




The purchase of the Diabetic Healthy Food Basket in Cyprus results in cost savings: is it affordable among the low-income population?

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Abstract

Objective: The main objective was to assess the cost, acceptability and affordability of the Cypriot Diabetic Healthy Food Basket (DHFB).

Design: The development of DHFB was based on the Cypriot HFB with adjustments based on the nutritional guidelines for diabetes as developed by the American Diabetes Association (ADA) and information retrieved through the questionnaires. Two DHFB were constructed for adult women and adult men (± 40 years) diagnosed with diabetes. Affordability was defined as the cost of DHFB as a percentage of the Guaranteed Minimum Income (GMI).

Setting: Cyprus.

Participants: 422 diabetic patients aged 18–87 years from different socioeconomic backgrounds.

Results: DHFB consists of eight food categories, similar to Cypriot HFB, but different specific food items. The total monthly budget for a diabetic woman is about 15% (25.68 Euros less) lower compared with HFB, and the relative percentage for a diabetic man is about 16% (37.58 Euros less). The total monthly budget for a diabetic woman is about 30% lower (60.32 Euros less) compared with that of a diabetic man. For low-income adults receiving GMI, the proportion of income that would need to be spent on DHFB ranges from around 30 to 42% for women and men, respectively.

Conclusions: The cost of DHFB is lower compared with HFB, meaning that nutritional treatment based on the practice guidelines for diabetes could be a cost-efficient therapy for these patients. DHFB is still not affordable among low-income persons.

Keywords
Healthy Food Basket
Affordability
Diabetes
Cyprus

Diabetes is a metabolic disease characterised by hyperglycaemia due to decreased insulin secretion, insulin action or both⁽¹⁾. Data published by the WHO support that diabetes was the seventh leading cause of death in 2016⁽²⁾. Moreover, recent findings demonstrated that in 2017, 451 million people between 18 and 99 years of age were diagnosed with diabetes worldwide, and these numbers are expected to increase and reach 693 million by 2045⁽³⁾. In Cyprus, in 2017, there were 93 200 cases of diabetes among the total population of 884 480. Furthermore, the prevalence of diabetes among the Cypriot population equals 10.5%⁽⁴⁾.

Diabetes and its complications pose a great financial burden for patients, families and society^(5–7). A recent study indicated that, in 2017, the total costs for healthcare of people with diabetes were extremely high, equalling \$850 billion⁽³⁾. A medical nutrition therapy (MNT) is a nutrition-based treatment provided by a registered dietitian (RD), including nutrition diagnosis as well as therapeutic and counselling services, to help manage diabetes⁽⁸⁾. The American Diabetes Association (ADA) supports that MNT can result in cost savings for the national health system and improved clinical outcomes⁽¹⁾. Particularly, a previous study has shown that MNT had a significant cost-efficient

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advantage and provided significant clinical improvements compared with the basic nutritional therapy⁽⁹⁾. Although MNT is considered a keystone for the medical treatment of diabetes, relative literature is scarce.

Food insecurity exists when people have limited or uncertain availability of nutritionally adequate and safe foods and/or low affordability of foods fulfilling basic energy requirements⁽¹⁰⁾. Most at risk of experiencing food insecurity are low-income groups and other social groups associated with poverty, such as single mothers^(11,12). The risk of experiencing food insecurity among people suffering from non-communicable diseases (NCD), such as diabetes, has not yet been examined, although the prevalence of food insecurity and low affordability has been extensively and deeply examined among healthy populations of different nations^(13–18). Recently, a study by Chrysostomou *et al.* has shown that the Cypriot Gluten-Free Healthy Food Basket (GFHFB) is costly and not affordable among low-income Cypriots diagnosed with celiac disease, and thus, patients are likely to experience food insecurity, compromising their long-term health⁽¹⁹⁾.

A food basket, which is a mixture of basic products in sufficient amounts to adequately fulfil the energy requirements of each member of the family, is one of the most commonly used tools to monitor trends in the affordability of foods^(20,21). Based on the literature, no study has evaluated the cost of a realistic monthly food basket specifically developed for people with diabetes. Thus, the main objective of this study was to assess the cost, acceptability and affordability of the Cypriot Diabetic Healthy Food Basket (DHFB) and to examine whether the low-income diabetic population in Cyprus are at risk of experiencing food insecurity due to low affordability.

