated welfare cost of 1.01%, with a standard deviation of 1.05%. These estimates are numerically close to the ones produced in the Great Moderation period at 1.22% and 1.09, respectively. The Great Recession period produces the smallest welfare costs estimates, with the estimated average at 0.54% and standard deviation of 0.59%. Estimates in columns (4)-(8), following the agnostic procedure, produce much smaller estimates of the welfare costs of business cycles. In addition, all estimates are numerically close to the ones in Table IVa, which, once more, suggests that the inclusion of leisure-hours in the utility function does not affect the welfare costs of business cycles.

Table IVa: Estimates of Welfare Costs of Business Cycles Fluctuations for Developed Countries for different time periods – Consumption Only

	Lucas (2003)				AG – Consumption Only			
Country	**B.W. Col.(1)**	**G.I. Col.(2)**	**G.M. Col.(3)**	**G.R. Col.(4)**	**B.W. Col.(5)**	**G.I. Col.(6)**	**G.M. Col.(7)**	**G.R. Col.(8)**
Australia	0.43%	0.05%	0.28%	0.07%	0.19%	0.03%	0.05%	0.02%
Austria	2.59%	0.27%	0.55%	0.08%	0.14%	0.17%	0.14%	0.05%
Belgium	0.46%	3.13%	0.46%	0.14%	0.27%	0.57%	0.30%	0.12%
Canada	0.20%	0.25%	0.12%	0.17%	0.06%	0.11%	0.09%	0.08%
Switzerland	0.64%	0.18%	0.49%	0.24%	0.10%	0.14%	0.17%	0.12%
Germany	3.44%	1.46%	1.08%	0.19%	0.34%	0.33%	0.12%	0.08%
Denmark	1.48%	0.36%	0.39%	0.15%	0.21%	0.21%	0.26%	0.13%
Spain	4.13%	1.19%	2.09%	1.44%	0.20%	0.27%	0.37%	0.25%
Finland	0.78%	0.22%	0.71%	0.13%	0.38%	0.12%	0.40%	0.12%
France	0.97%	1.25%	0.40%	0.23%	0.10%	0.18%	0.23%	0.04%
U. Kingdom	0.62%	0.19%	1.98%	1.35%	0.09%	0.14%	0.31%	0.45%
Ireland	0.73%	0.35%	3.19%	1.80%	0.22%	0.50%	0.39%	0.49%
Italy	1.16%	2.86%	1.74%	1.37%	0.11%	0.58%	0.33%	0.11%
Japan	8.89%	0.85%	3.86%	0.69%	0.12%	0.22%	0.24%	0.05%
Netherlands	1.42%	1.21%	0.92%	1.26%	0.20%	0.35%	0.34%	0.29%
Norway	0.30%	0.68%	1.41%	0.16%	0.22%	0.31%	0.44%	0.18%
New Zealand	1.57%	1.67%	1.32%	0.09%	0.74%	0.27%	0.18%	0.07%
Portugal	1.09%	3.12%	3.01%	0.76%	0.85%	0.76%	0.36%	0.14%
Sweden	0.19%	0.19%	0.44%	0.08%	0.09%	0.04%	0.25%	0.07%
United States	0.28%	0.13%	0.08%	0.22%	0.07%	0.13%	0.06%	0.06%
Average	1.57%	0.98%	1.23%	0.53%	0.24%	0.27%	0.25%	0.15%
Std. Dev.	2.03%	1.01%	1.10%	0.58%	0.21%	0.20%	0.12%	0.13%

Notes: B.W. refers to the Bretton Woods period, 1950-1970; G.I. refers to the "Great Inflation" period, 1965-1982; G.M. refers to the "Great Moderation" period, 1983-2007; and G.R. refers to the Great Recession period. Estimates above used a coefficient of relative risk-aversion equal to 5, i.e., $\theta = 5$.

As mentioned above, we also group the countries as inflation targeters (IT) and non-targeters (IT) and estimate the welfare costs of business cycles for the periods before and after the adoption of the inflation targeting regime. To economize on space, we do not present the table with the estimates here. However, we comment on the main findings from the Lucas's estimation procedure and make all estimates available upon request.

Table IVb: Estimates of Welfare Costs of Business Cycles Fluctuations for Selected Developed Countries for different time periods – Consumption and Leisure

	AM – non separable				AG – non separable			
Country	**B.W. Col.(1)**	**G.I. Col.(2)**	**G.M. Col.(3)**	**G.R. Col.(4)**	**B.W. Col.(5)**	**G.I. Col.(6)**	**G.M. Col.(7)**	**G.R. Col.(8)**
Australia	0.43%	0.06%	0.27%	0.07%	0.18%	0.07%	0.07%	0.01%
Austria	2.60%	0.26%	0.53%	0.07%	0.12%	0.15%	0.14%	0.02%
Belgium	0.46%	3.26%	0.50%	0.14%	0.29%	0.70%	0.36%	0.09%
Canada	0.19%	0.30%	0.13%	0.17%	0.07%	0.11%	0.07%	0.04%
Switzerland	0.60%	0.18%	0.53%	0.24%	0.10%	0.14%	0.23%	0.14%
Germany	3.61%	1.52%	1.15%	0.20%	0.39%	0.38%	0.15%	0.05%
Denmark	1.42%	0.39%	0.41%	0.15%	0.24%	0.32%	0.30%	0.16%
Spain	3.96%	1.14%	2.02%	1.45%	0.18%	0.20%	0.31%	0.29%
Finland	0.76%	0.25%	0.72%	0.13%	0.38%	0.18%	0.39%	0.10%
France	0.96%	1.36%	0.43%	0.25%	0.13%	0.17%	0.26%	0.05%
U. Kingdom	0.64%	0.18%	1.90%	1.41%	0.09%	0.14%	0.28%	0.37%
Ireland	0.77%	0.36%	3.32%	1.84%	0.23%	0.66%	0.42%	0.46%
Italy	1.18%	3.01%	1.79%	1.34%	0.23%	0.68%	0.32%	0.07%
Japan	8.36%	0.86%	3.79%	0.71%	0.23%	0.24%	0.33%	0.03%
Netherlands	1.38%	1.31%	0.88%	1.29%	0.24%	0.57%	0.36%	0.28%
Norway	0.30%	0.65%	1.34%	0.17%	0.23%	0.42%	0.42%	0.16%
New Zealand	1.64%	1.67%	1.27%	0.09%	0.74%	0.27%	0.19%	0.03%
Portugal	1.13%	3.13%	2.93%	0.76%	0.85%	0.72%	0.47%	0.12%
Sweden	0.23%	0.18%	0.44%	0.08%	0.08%	0.11%	0.30%	0.07%
United States	0.27%	0.13%	0.07%	0.23%	0.06%	0.08%	0.06%	0.02%
Average	1.55%	1.01%	1.22%	0.54%	0.25%	0.32%	0.27%	0.13%
Std. Dev.	1.93%	1.05%	1.09%	0.59%	0.21%	0.23%	0.12%	0.13%

