Light Pollution in Singapore

by **Melvin Koh**

Is Public Lighting a Boon or Bane?

I brought my family on a vacation to the Australian state of Tasmania last November. Staying on a farm was a natural inclusion into our itinerary as my two-year-old adores tractors. After a long and windy drive into the countryside, we received a warm welcome from our hosts and prepared to settle in for the night.

As I flipped through the pages of the visitor log in our guesthouse, I was surprised to see that with the exception of local Australians looking for a weekend getaway, almost all the other entries were written by Singaporean families. When I brought this up to the farmer the following day, he replied with a wry smile, "Ah, they've come to escape the Singapore lights and to enjoy the obscurity of our nightfall."

Singaporean's Affinity for Street Lighting

Now as an Economics tutor, that surprised me. What he said seemed to run contrary to the wisdom which we inherited from microeconomics. Street lighting has always been regarded as a public good, alongside national defence and other services such as dengue or flood control measures. The term "public good" refers to a good which is not only non-excludable and non-rivalrous in consumption, but also socially desirable. The social benefits are mainly derived from the ability of well-lit roads to prevent traffic mishaps due to poor visibility.

Now I have to admit that I found the lack of street lighting in Tasmania slightly unsettling, especially when I drove along the murky forest trails. I also could not help but notice that almost 80 per cent of the cars being driven around in Tasmania were white. The main reason, I presume, is to improve their visibility to other drivers at night. Given our local experience with car colours and the sovereignty of consumers (reference to the dizzying array of matt and gloss vehicle colours in Singapore), I assumed that the prevalence of white cars in Tasmania was not determined solely by individual owner preferences, but likely involved some element of moral suasion from the government. In fact, regression analysis done on data from Western Australia and Victoria showed that white vehicles had a 47 per cent lower crash risk compared to black cars under dawn or dusk conditions.[1]

What surprised me further as an Economics tutor based in Singapore was the revelation that my fellow countrymen would be keen to seek out the darkness of the night to augment their experiential journeys. In fact, Singapore stands out not just as a green oasis to its residents and visitors, but also as an extremely well-lit city — as anyone who has looked down at our city skyline from a departing night flight can attest to. In addition to managing more than 95,000 streetlights along Singapore roads, Singapore's Land Transport Authority (LTA) also maintains lighting at bus shelters, covered linkways, footpaths and road crossings. Street lighting conditions are also checked every two months to ensure that any faulty lighting is swiftly dealt with.

Indeed, Singaporeans have high expectations when it comes to keeping our roads well-lit. It is not uncommon to come across forum letters beseeching the government to install more lighting in dark pockets of Singapore as a safety precaution. In addition, we also seem to associate our social spaces with a surplus of lighting. Just last month, Singaporeans welcomed the news that car-free Sundays would commence in the Civic District and Central Business District, with more street lights to be installed to create public spaces. Similarly (and rather ironically), the Singapore Night Festival is associated with a line-up of bright light installations across the entire Bras Basah precinct.

Looking Up Into the Sky

So, given our love relationship with lighting, why have Singaporeans grown tired of well-lit streets and come to appreciate the "obscurity of

1 An Investigation into the Relationship between Vehicle Colour and Crash Risk. Stuart Newstead and Angelo D'Elia. Moniash University Accident Research Centre Report No. 263. May 2007.

the nightfall", as my Australian host referred to?

I think the answer can be traced back to the change in living standards in Singapore's modern history. Singapore had achieved phenomenal economic growth in the past few decades and this has allowed our residents to enjoy a reasonable level of economic sustenance. With most Singaporeans no longer concerned about daily bread-and-butter issues, we have progressed past looking into our wallets and have turned our attention towards looking up into the sky.

Figuratively, this means that we are questioning the meaning in what we do on a daily basis. Attention has shifted away from survival concerns towards fulfilling the non-material aspects of living standards. Taking reference from Maslow's hierarchy of needs, given that the Singapore government has broadly fulfilled the "physiological" and "safety" needs of its population, Singaporeans now aspire towards a "healthier" balance in their lives, such as greater work-life harmony and leading a more holistic life. Among some Singaporeans, this entails rejecting the paternalistic approach of the government and questioning the wisdom of government intervention in free markets. While the government's role in providing public goods is still

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valued, some doubts have been raised about the scale of intervention. For example, questions have been asked about the amount of resources devoted towards national defence (another public good), including whether the conscription tenure for Singapore males should be further reduced.

Literally, looking up into the sky means that Singaporeans have become more concerned about the state of the environment which they live in. The recent debate over the preservation of the Bukit Brown cemetery is a good example. As mentioned in a 2015 Straits Times commentary by Professor Euston Quah and Mr Nicolas Neo, "the dichotomy of economic growth and the environment has been a growing concern to Singapore."[2] It now appears that in addition to the debate of whether we are valuing "green spaces" correctly, there is scope to consider whether there are enough "dark spaces" in Singapore. If the farmer's words are anything to go by, some Singaporeans have grown tired of living in an environment constantly bathed in artificial light, and have aspired towards a more elementary way of life involving a balance between light and darkness.

Light as a Form of Pollution

If too much light is bad, then there is scope to think of light as a form of pollution.