Methods

The aim of this study was to develop a DHFB on the basis of HFB developed for Cyprus by the same researchers⁽¹⁸⁾. The Cypriot HFB was constructed by a RD based on the National Guidelines for Nutrition and Exercise (NGNE) developed by the Nutrition Committee of Cyprus⁽²²⁾. NGNE were developed based on current scientific evidence, such as the results of existing epidemiological studies in Cyprus, the US dietary reference intakes (DRI) and the WHO/FAO nutritional guidelines. The acceptability and feasibility of Cypriot HFB was tested through focus groups (FG). An FG consisted of people of different socioeconomic and educational status. After consultation with FG, changes in HFB were done in collaboration with the RD as long as they did not contradict healthy eating recommendations.

Development of the Diabetic Healthy Food Basket

In the current study, baskets (DHFB) for two different household types were developed: those with one adult woman (± 40 years) or those with one adult man (± 40

years). It was assumed that both adults (woman and man) were diagnosed with diabetes. In particular, the development of food baskets should be based on specific nutritional guidelines. Therefore, DHFB was based on Cypriot HFB with adjustments based on the most recent nutritional guidelines for diabetes as developed by the ADA⁽¹⁾. ADA guidelines published in 2014 are the most recent for diabetes mellitus globally. Thereafter, the acceptability of DHFB was examined through the questionnaires. In comparison with Chrysostomou and Andreou (2016)⁽¹⁸⁾ and Chrysostomou *et al.* (2017)⁽²³⁾, the acceptability of our DHFB was examined through questionnaires. The advantage of this approach is the collection of information from a sufficiently large and representative sample of diabetic population in the country of reference. Based on information collected through the questionnaires, any changes in food baskets could be made only if $\geq 50\%$ of the participants supported the change. The change could be made in collaboration with the RD as long as it did not contradict eating recommendations for diabetes⁽¹⁸⁾.

Sample recruitment and data collection

Participants were recruited from public hospitals in Cyprus (Nicosia General Hospital, Limassol General Hospital) during 2018–2019 by the RD. All participants included in the study were aged between 18 and 87 years. To be eligible, they had to be diagnosed with diabetes mellitus (type 1 or type 2) regardless of treatment method and year of diagnosis. In total, 422 adult women (41.1%) and men (58.6%) signed the informed consent, which has been approved by the Cypriot Bioethics Committee and the Office of the Commissioner for Personal Data Protection.

A questionnaire inquiring on general social/demographic/financial, medical and nutritional aspects was administered. The questionnaire was based on FG discussions in a previous work⁽¹⁸⁾. The questionnaire included questions relating to the socioeconomic and demographic background of participants; other questions related to participant's medical status such as the type of diabetes, age of diagnosis, HbA1C level, type of medical treatment, presence of other diseases, health problems among other first-degree family members, medical insurance, personal aspects about previous/current/future health status, complications of medical treatment and the effect of disease on financial status. In the third part of the questionnaire, questions relating to the DHFB were included, such as the adequacy of the food basket, food items to be added/deleted, taste/variety/gastronomy of the food basket, preferable hypermarkets, cost of food products, take-away food, dining outside home and other questions aiming to develop an acceptable food basket as one of the major factors affecting the level of adherence to a specific diet⁽²⁴⁾. Moreover, a typical weekly diabetic food menu was attached with the questionnaire to ensure a better understanding of the proposed DHFB by participants.



Cost and affordability

The pricing of DHFB was based on Chrysostomou and Andreou⁽¹⁸⁾. Most of the data were retrieved from the website of the Ministry of Energy, Commerce, Industry and Tourism of the Republic of Cyprus⁽²⁵⁾. Moreover, using the Consumer Price Index (CPI) provided by the Statistical Service of Cyprus, all products were adjusted to 2019 prices.