Notes: B.W. refers to the Bretton Woods period, 1950-1970; G.I. refers to the "Great Inflation" period, 1965-1982; G.M. refers to the "Great Moderation" period, 1983-2007; and G.R. refers to the Great Recession period. AM denotes Arrigoni-Mello; These estimates were generated from equation (8) with $\theta = 1$, and $\eta = 1$. AG denotes agnostic procedure; These estimates were generated from equation (2) with $\theta = 5$ and $\eta = 5$.

We divide the countries in two groups, Advanced and Emerging Markets, according to the International Monetary Fund classification. Then we classify them as IT or non-IT, following Roger (2009) and our own research on central bank websites. We come up with four groups of countries: (i) Advanced economies adopting the IT regime (Australia, Canada, UK, South Korea, Iceland, New Zealand, and Sweden); (ii) Advanced economies not adopting the IT regime (Austria, Belgium, Switzerland, Cyprus, Germany, Denmark, Spain, Finland, France, Hong Kong, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Singapore, and the U.S.); (iii) Emerging markets economies adopting IT (Brazil, Colombia, Indonesia, Mexico, Peru, Poland, Thailand, and Turkey); and (iv) Emerging markets economies not adopting the IT regime (Argentina, Malaysia, India, and Venezuela). Additionally, for the non-targeters we choose the year 2000 as the year separating the pre/post adoption period, because this is the median year of IT adoption for the targeters.

Following Lucas's procedure with consumption only in the utility function and including all Advanced and Emerging Markets in the sample, we find estimates suggesting that welfare costs of business cycles for targeters before and after the periods of IT adoption are, respectively, 1.12% and 2.50%. And, for non-targeters in the before and after periods, are 1.82% and 3.61%, respectively. These estimates show little variation when we add leisure-hours in the utility function in a non-separable fashion.

When we restrict the sample to Advanced economies, for targeters in the pre-adoption period of IT, we find an estimated welfare cost of 0.99%, and of 1.79% for the post-adoption period. For non-targeters, we find that the pre and post-adoption periods estimates are 0.99% and 1.64%, respectively. That is, for advanced economies, estimates of the welfare costs of business cycles are the same, whether or not they adopted the inflation targeting regime. This finding is intuitive, it means that independent of the monetary regime in place, advanced economies adopt responsible monetary policies and all else equal, should experience similar business cycles fluctuations.

On the other hand, the same is not true if the sample includes only emerging markets economies. For the case of targeters, following Lucas's procedure with consumption only in the utility function, the pre and post periods estimated welfare costs are 1.23% and 3.13%, respectively. For the non-targeters, these estimates are 5.80% and 12.98%, respectively.[8] These estimates suggest that emerging market economies can improve their macroeconomic performance with better monetary policy.

The above robustness exercises produce estimates of the welfare costs that are consistent with our initial estimates. In general, we observe large cross-country variation in welfare costs, particularly for less developed and emerging market economies.

6. Conclusion

We estimate the welfare cost of business cycles for a broad set of countries over the period 1950-2014. We find that: (i) following Lucas (2003), with consumption only in the utility function, the welfare costs of business cycles, beyond the welfare costs associated with general stabilization policies that already took place, for the U.S. is estimated to be 0.35% of the consumption level, which is negligible and confirms Lucas's (2003) finding; (ii) Following Lucas's procedure, with consumption only in the utility function, we find substantial cross-country variability in welfare costs associated with business cycles fluctuations. In particular, the estimated welfare costs of business cycles for Developed economies is, on average, 2.34%, for Latin American economies is, on average, 7.13%, and it is 4.90% for Asian economies. This finding suggests that, while stabilizing business cycles fluctuations in the U.S. generate small welfare benefits, for some other countries these welfare gains can be sizeable. We consider this to be the main contribution of our paper; (iii) When we include leisure-hours in the utility function, following either Lucas or the agnostic procedure, we find welfare estimates that are numerically close to the ones generated when consumption is the only argument in the utility function. As mentioned above, this suggests that the changes in utility in boom times when leisure is down and consumption is up, and in recession times when leisure is up and consumption is down, exactly offset each other. This finding contrasts with claims in the literature that suggests that the inclusion of the labor-leisure trade-off in the utility function can account for the small welfare costs of business cycle fluctuations.

[8] The estimates for non-targeters are contaminated by Venezuela, which exhibits large welfare costs of business cycles.

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