When one talks about pollution in Singapore, we often think of the transboundary haze problem, which has become quite a pertinent issue in Singapore. The Oxford dictionary defines pollution as "the presence or introduction into the environment of a substance which has harmful or poisonous effects". While having too much light can be unpleasant, they are certainly not harmful or poisonous to health, unless they interfere with sleep patterns.

Traditionally, when the term "light pollution" is used, it refers to the brightening of the night sky due to urban lighting, which obliterates the view of the Milky Way and stars for night sky enthusiasts. However, there is growing interest in the effects of excessive lighting on human health and immune functions. While the effects of inappropriate light exposure due to shift-work and jet-lag are well documented, an article written by Steven Lockley from Harvard Medical School[3] further considers the effects of lighting on people living on more regular schedules. Specifically, he posits that unnecessary horizontal and vertical street lighting, given their ability to permeate living spaces such as bedrooms, can have measurable effects on sleep disruption and melatonin suppression, which carry health risks. Nonetheless, these are still hypotheses awaiting further research evidence. For example, there is no direct evidence to prove that the alteration of melatonin levels has any effect on cancer risk.

2 Look beyond market value in preserving green spaces. Euston Quah and Nicolas Neo. Jun 16, 2015. The Straits Times.

3 "Human health implications of light pollution". British Astronomical Association handbook (2009).

A Cost-benefit Analysis to Understanding Light Pollution in Singapore

So, how bad is light pollution in Singapore, and is this an area which the government should be concerned about? Specifically, is public lighting a boon or bane for Singaporeans?

The key to assessing this is through a cost-benefit analysis, an economist's favourite tool. Specifically, the benefits to society from providing public lighting should be weighed against the costs of doing so. Having well-lit roads mainly reduces the risk of road accidents, while providing brightly illuminated pathways helps to keep pedestrians safe and secure. These form the main benefits of public lighting.

[*During my Economics classes, some students argued that street lighting should be viewed as rivalrous in consumption, since having an individual read the papers under a lamp post would deprive another person of the same standing spot. My answer to this is simple. The intent and purpose of the government in providing street lighting is to ensure safety and not to boost national literacy.*]

The cost to public provision of street lighting is mainly the financing cost in terms of money and resources needed to construct and maintain the lights, and the opportunity cost that such spending entails. These costs are significant, given the prevalence of public lighting in Singapore, and the rigorous standards in LTA's maintenance schedule. Furthermore, light pollution can add on to the costs identified above (akin to a spillover cost). However, we run into the problem of estimating and imputing the costs resulting from light pollution. As mentioned earlier, from a scientific perspective, the exact health impact of light pollution on regular individuals has not been ascertained. It seems that at this stage, Singaporean visitors to countryside retreats are more eager to check out the wonders of the night sky, rather than to seek a permanent retreat from outdoor lighting. The benefits that they derive from staring into the night sky (no doubt an inspirational natural resource) are hard to quantify, and likewise, the cost of being deprived such a resource.

Furthermore, before government intervention can be considered under grounds of market failure, we need to assess whether light pollution qualifies as a negative externality. Negative externalities are defined as spillover costs incurred by third parties, which are not accounted for by the price mechanism.

Street lighting generates light pollution, but it is tricky to find third-parties to compensate here. This is because unlike Australia, even the thickest and wildest patch of jungle in Singapore is not far from the nearby glow of street lighting. Hence, almost every Singaporean potentially affected by street lighting is a direct beneficiary of having lit streets. Even if third-parties can be identified, the difficulty in quantifying the spillover costs in the form of light pollution also means that it is hard to determine the size of the tax to impose. On a nett basis, it is still likely that Singaporeans would regard street lighting as a socially desirable good, in spite of them being denied the majestic beauty of the night sky through living in an environment bathed in artificial light.

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Let There (Continue to) Be Light

Overall, there is yet to be a formal framework for measuring the cost of light pollution on human health. Until more robust evidence is produced, there are other pressing issues for the government to consider at this stage to improve Singaporeans' non-material living standards (e.g. congestion, work and academic stress, and erosion of green spaces). It is also hard to say whether the "obscurity of the night" which one can enjoy in Tasmania is a deliberate effort at preservation by the Australian government, or simply a case of it being untenable for the local government to install street lighting in such vast and open spaces. Viewed from that perspective, the ability of the Singapore government to provide good lighting conditions in almost every populated part of the island is a blessing.

As LTA continues to explore ways to cut energy costs for lighting, such as through reducing the illumination level at some commuter facilities, this can also be seen as a gradual and calibrated way to return some dark spaces to Singaporeans. There are also stargazer hobby groups in Singapore dedicated to fighting for tighter lighting rules in Singapore. These include fighting for the use of "downlighting" (directing light downwards towards the ground instead of skywards) and motion-activated light sensors. From my own experience living in a HDB unit facing a brightly illuminated park, there is no light which a thick set of window curtains cannot cut out. Hence, I am still enjoying my restful sleep every night.

I should also add that before my host left us for the night, he passed me an LED torch and added with a cheeky grin, "If you bring this out after dusk, you may be able to spot one or two wallabies near the guesthouse!"

It does look like at times, we are responsible for adding to the glow that we call light pollution.

Melvin believes that a background in Economics serves as an enabler for students to make better decisions in life. He also believes that good teaching aids serve as a multiplier which amplifies students' interest and performance in the subject. He has written two books to help 'A' Level Economics students and is planning to roll out a third book, plus a macroeconomics board game later this year.