Determining the adequacy of income levels requires their evaluation against a benchmark⁽¹³⁾. An appropriate benchmark for assessing food affordability in this study is the minimum income threshold as defined by the Guaranteed Minimum Income (GMI) scheme. The scheme was introduced in Cyprus in 2014 following an important social policy reform aiming at a more efficient and targeted social protection, thereby providing relief to households vulnerable to income deprivation and social exclusion⁽²⁶⁾. GMI is a top-up benefit, defined as the difference between a minimum income threshold and family income. Simply stated, if a family's income falls below the minimum income threshold, the state steps up to fill the difference, provided a series of other eligibility conditions are satisfied. The minimum income threshold represents the minimum income necessary to ensure recipients' access to a basket of goods and services corresponding to the minimum socially accepted standard of living. The value of this basket, calculated by the Ministry of Labour, Welfare and Social Insurance using a reference budget methodology, is currently set at €480 per month for a single adult and increases for larger recipient units (by 50% for an additional adult and by 30% for an additional child)⁽²⁶⁾.

The affordability of DHFB was measured by calculating the cost of the food basket as a percentage of household income and occurs when households spend $\leq 30\%$ of their income on food costs⁽¹⁶⁾. Thus, the cost of each basket as a percentage of GMI is used as a yardstick of affordability.

Results

Participants' socioeconomic background

As already mentioned, the sample consisted of 422 adults (59% men and 41% women). The average age was 65.3 years (66.5 for men and 63.5 for women) due to the fact that the sample was derived from public hospital visitors, typically of older age. Although the DHFB was developed for adults around 40 years, this would not introduce any kind of bias since the basic nutritional requirements (at a macronutrient level) might not differ among younger and older adults (up to 65 years), thereby not significantly affecting the content and cost of DHFB. About 35% of participants had only completed primary education or less, 49.5% had completed up to upper secondary education (including post-secondary non-tertiary level) and only 15.2% were highly educated (i.e. holding a bachelor's degree or above). The average educational attainment

was lower among women (e.g. 44.8% of female participants had completed primary education or less), reflecting the lower participation of women in education among the older cohorts of the population. As it can be expected, the majority of participants were pensioners (66.4%); yet, there was also a significant share of employed (17.1%) and unemployed persons (6.4%). Finally, other economic activities included mostly housewives (14.9% among female respondents). It is worth mentioning that a significant proportion of participants (28.0%) reported very low annual family income ($<€11\,000$ per annum), with another 38.4% reporting rather low family income (between €11 001 and €20 000), and only 28.0 and 3.8% reporting family income between €20 001 and €40 000 and $>€40\,001$, respectively. The above are described in detail in Table 1.

Diabetic Healthy Food Basket v. Healthy Food Basket

A DHFB is described in detail in Table 2. The majority of participants (89.4%) considered DHFB as acceptable, while about 95% mentioned that DHFB has sufficient taste and consists of a variety of food items. DHFB consists of eight food categories, similar to the Cypriot HFB. The distribution of food groups remained the same for DHFB but differed in food quantity due to the effect of gender. Although food categories remained the same, specific food items were removed and others were replaced following ADA guidelines and information collected through the questionnaires⁽¹⁾. A more detailed description of adaptations in DHFB compared with HFB follows.

Compared with the Cypriot HFB, some food items were removed. Concerning the *Liquid group*, all alcohol drinks were removed (wine and beers). Based on the ADA guidelines, alcohol consumption may place people with diabetes at an increased risk of delayed hypoglycaemia, especially if taking insulin or insulin secretagogues⁽¹⁾. Regarding the *Grains group*, all food items remained the same but were replaced by whole wheat so as to ensure adequate consumption of fibre and whole grains following the ADA guidelines⁽¹⁾. In regard to this, several studies using low-glycaemic-index eating patterns have demonstrated improved glycaemic control^(27,28). Moreover, in the same group, weekly number of portions for specific food items has been reduced. This change was based on the ADA guidelines, which support that an MNT provided by a RD should reduce daily energy intake (232–710 kcal/d) to provide modest weight loss and prevention of weight gain followed by a potential effect on glycaemic profile⁽¹⁾. In particular, *bread, wholegrain (day: breakfast, snack, side dish)* was reduced from seven portions per week to three portions per week. Also, *breakfast cereals, not sweetened* were reduced from seven portions per week to four portions per week. In the same group, portions for *pasta* were reduced from three to one portion per week. In the

