Baggage Claim

What strategy should an arriving airline passenger pursue if their bags are missing?

BY HARRISON SCHRAMM

How long should I wait for my bags after a flight before deciding they are lost? This practical problem is the focus of this issue's analysis.

First, a question so basic it is rarely asked: Why wait for your bags at all? Why not, say, go get your rental car, have a leisurely dinner, make some phone calls and then come back to collect your bags from the unclaimed pile against the wall at your leisure? The answer is, as far as I can tell, in two parts: First, people like being united with their "stuff." This is emotional and not amenable to analysis. Second, people are anxious to get their bags because of the real or perceived risk of theft.

Without thinking too hard, we nominate two "end post" strategies:

- Greedy-Service: Immediately report to the baggage office when you get off the plane. File a missing bag report. If the person who is taking the report notes (correctly) that as all the bags have not come off the carousel yet, you cannot know if your bag is truly missing, you threaten to call their manager. Upon filing your claim, if your bag has arrived, you tear up the report and be on your way.
- Greedy-Bags: Immediately report to the baggage carousel when your flight lands. Do not leave until you either have your bags in hand or they turn off the lights for the night and send everyone home.

Neither of these strategies are sophisticated. They are two extremes that help to scope the problem. So let's think about the risks that are associated with each strategy. First, the Greedy-Service strategy is best if your bag is actually lost. If your bag is not lost, you lose both time that you spend waiting to file the claim, as well as the possibility of your bag being stolen if it is not lost. If you choose Greedy-Bags, you lose the value of your time waiting for the bag, which may never arrive.

Let's do some math and be a bit more rigorous in our thinking. Suppose that you are constrained to choosing between these two very simple strategies but with a twist: You get to decide before landing that at some time, call it t^*, that you will switch from the baggage strategy to the service strategy. In plain language, you will abandon the baggage carousel for the claims line.

First, we need to define some parameters. Let: p_L be the probability that a bag is lost. The bag will actually be lost before the plane takes off from it's origin, but the fact of loss will not be revealed until it fails to arrive. Let λ_T be the per hour risk of theft, expressed in bags stolen per hour. Let V_{bag} be the value of your bag, and its contents. Let V_T be the value of your time, expressed in dollars per hour. Finally, let T_{max} be the time that the carousel runs. We assume for simplicity's sake that if you move from the baggage carousel to the line, that you will stay at the claims line until T_{max}.

The resulting expression is best understood in pieces. Let's talk about the things that can happen:

1. My bags could be present and they could get stolen when I walk away to join the line to report them as missing. This has a cost of $(1-p_L)(1-e^{-\lambda_T(T_{max}-t^*)})V_{bag}$, where the middle term is the cumulative probability that an exponentially distributed random event occurs in $[t^*, T_{max}]$.
2. My bags could be present and I will waste time standing in line when I could have been waiting for the bag. This has a cost of $(1-p_L)(T_{max}-t^*)V_T$.
3. My bags could be absent and I could waste time waiting at the carousel that I could have been filing a claim. This has a cost of $p_L t^* V_t$.

Now, all we have to do is put it all together. Since these are expressed in terms of costs, we want to:

$$\min_{t^*}\Big\{(1-p_L)\big[(1-e^{-\lambda_T(T_{max}-t^*)})V_{bag} + (T_{max}-t^*)V_T\big] + p_L t^* V_T\Big\}$$

$$\text{s.t.} \quad 0 \leqslant t^* \leqslant T_{max}$$

With the restriction on t^* meaning that you cannot decide to get in the baggage line before the plane has landed, and if you wait until the baggage carousel stops, you will be forced to get in the claims line.

Now it looks like an ugly mess; we're looking for the global minimum of a non-linear function. It's not that bad, however, and a "quick and dirty" way to solve this is to use "line search," which is a grown-up version of "too hot- too cold." You may also differentiate this equation, which is what supports my conclusions below.

For example, if my bag and contents are worth $170, I bill at $100 per hour, the maximum time the carousel runs is 20 minutes and the baggage theft risk is one bag per hour, the optimum solution is to wait for 20 minutes, i.e., wait for my bag, or in our original parlance "Greedy-Bags."

It turns out that in order to drive the solution away from $t^{*}=T_{max}$, one of the following has to happen:

- The bag must be practically worthless. Not really practically applicable because people do not bother to transport worthless bags. Even if the market value of the bags is zero, they usually have some value to the passenger.
- There must be a high probability of baggage loss. The historical rates of baggage loss in the United States are below 1 percent.
- You must have a very high billing rate. People with these fee schedules typically do not collect their own bags!

So, we've done some math and discovered something that we knew all along: For most people, the best thing to do when getting off the airplane is to simply wait for their bags.

Bonus: This problem has many other dimensions; I have not done it justice in such a short note. For example, I did not treat the information gained by seeing others still waiting for their bags, which would tend to make you be willing to wait longer. ❙

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