Table 1 Participants' socioeconomic backgrounds by gender

	Male	Female	All	Male %	Female %	All %
Education						
Primary or less	70	78	148	28.2	44.8	35.1
Secondary*	142	67	209	57.3	38.5	49.5
Tertiary	36	28	64	14.5	16.1	15.2
No response	0	1	1	0.0	0.6	0.2
	248	174	422	100	100	100.0
Economic activity						
Employee	39	33	72	15.7	19.0	17.1
Pensioner	178	102	280	71.8	58.6	66.4
Self-employed	7	2	9	2.8	1.1	2.1
Unemployed	17	10	27	6.9	5.7	6.4
Other†	5	26	31	2.0	14.9	7.3
No response	2	1	3	0.8	0.6	0.7
	248	174	422	100.0	100.0	100.0
Annual family income						
Up to 11 000	57	61	118	23.0	35.1	28.0
11 001–20 000	104	58	162	41.9	33.3	38.4
20 001–40 000	69	46	115	27.8	26.4	27.3
>40 001	12	4	16	4.8	2.3	3.8
No response	6	5	11	2.4	2.9	2.6
	248	174	422	100.0	100.0	100.0
Average age	66.5	63.5	65.3			

*Secondary education also includes the non-tertiary post-secondary level.

†'Other' category in economic activity includes housewives.

Vegetables group, *frozen unprepared vegetables and vegetable juice* were replaced with *fresh vegetables* for being good sources of vitamins and minerals. This change was also based on the ADA guidelines that promote the consumption of fresh fruits and vegetables as these food items have shown significant improvements in glycaemic control^(1,27). In the *Fruits* group, all food items remained the same and only weekly portion of *fruit juice* was changed from four to three portions per week. In the *Dairy* group, only cheese was changed from mature to low-fat cheese and the weekly portions were increased from two to three since individuals with diabetes should moderate their fat intakes to be consistent with their goals to lose or maintain weight⁽¹⁾. In the *Meat/Fish/Eggs* group, only *fish canned* was replaced with *fresh fish*, whereas the number of portions remained the same. This change was based on the recommendation for the general population to consume fish (particularly fatty fish) at least two times (two servings) per week, which is also appropriate for people with diabetes⁽¹⁾. In the *Fat* group, weekly portions of *nuts* were reduced from seven to four. Finally, in the *Residuals* group, weekly portions of *Choco* were increased from one to two and replaced with *dark choco* (participants' requirement). *Ice cream* was removed (RD's recommendation). Additionally, participants asked for more sweets in DHFB, to which the RD disagreed. Moreover, jam and honey were removed from the basket (participants' requirement). Salt and cold sauces (ketchup) were also removed following the RD's recommendation. In regard to salt consumption, a Cochrane review of randomized controlled trials has found that decreasing sodium intake reduced blood pressure and

improved cardiovascular risk in those with diabetes⁽²⁹⁾. Therefore, salt was completely removed from the basket. Notably, a great majority of participants asked to add more Cypriot traditional foods within the food basket, but the RD disagreed since these foods consist of high amounts of saturated fats that have negative health effects⁽³⁰⁾. However, all participants agreed with the final version of DHFB, and thus, after all adjustments, the DHFB could be considered acceptable for its population.

Cost and affordability of the Diabetic Healthy Food Basket

Table 3 shows the monthly budget required for each food item included in DHFB. The total budget for DHFB is lower for both households (i.e. single woman and single man) compared with HFB. The total monthly budget for a diabetic woman is about 15% lower (25.68 Euros less) compared with HFB, and the relative percentage for a diabetic man is about 16% (37.58 Euros less) lower. Also, the total required monthly budget for a diabetic woman is around 30% lower (60.32 Euros less) compared with that of a diabetic man.

Table 4 presents the food values corresponding to DHFB and HFB for women and men in Cyprus in terms of GMI. Line 1 presents the corresponding GMI values. Lines 2 and 4 present the monthly costs for DHFB and HFB for women and men, respectively. The monthly cost for women is lower compared with that for men in both lines. Finally, lines 3 and 5 show the proportions of GMI that needs to be spent on DHFB and HFB, respectively.

**Table 2** Components of the Diabetic Healthy Food Basket for each member of the household based on the Cypriot National Guidelines for Nutrition and Exercise⁽²²⁾, American Diabetes Association⁽¹⁾ guidelines for diabetes, and information retrieved from questionnaires

Item	Number of portions per week	Female portion amount	Male portion amount
Liquids			
Water (ml)	7.02	1440	1920
Coffee (g)	7.02	5.00	5.00
Tea (g)	7.02	2.5	2.5
Light soft drinks (ml)	7.02	240	240
Bread, grains, legumes, potatoes			
Bread, wholegrain (main dish meal) (g)	7.02	30	60
Bread, wholegrain (day: breakfast, snack, side dish) (g)	3.00	30	60
Breakfast cereals, not sweetened (g)	4.00	62	93
Potatoes (g)	2.00	180	270
Rice, wholegrain (g)	2.00	80	120
Pasta wholegrain (g)	1.00	80	120
Legumes (g)	3.00	86	86
Vegetables			
Fresh vegetables (g)	7.02	300	600
Fruits			
Fresh fruit (g)	7.02	220	330
Fruit juice (ml)	3.00	120	120
Dried fruit (g)	3.00	25	25
Dairy			
Milk, semi-skimmed (ml)	7.02	240	360
Yogurt, semi-skimmed (g)	7.02	170	255
Cheese, low fat (g)	3.00	30	60
Meat, fish and eggs			
Fish, fresh (g)	2.00	90	90
Fish, frozen (g)	2.00	90	90
Meat, lean (g)	3.00	90	90
Meat, fatter (g)	1.00	90	90
Eggs (g)	2.00	50	50
Fat			
Olive oil (ml)	7.02	30	60
Nuts, without husk (g)	4.00	8	16
Residual			
Choco (g)	2.00	50	75
Jam			
Spices: pepper (g)	7.02	1.00	1.50
Spices: iodised salt			
Spices: oregano (g)	7.02	3.00	3.00
Spices: cinnamon (g)	7.02	3.00	3.00
Vinegar (ml)	7.02	30.00	60.00

Table 3 Cost of the Diabetic Healthy Food Basket v. Healthy Food Basket, monthly amounts in Euros, July 2019

Diabetic Healthy Food Basket ⁽¹⁸⁾	Woman	Man	Healthy Food Basket ⁽¹⁸⁾	Woman	Man
Liquids	10.62	10.66	Liquids	26.85	38.49
Grain	21.65	31.53	Grain	25.83	38.57
Vegetables	13.81	27.63	Vegetables	16.07	26.03
Fruit	22.31	31.06	Fruit	23.08	31.84
Dairy	30.81	48.56	Dairy	28.10	43.14
Meat, fish and eggs	24.61	24.61	Meat, fish and eggs	24.62	24.62
Fat	6.66	13.33	Fat	8.51	17.03
Residuals	12.14	15.55	Residuals	15.23	20.81
Total diabetic healthy food	142.61	202.93	Total healthy food	168.29	240.51

For low-income adults in Cyprus receiving GMI, the proportion of income that would be spent on DHFB ranges from around 30% to 42% for women and men, respectively. In addition, the relative proportions for HFB

(line 5) are higher compared with that for DHFB for both genders. However, the difference in affordability rates between DHFB and HFB for women is lower than that of men (around 5 v. 8%, respectively).

Table 4 Guaranteed Minimum Income (GMI), Diabetic Healthy Food Basket (DHFB) and Healthy Food Basket (HFB) for Cypriot adults

	Woman	Man
GMI (Euros 2019, per month)	480	480
DHFB (Euros 2019, per month)	142.6	203
DHFB/GMI	29.70 %	42.30 %
HFB (Euros 2019, per month)	168.3	240.5
HFB/GMI	35 %	50.10 %

Discussion

Nutrition has been the cornerstone of therapy to enable persons with diabetes to manage their chronic disease, prevent complications and provide a good quality of life⁽⁹⁾. Although the need for data on the outcomes of costs of diabetes treatment, including nutrition therapy, has been expressed repeatedly⁽⁹⁾, relative studies are still scarce. Therefore, this study aimed to develop an acceptable Cypriot DHFB and provide information relating to the cost and affordability of this basket among the low-income population. The current study shows that the cost of Cypriot DHFB is lower compared with Cypriot HFB, meaning that nutritional treatment based on the practice guidelines for diabetes could result in cost savings for these patients.

In regard to the affordability of Cypriot DHFB, results seemed to be more promising compared with Cypriot HFB and other disease-based food baskets. Results of the current study show that DHFB is more affordable compared with HFB among low-income Cypriots. Notably, for low-income women, it seems that the purchase of DHFB could be defined as affordable since <30% of their income is required for purchasing healthy food⁽¹⁶⁾. However, the rate of affordability is marginal (29.7%), indicating that the risk of experiencing food insecurity still exists. Hence, compared with HFB, it seems that purchasing DHFB is more affordable (29.7 *v.* 35%) for a low-income diabetic Cypriot woman (Table 4). On the other hand, the purchase of DHFB for an adult (low-income) man with diabetes is not affordable, despite affordability is better compared with HFB (42.3 *v.* 50.1%) (Table 4). Thus, it could be assumed that both household types are at risk of experiencing food insecurity due to low affordability, but the risk is higher for diabetic men. Moreover, the risk of experiencing food insecurity is lower for DHFB compared with HFB for both types of households. Based on the above findings, it could be supported that nutrition therapy that follows practice guidelines for diabetes is more affordable compared with the basic nutrition therapy.

Findings of the current study are in contrast with previous findings relating to the food baskets developed for patients with other chronic diseases requiring MNT. Particularly, a recent study in Cyprus has shown that for low-income people diagnosed with celiac disease and

receiving GMI, the proportion of income that must be spent on GFHFB ranges from around 42 to 60%. Particularly, GFHFB was 33.6 and 47 Euros/month more expensive compared with HFB for women and men, respectively⁽¹⁹⁾. Thus, comparing the three food baskets (DHFB, GFHFB, HFB) developed for the Cypriot population, it seems that DHFB is the most cost-efficient nutrition therapy for both household types (142.6/202.93 euros, 201.2/285.8 euros, 168.29/240.51 euros for women and men, respectively). Moreover, comparing disease-based food baskets (DHFB and GFHFB), it seems that DHFB is a more cost-efficient therapy compared with GFHFB, and the cost may be 29% lower for both household types (woman and man). In addition, affordability rates for low-income people range accordingly. Better affordability is shown for DHFB, following HFB, and then higher affordability is shown for GDHFB (41.92, 59.54% for woman and man, respectively)^(18,19).

MNT provided by an RD is a key complement to traditional medical interventions in several chronic diseases⁽⁸⁾. Regardless of medical and clinical benefits, studies have shown that nutrition interventions that follow practice guidelines, such as the MNT, provide a reasonable economic investment⁽⁹⁾. Thereafter, ADA guidelines support that diabetes nutrition therapy can result in cost savings⁽¹⁾. The current study confirms the above statement regarding the effectiveness of diabetes nutrition therapy⁽¹⁾. Particularly, this study shows that developing a national DHFB in line with evidence-based nutrition recommendations and considering the population's needs and preferences in the treatment of diabetes is more cost-efficient compared with basic nutrition therapies, but still the issue of affordability remains among the low-income population, mainly among diabetic men. Although affordability has improved compared with other nutrition therapies, it still requires attention.

The implications for public policy are straightforward. Although DHFB is less costly than HFB, it still remains unaffordable or marginally affordable for the GMI-supported population (or for any person facing income deprivation). Although not examined explicitly in this study, the problem of affordability is likely to deteriorate for larger family units, as food consumption is characterised by limited household economies of scale (i.e. adding one adult to the household would almost double the cost of food basket, while it might increase welfare payments only by 50%). Thus, the specialised nutritional needs of the diabetic population emerge as an important policy concern not only for reforming income schemes but also for the formulation of public health policy. This is crucial for an additional reason. As shown in the literature, low income is associated with a higher prevalence of diabetes and diabetes-related complications⁽³¹⁾. This was evidenced in our data where 28% of participants reported living off very low annual family income. Further, 26% of participants reported that the financial situation of their family is very strongly (10%) and strongly (16%) affected by their health condition,



highlighting the hardship in maintaining a healthy nutrition in the presence of income vulnerability.

Overall, the findings of this study should encourage similar studies in other countries in expectation of more useful information relating to the cost of DHFB in different socio-economic contexts. Notably, MNT may not always be cost-efficient since this depends on the disease. However, in regard to diabetes, each country should assess the cost of a national DHFB and examine the possibility of financially supporting this diet, especially for the low-income population. The expected benefits of this initiative on improving public health, reducing health inequalities and promoting economic efficiency would be unambiguously large.

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